



Analysis case studies

Deliverable 2.5

December 2025

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Funded by
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Technical References

Project Acronym	BIOTraCes
Project Title	BIOdiversity and Transformative Change for plural and nature positive societies
Project Coordinator	Dr. R.I. van Dam (WR)
Project Duration	48 months (2022 – 2026)

Deliverable No.	2.5
Dissemination level¹	PU
Work Package	WP2
Task	T2.1
Lead beneficiary	UNICT
Contributing beneficiary(ies)	BC3, CES, CER, MRU, UBB, UGOT, UT, WR
Due date of deliverable	30 November 2025
Actual submission date	11 December 2025

- 1 PU = Public
 PP = Restricted to other programme participants (including the Commission Services)
 RE = Restricted to a group specified by the consortium (including the Commission Services)
 CO = Confidential, only for members of the consortium (including the Commission Services)

Document history

V	Date	Beneficiary	Author
V0.1	April 2025	BC3, CES, CER, MRU, UBB, UGOT, UT, WR	UNICT
V0.2	October 2025	BC3, CES, CER, MRU, UBB, UGOT, UNICT, UT, WR.	BC3, CES, CER, MRU, UBB, UGOT, UNICT, UT, WR.
V0.3	November 2025	BC3, CES, CER, MRU, UBB, UGOT, UNICT, UT, WR.	BC3, CES, CER, MRU, UBB, UGOT, UNICT, UT, WR.
V1	December 2025	BC3, CES, CER, MRU, UBB, UGOT, UT, WR	UNICT

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Introduction

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This deliverable brings together insights from the nine BIOTraCes case studies, which examine how biodiversity governance unfolds across European territories ranging from dense urban environments to peripheral rural regions, from river valleys and forests to schoolyards, grasslands, and contested development sites. These include the pastoral grasslands of Hungary (CER), the semi-arid landscapes of Mértola in Portugal (CES), the High Nature Value farmlands of Transylvania in Romania (UBB), the river basin and agricultural territories of the Simeto Valley in Sicily (UNICT), the fluvial landscapes of the Anykščiai dam in Lithuania (MRU), the privately managed forests of southwestern Sweden (UGOT), the renaturalised schoolyards in Vitoria-Gasteiz in the Basque Country (BC3), the civic mobilisation around land-use conflicts in Amsterdam's Foodpark (UT), and the efforts toward nature-inclusive construction in Wageningen in the Netherlands (WR).

Although these contexts differ considerably, they share a central recognition: biodiversity loss cannot be addressed as a purely ecological or technical issue. It is shaped by the routines that structure daily life, by the institutional arrangements governing land and water, by economic pressures and political histories, and by the social relations through which communities understand and inhabit their environments. Across these diverse sites, biodiversity emerges not as a fixed ecological object but as a relational and negotiated field, shaped by the different ways actors interpret, value, and interact with the landscapes they inhabit.

This perspective aligns with the broader analytical approach of BIOTraCes, informed by the Theory of Transformative Change (ToTC) and the PEPE principles, which orient the project toward understanding how plural knowledge systems, socio-ecological embeddedness, power asymmetries, and uneven capacities for action shape the conditions under which transformation becomes possible. Rather than treating these cases as isolated examples, the deliverable explores how biodiversity governance takes shape within hybrid socio-ecological regimes where extractive and regenerative tendencies coexist and where actors navigate tensions between long-standing practices and governance structures, emerging innovations, and contested visions of land and nature.

Cast study	Research Team	Main Themes
Foodpark Against Industry	UT - Utrecht University	- Land-use conflict - Food commons - Urban movements - Agroecology
Mértola Future Lab	CES – University of Coimbra	- Syntropic agriculture - Local food systems - Participatory governance
Urban Schoolyards Biodiversity Lab	BC3 – Basque Centre for Climate Change	- Renaturalisation - Inclusivity - Child-centred design - Governance of educational spaces
High Nature Value Farming	UBB – Babeş-Bolyai University	- Traditional farming - Social inequalities

		• Biodiversity of semi-natural grasslands
Free-Flowing Rivers	MRU – Mykolas Romeris University	• Dam removal • Ecological continuity • Memory and identity • Conflict mediation
Bottom-up Forest Biodiversity	UGOT – University of Gothenburg	• Forest management • Productivism lock-ins • Co-learning with forest owners
Traditional Herders' Knowledge	CER – Centre for Ecological Research	• Traditional ecological knowledge • Marginalisation • Grassland biodiversity
Fluvial Eco-Partnership	UNICT – University of Catania	• Water governance • Agriculture • Territorial justice • Energy communities
Nature-Inclusive Building	WR – Wageningen university & research	• Construction practices • Regulatory constraints • Policy innovation • Human nature narratives

Table 1 - Synoptic Table of the Nine BIOTraCes Case Studies

Reading Biodiversity Beyond Nature

Understanding the contemporary socio-ecological crisis requires an approach that extends beyond ecological metrics to consider the cultural, political, and economic relations through which biodiversity is produced and transformed. Across the nine case studies — from Hungary's herding systems to Portugal's drylands, from Romania's High Nature Value landscapes to Lithuania's river debates, from Sweden's forests to the multi-layered governance of Sicily's Simeto Valley, and from the urban experiments in Vitoria-Gasteiz, Amsterdam, and Wageningen — transformations of nature emerge from the entanglement of everyday practices, institutional regimes, local economies, territorial memories, collective imaginaries, and relations of power.

A recurring insight across these cases is that biodiversity is not a single, universally shared concept. Actors mobilise and interpret it differently depending on their experiences, responsibilities, and ties to land and water. For herders in Hungary, biodiversity is intertwined with labour and livelihood; for farmers in Mértola or Transylvania, it involves soil, water, and sustaining community life under changing conditions; for civic movements in Amsterdam, it becomes part of a claim for commons-based governance; for forest owners in Sweden, it is negotiated through family histories, market pressures, and woodland practices; for teachers and students in Vitoria-Gasteiz, it is embedded in schoolyard routines and forms of learning; for planners in Wageningen, it intersects with regulatory constraints and technical procedures; for residents in the Simeto Valley or in Lithuania's Anykščiai context, it is entangled with identities, memories, and infrastructural dependencies. The ToTC and PEPE principles help orient the analysis of these plural interpretations, highlighting how values, knowledge, governance arrangements, and capacities condition the framing and negotiation of biodiversity across settings.

Considered collectively, these perspectives—across the four high impact sectors of agro-pastoral and forestry systems, fluvial and water-based transformations, urban and infrastructural transitions—compose a mosaic of heterogeneous socio-ecological situations and relations. They illustrate that biodiversity is produced through the interaction of values, practices, governance structures, and divergent understandings of land and nature.

Agro-Pastoral and Forestry Systems and Transformative Soil Practices

A significant portion of the case studies focuses on agricultural, pastoral and forest spaces—territories where soil, care practices, and daily labour represent the most immediate point of connection between human communities and biodiversity. In these contexts, different ways of inhabiting and managing land emerge, oscillating between tradition, innovation, and conflict, and contributing to a plurality of relations within social-ecological systems. These spaces illustrate particularly well how everyday practices—rather than formal planning alone—shape the conditions under which biodiversity is either undermined or regenerated.

In the Mértola Future Lab (CES) case, developed in a semi-arid area of southern Portugal, biodiversity becomes inseparable from the challenges of desertification, water scarcity, and rural depopulation. Here, ecological regeneration is connected to agroecological practices, syntropic agriculture, territorial food systems, and participatory governance involving public bodies, associations, schools, local enterprises, and civic networks. The ecological complexity of Mértola requires a profound rethinking of the relations between community and territory: regenerating soil means restoring value to local knowledge, building new social coalitions, and experimenting with models capable of addressing environmental vulnerabilities and socio-economic inequalities. The concluding chapter will return to this case to show how innovations rooted in relational ecological worldviews can open significant transformative pathways, while also facing structural constraints that limit their long-term embedding.

A similar dynamic characterises the High Nature Value Farming (UBB) case in Transylvania, where extensive agriculture and landscape management in the past significantly shaped the state of today's biodiversity. The coexistence of traditional practices, modernising pressures, and social inequalities produces tensions that directly affect the capacity of communities to preserve species-rich ecosystems. Biodiversity here depends not on technical interventions but on practices and knowledge gradually eroding under intensification, abandonment, and economic pressures that disproportionately affect vulnerable groups such as certain Roma communities. This example underscores how the uneven distribution of vulnerabilities and capacities among actors profoundly shapes biodiversity outcomes and conditions the possibilities for transformative interventions.

In the Traditional Herders' Knowledge (CER) case in Hungary, the conservation of high-biodiversity grasslands is linked to extensive grazing. Herders—holders of ecological knowledge built over generations—are crucial actors for landscape regeneration, yet their practices are threatened by social marginalisation, inadequate regulations, and economic pressures. By foregrounding these dynamics, the case anticipates a main argument of the concluding synthesis: marginalised actors often hold essential knowledge for biodiversity governance, and their exclusion limits the potential for transformative change.

Agro-pastoral practices also intersect with the Fluvial Eco-Partnership (UNICT) case in Sicily's Simeto Valley, where agriculture, water management, habitat protection, and territorial infrastructures compose an interconnected socio-ecological system. Challenges include river fragmentation, erosion of agricultural biodiversity, crisis of traditional citrus cultivation, expansion of large-scale energy infrastructures, and the absence of water governance that is responsive to territorial needs and structured around workable relational arrangements. Yet long-standing civic networks and emerging regenerative practices illustrate how transformative change can grow from the interplay of new practices, territorial memory, conflict, and collective organisation. This example highlights how socio-ecological regimes often function as hybrid systems in which extractive pressures and regenerative tendencies coexist and continuously reshape one another.

Completing this thematic cluster is the Bottom-up Forest Biodiversity (UGOT) case in Sweden, where forest biodiversity is shaped by the decisions of private forest owners. Forests, often perceived as "natural," are in fact the outcome of complex management decisions influenced by market structures, family histories, and conflicting visions of the landscape's future. Transformative potential arises from creating arenas for dialogue and co-learning, yet these processes remain vulnerable without long-term structures. This

exposes a recurring challenge: without stable institutional anchoring, even well-established practices of care and stewardship risk remaining precarious.

Across these cases, the biodiversity of soils and agroecosystems is not a static attribute but the dynamic outcome of material and social relations. Mértola, rural Transylvania, the Hungarian grasslands, the Swedish forests and the Simeto Valley show that biodiversity conservation requires attention to labour, place-based knowledge, local economies, and the tensions generated by unsustainable production models. These contexts also reveal that the value of biodiversity is far from universally shared: it becomes a terrain of conflict, divergent interpretations, and competition among actors with unequal influence, reflecting the coexistence of multiple ecological worldviews and contested ways of understanding and governing nature.

Fluvial Transformations and Water Governance

The biodiversity associated with water becomes particularly evident in cases focused on fluvial landscapes and water governance. Managing rivers brings together institutional, ecological, economic, and symbolic dimensions, often materialising in conflicts over land use, landscape identity, and public policy priorities. These cases show that water systems provide a particularly clear lens for understanding how socio-ecological vulnerabilities and value conflicts shape governance outcomes, and why rivers often become focal points of political negotiation and ecological concern.

In the Free-Flowing Rivers (MRU) case in Lithuania, the proposal to remove the Anykščiai dam highlights tensions between ecological needs—such as river continuity, fish migration, and habitat regeneration—and social dimensions linked to memory, cultural identity, and local meanings attributed to the river. The dam is not merely technical infrastructure; it is a fragment of local history that generates emotions, fears, and resistance. This illustrates how ecological restoration efforts unfold within dense webs of symbolic attachments, contested values, and historically sedimented relations between communities and their environments.

Water is likewise central in the Fluvial Eco-Partnership (UNICT) case, where agriculture, energy, and water governance intertwine. The complexity of the Simeto's hydrological system shows that a river is simultaneously an ecosystem, a productive resource, an identity element, and a political object. Transformative processes must address infrastructural challenges, power asymmetries between institutions, agricultural vulnerabilities, and the need to restore ecological continuity. These dynamics demonstrate how water scarcity, fragmented governance, and competing economic priorities shape biodiversity outcomes and condition the possibilities for socio-ecological regeneration.

Although located in distinct contexts, these cases demonstrate that transforming water landscapes requires recognising rivers as more-than-human assemblages carrying ecological and cultural values alike. Rivers become sites where divergent perceptions, memories, knowledge, and interests converge. Water governance thus becomes a privileged terrain for examining how biodiversity is interpreted, contested, or defended by actors with different capacities for action. Conflicts in these settings emerge not simply as obstacles, but as productive moments through which new ecological visions, alliances, and governance arrangements can take shape.

Urban and Infrastructure Transitions

Biodiversity is not exclusive to rural settings; it takes shape in urban environments, forests, and infrastructural systems. Here, relations with nature are often mediated by regulations, planning frameworks, and economic interests, yet remain essential for understanding socio-ecological transformations.

In the Urban Schoolyards – Biodiversity Lab (BC3) case, the renaturalisation of schoolyards in Vitoria-Gasteiz shows how the transformation of small spaces can produce wide-ranging

educational, social, and environmental implications. Schools become laboratories of inclusion and environmental learning, while also exposing tensions between ecological ambitions and limited institutional resources. This reflects a broader pattern: many biodiversity innovations are small-scale, experimental, and structurally fragile, and require sustained support to consolidate and expand their influence.

A different urban dynamic emerges in Foodpark Against Industry (UT), located in Amsterdam, where a civic movement opposes the conversion of agricultural land into a logistics hub. Here biodiversity becomes a mobilising element that connects urban agriculture, the right to the city, alternative visions of land use, and collective self-management. Territorial conflict becomes a generative moment capable of producing new narratives and practices that demand more equitable and sustainable territorial governance. In this sense, conflict appears as a driver of political imagination and socio-ecological innovation rather than a barrier to be neutralised.

A similar tension—though within the domain of construction—characterises the Nature-Inclusive Building (WR) case, which examines how the Dutch building sector attempts to integrate biodiversity criteria into architectural and urban projects. Here, ecological objectives intersect with regulatory constraints, market pressures, and public-private arrangements, revealing how technical innovations are inseparable from institutional dynamics. These intersections highlight how embedding biodiversity criteria within built environments requires not only technical solutions but also institutional willingness to adapt procedures, norms, and incentives.

Despite their differences, these urban cases share a key insight: biodiversity is a field where multiple values and imaginaries intersect, giving rise to conflicts and negotiations. Transformative change requires institutions to open themselves to social plurality, communities to experiment with new governance forms, and economic actors to acknowledge the limits of prevailing models. Together, these cases show that socio-ecological regeneration depends on the ability to work across scales, frameworks, and worldviews, rather than within fixed policy or disciplinary boundaries.

Entanglements and trajectories of transformation

Reading across the nine BIOTraCes case studies allows us to identify several broad trajectories that guide the analyses presented in this deliverable. These trajectories do not present conclusions but provide orientation for understanding how socio-ecological relations, institutional practices, and everyday dynamics shape biodiversity governance.

A first trajectory concerns the importance of everyday practices. Whether through extensive grazing in Hungary, agroecological innovation in Mértola, farming routines in Transylvania, river stewardship in the Simeto Valley and Lithuania, forest care in Sweden, or schoolyard and civic practices in Vitoria-Gasteiz, Amsterdam, and Wageningen, biodiversity emerges from daily lived experiences and interactions rather than from policy interventions alone.

A second trajectory concerns the position of actors who are essential to biodiversity governance yet often marginal within institutional settings. Herders, small farmers, Roma communities, civic coalitions, children, peripheral residents, and forest owners all hold forms of knowledge and responsibility that shape biodiversity outcomes but whose capacities to participate are often constrained. This echoes the Empowering and Pluralising dimensions of the BIOTraCes framework.

A third trajectory concerns the contested nature of biodiversity across these contexts. Divergent ecological meanings — scientific, relational, livelihood-based, identity-driven, or justice-oriented — coexist and interact, revealing the importance of Politicising biodiversity governance to account for underlying tensions and competing values.

A fourth trajectory emerges from the multi-level governance environments in which these cases unfold. From European directives to national incentives, regional planning

frameworks, and local constraints, the Embedding of practices within institutional systems shapes how interventions take root, evolve, or remain fragile.

A final trajectory concerns the difficulty of sustaining biodiversity-oriented innovations over time. Whether in agroecology, civic mobilisation, forest stewardship, fluvial partnerships, or nature-inclusive design, many promising initiatives rely on precarious arrangements unless anchored in governance structures capable of providing continuity and institutional support.

Taken together, these trajectories orient the analyses developed throughout this deliverable. By explicitly naming each case study and situating them within a shared interpretive landscape, this introduction offers an entry point for understanding how European territories, communities, and institutions reinterpret their relations with nature through plural values, everyday practices, and evolving governance configurations.

Reading guide

This deliverable includes all nine case studies, framed by an opening introduction and a concluding synthesis. Each case study follows a shared structure: a summary, followed by Case study introduction (section 1), Research methods and application of PAR (section 2), Case study contextualization (section 3). Sections 4, 5, and 6 correspond respectively to the core analytical components of WP2—Transformative Biodiversity Innovations (D2.2), Social-Ecological System Analysis (D2.3), and Locally Tested Interventions (D2.4). The case studies appear in alphabetical order of the research teams leading them: BC3, CES, CER, MRU, UBB, UGOT, UNICT, UT, and WR. The deliverable closes with a conclusion that integrates insights across cases and situates them within the broader aims of BIOTraCes.

Overall, the structure supports different types of readers: those seeking methodological detail, those interested in contextualised empirical narratives, and those concerned with the strategic and transformative implications of biodiversity-related practices. By following the sequence of sections, the reader can move from contextualisation through innovation mapping, SES analysis, and intervention assessment toward a comprehensive cross-case understanding of biodiversity governance.



BC3 Urban Schoolyard Biodiversity Lab

D2.5, Spain

December 2025

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Funded by
the European Union

schoolyard greening program initiated in 2022 as a response to a manifesto of the municipal associations of parents demanding healthier and greener school environments a year earlier. Administrated by the city hall and funded by different public grants, as of 2025 14 schoolyards have been renaturalized through replacing hard with permeable, natural surfaces such as sand and soil and the adding of plants, trees, and lawn areas, nature-based play equipment and garden elements. The process was implemented through the collaboration of different municipal entities and, in various degrees, together with the educational communities of the different schools.

In this case study, we focus specifically on the governance configurations of schoolyard greening on the local level, collaborating with the public administration (the Center for Environmental Studies and the municipal education department) and the local educational communities, including teachers, families, school staff, and organizations dedicated to educational activities. That is, we zoom on to the various challenges derived from a combination of complex administrative structures and responsibilities scattered across different institutional entities, plural imaginaries attached to the role of schoolyards in education and urban planning, and a diversity of actors involved and needed to make the schoolyard interventions successful. Concretely, we disentangle the various challenges, but also potentials of the current program structure together with multiple actors to envision a version of the improved schoolyard greening program in future, where biodiversity and equity are at center of the design, use, and narrative of the schoolyard.

Until now, there have been only a few standards at the regional and national level for implementing nature-based elements in schoolyards. That is, most schoolyards are characterized by a design allowing for low maintenance costs (resulting in e.g. huge, asphalted areas) and with a priority on competitive sports (such as football or basketball), raising issues of gender inequality and inclusivity. Despite these regulatory frameworks, there is a high awareness of the local administration in the case study context for the importance of improving school environments through renaturalization efforts, also to adapt schools to climate change impacts (e.g. heat vulnerability). The locally formulated ambitious objectives of these interventions are threefold: first, to increase inclusivity through gender-inclusive design; second, to contribute to a paradigm shift towards co-education, and lastly, to embed sustainability into every aspect of school life.

Over the course of BIOTraCes, a slowly, but steadily growing awareness of policymakers across scales can be noticed, exemplified by more regional funding schemes specifically dedicated to improving schoolyards or increasing schoolyard greening pilot projects scattered across Spain and other European countries. However, in the context of Vitoria-Gasteiz, as for now, it is not clear if the city hall and its elected politicians will include the program into the annual budget after 2026, i.e., if the schoolyard greening program will be continued after its pilot phase. Core objective of BIOTraCes is hence to support through a participatory action approach the public administration and educational communities in their objective of having schoolyard greening as core part of municipal planning allowing for an improvement of the schoolyards of all the public schools located in Vitoria-Gasteiz and beyond.

Next to these challenges derived from a lack of prioritization of local political decisionmakers of improving those educational and recreational spaces crucial for children's development and well-being, this case study identified three overarching obstacles that need to be overcome to unleash the transformative potential of a municipal schoolyard greening program. First, one of the most complex issues relates to the unequal capacities of different schools to enact change, given their heterogenous socio-demographic profiles. That is, those schools with higher percentages of children belonging to vulnerable communities tend to have less capacities to implement, maintain over the long run, and deeply integrate renaturalized schoolyards into educational and recreational activities. This is due to an often-lacking strong and active parents' association, as parents part of marginalized communities and impacted by structural injustices face other urgent priorities. The parents' associations, however, have been identified as a main driver sustaining the success of schoolyard greening.

Second, while the project is framed around very ambitious and holistic objectives, namely co-education, inclusion, and sustainability, this has generated frustrations on the side of the educational communities. Resources are very limited for the implementation of each schoolyard, as the project, including a participatory process with the specific educational community, must be designed, decided and implemented over the course of one academic year. Given the little budget, the decision has been made to focus on nature-based elements only, with a prioritization of the replacement of hard surfaces (concrete) with natural materials (sand, soil, lawn) and to add more elements as there is budget. As the short time frame and possible interventions resulting from the limited budget pose a challenge to an in-depth participatory process with the schools and to meet all the a priori formulated objectives of co-education, inclusion, and sustainability, outcomes of the schoolyard improvements often do not meet the expectations of the educational communities. This risks long-term engagement and commitment of the specific educational communities to the maintenance of the schoolyard and even may deride trust in future institutional initiatives aiming to improve educational spaces.

Lastly, although the municipal program's title of "renaturalizing urban schoolyards", biodiversity and nature, so far, only plays a secondary role in the program. That is, while nature-based interventions are the main criteria for physical changes in the schoolyard, on the discursive level the current focus is more on the schoolyard's social aspects. Following, we identify a need to include nature, and specifically children's relationship with and through nature, into the narrative of the schoolyard greening, understanding their challenges through a social-ecological lens with an emphasis on the strong interconnections and links between nature and society.



Figure 1 - A Schoolyard of a municipal public preschool before (photo left) and after (photo right) the renaturalization interventions.

1. Case Study Introduction

1.1 Justification of the importance of the case study

In the context of a social-ecological crisis, children are one of the most vulnerable groups. However, their needs are still only considered at the margins of political debates and decision-making. Children spend most of their time in school environments. It is hence imperative to design them in a way they respond to children's well-being, allow for creative learning and play environments that enable contact with nature, and offer protection from impacts of extreme weather events. That is, schoolyards should be thought of as social-ecological systems through the lens of inclusivity, co-education and sustainability.

However, in a Spanish context, until now, schoolyards have received only little political attention. National standards and municipal criteria for schoolyards still follow paradigms of cost-efficiency and competitiveness that prioritize concrete over nature, as the maintenance of green schoolyard involves higher costs, and that are designed around competitive sports, such as football or basketball, fueling gender inequality. While there is a need to create governance frameworks facilitating the administrative burdens of schoolyard greening, local educational communities together with institutional partners also hold, to a certain degree, agency to enact change (Sekulova et al., 2025; Sekulova & Mallen, 2024).

Based on previous literature, we identify six overall reasons to put improved school environments, with a focus on renaturalized schoolyards, at the center of both planning and education theory and practice¹:

1. To increase children's well-being through nature-inclusive and creative-play designs of schoolyards (e.g., Chawla et al., 2014).
2. To increase inclusivity and social equity by enabling access to green recreational and educational spaces for children belonging to marginalized communities, e.g. through gender-inclusive design (Raney et al., 2023).
3. To create nature-inclusive learning spaces enabling deeper human-nature connections through early on contact with and care for nature (Frisk & Larson, 2011).
4. To increase urban green infrastructure, by embedding urban biodiversity in schoolyards, also with a focus on child-centered urban planning (Clauzel et al., 2025)
5. To increase climate resilience towards extreme weather events and counter urban heat island effects by replacing asphalt with natural materials like trees, permeable and natural soils, and plants to provide natural cooling (e.g., Flax et al., 2020).
6. To increase social cohesion at the neighborhood level, by understanding schoolyards as a community space open and accessible to a broader public (Cilliers et al., 2024).

1.2 Explanation of the focus of the case study

This case study focuses on the potential and current challenges of a municipal schoolyard greening program for achieving transformative change beyond changes of the physical landscapes, by including value and paradigm shifts in the urban planning and education sector. We focus on the multi-level governance configurations of schoolyard greening, collaborating with the local public administration and the local educational communities. That is, we zoom on to the various challenges derived from a combination of complex administrative structures and responsibilities scattered across different institutional entities, plural imaginaries attached to the role of schoolyards in education and urban

¹ See BIOTraCes factsheet: Why schoolyard greening matters? https://www.biotraces.eu/wp-content/uploads/2025/04/20250407_BioTraCes_FactSheet_Spain_ENG_WEB.pdf

planning, and a diversity of actors involved and needed to make the schoolyard interventions successful. Concretely, we disentangle the various challenges, but also potentials of the current program structure together with multiple stakeholders to envision a version of the improved schoolyard greening program in future, where biodiversity, justice, and multi-actor participation are the core pillars of a school remaking. Following (Sekulova & Mallen, 2024), we thereby apply an understanding of renaturalizing schoolyards “beyond narrow technical solutions for climate adaptation or pedagogical innovation (...) towards a process of school (re)making.” This implies a democratization of school governance attributing agency of change to the educational communities through a co-governance of the school environments attentive to specific local needs and perspectives.

1.3 Research questions addressed by the case study

The overarching research objective is to explore to what extent green and inclusive schoolyards can be part of a wider transformative change towards a (bio)diverse society. We explore this objective through the following sub-questions:

RQ1: What is the national, regional and municipal governance configuration for schoolyard greening, focusing on the sectors of urban planning and education?

RQ1.1: How do dominant paradigms in the education system create barriers for transformative sustainability education?

RQ2: What are current visions of municipal schoolyard greening programs and how do they relate to transformative change? How are the concrete objectives of municipal schoolyard greening programs underpinning the overall vision contributing to creating just and sustainable school environments through changing values, structures, and practices? How and by whom are visions and objectives formulated and defined?

RQ3: How can institutional and educational community actors drive, promote, participate in a more just and democratic schoolyard greening governance?

RQ3.1: Where does the agency of educational communities lie to enact change considering the socio-economic differences of educational communities and resulting different capacities to be driver of change? How can agency and capacity be increased?

RQ3.2: How can institutional actors support the educational communities and what are concrete strategies to overcome current institutional blockages? How can bottom-up and top-down actors better collaborate and maintain transformative momentum?

RQ4: What is the broader imaginary of biodiversity and nature in municipal schoolyard greening program? What role does biodiversity play in the overall framing and in the concrete implementation of the program?

1.4 Reading guide

In the remainder of this deliverable, we will present the findings from a participatory action approach applied in the context of a municipal schoolyard greening pilot program. The research presented here is the outcome of collaboration with the BIOTraCes societal partner, the Environmental Studies Center of Vitoria-Gasteiz, other relevant institutional actors, and most importantly, representatives of educational communities. In the following chapters, we will first present the research methods and application of PAR. This is followed by Chapter 3 describing the relevant case study context, focusing on cultural, social, ecological, and political aspects to ground this case study locally. Chapter 4 then continues with an in-depth presentation of the transformative biodiversity innovation – a municipal schoolyard greening pilot program –, its current actors involved, its potential for upscale and an initial mapping of successful interventions. Chapter 5 zooms onto the social-ecological interactions by providing an analysis of the current social-ecological system, focusing e.g. on values and knowledge guiding current governance configurations. Chapter

6 then provides an analysis of interventions implemented, identifying both enablers and disruptors and successful and failed practices and concludes with the transformative potential encountered in this case study and research approach.

2. Research Methods and application of PAR

2.1 Role of Societal Partner

Our societal partner is the Environmental Studies Center of Vitoria-Gasteiz (acronym: CEA), a municipal entity of the city hall of Vitoria-Gasteiz. CEA's core responsibilities in the municipal schoolyard greening program lie a) in the schoolyard (co-)design, implementation, and construction, led by CEA's architect, and b) in specific environmental accompaniment of the program, e.g. through the design of a citizen science program or monitoring of sustainability indicators related to the renaturalized schoolyard. It is one of the three institutional municipal actors involved in the schoolyard greening program that meet on a regular basis to update on project evolution and discuss challenges encountered and future actions.

Next, there is the city hall Department of Education that is leading the schoolyard greening program. They are responsible for the (financial) administration as they hold the municipal authority over the public pre- and primary schools and their schoolyards. The third actor is the Department of Maintenance, responsible for maintaining the schoolyards and the nature-based elements after the project's implementation. Despite all three representing the same institutional actor, namely the city-hall of Vitoria-Gasteiz, they have differing perspectives on different aspects of the program, such as the success of the program, the perceptions of schools involved, and the long-term maintenance of the schoolyards. Lastly, there is the Basque Government, and its departments of education and health, providing most of the funds used for the implementation of the municipal schoolyard greening program.

It is important to state that we have mostly interacted with the municipal technical staff, navigating the political dynamics inside the city hall. Regular meetings with the CEA and email exchanges were used to share updates on the evolution of the schoolyard greening program, discuss the schoolyard greening program and its potentials and blockages for transformative change and receive feedback on our workshop designs and overall observations. On a less regular basis, we also meet with the Department of Education technical staff, to contrast ideas and for feedback on project evolution, as they bring in a different institutional perspective of the schoolyard greening program.

The interactions and exchange with the CEA and the Department of Education are extremely valuable, as they provided us an in-depth understanding on the complexities and challenges public administrations are facing when implementing programs such as the renaturalization of urban schoolyards and navigating inter- and intra-institutional positions and (power) dynamics to enact change. The CEA draws on several decades of experience in implementing diverse environmental initiatives in urban, peri-urban, and rural areas, including green infrastructure, agriculture, mobility, environmental education, and citizen science programs. The Department of Education, as administrative entity of the public pre- and primary schools in Vitoria-Gasteiz, holds a good overview over the different challenges and capacities of the diverse educational communities spread across the city. The close collaboration with those two institutional entities enables us to contrast perspectives and challenges with other important research partners (see section below, educational communities) and identify together leverage points to develop the program towards a biodiversity innovation driving transformative change while being considerate and grounded in the realities of structural administrative barriers.

2.2 Collaborative Research and Application of PAR

We draw on a mixture of methodologies to create an in-depth picture of the local social-ecological context of the case study. Those methodologies were selected to allow for mapping, futuring, and reflecting (see BIOTraCes deliverable D1.4). While the local institutional actors are the official BIOTraCes partner, the educational communities are the main recipients of biodiversity innovation and hence the most important actor turning schoolyard greening into a successful contributor to transformative change. That is, the

PAR approach includes, next to the regular interactions with institutional actors, the integration of the educational communities' perspectives. We observed a lack of spaces of dialogue between the two broader actor groups of institutional and educational community actors to share broader perspectives regarding visions, challenges, and potentials of the municipal schoolyard greening program. Departing from this observation, we decided to implement multi-stakeholder workshops with the main objective of bringing the diverse actor groups together. Concretely, we implemented the following participatory activities in the field:

- Participation in internal cross-departmental meetings of local institutional actors regarding the municipal schoolyard greening program.
- Participation events organized by different city hall departments surrounding the schoolyard greening program (e.g. conferences about the city's mission of co-education or green schoolyards and sustainability education), together with various educational and institutional actors.
- Regular meetings between BC3 and CEA and/or Department of Education to discuss program evolution in relation to BIOTraCes research objectives.
- Fieldtrip to three pilot schoolyards together with the CEA and Department of Education, and open dialogue with teachers and deans of the respective schools (May 2023).
- Participatory mapping workshop with nine municipal institutional actors part of the administration of the schoolyard greening pilot program. Aim of workshop: identification of the different components of the social-ecological system, including actors, initiatives, direct drivers of biodiversity loss, or governance frameworks (June 2023).
- One-on-one interactions (informal, semi-structured interviews) with multiple local actors, including local institutional actors, educational community actors (representatives of parents' associations and teachers), architects involved in the design process, researchers and experts in environmental education (over the course of 2024).
- Workshop with 15 local institutional and educational community actors active in the schoolyard greening program to identify program visions with a prioritization of concrete objectives and current challenges hindering the objectives from being met (February 2025)
- Workshop with 10 local institutional and educational community actors active in the schoolyard greening program to identify concrete actions and pathways to overcome current program challenges (April 2025).

We had several iterations of adapting the overall research and the specific multi-actor workshop objectives and designs to assure relevance to both institutional actors and the educational community, while also meeting BIOTraCes objectives.

For this, we had regular meetings over several months to understand needs and perspectives of diverse actors, including the educational community, to draft and re-write specific research objectives based on the feedback and experiences shared by the CEA and the Department of Education. The research objectives shifted from an initially planned focus on 2 or 3 schools only towards researching the program's overarching governance structure. This shift resulted from the feedback of various actors emphasizing the limited capacities of educational communities. More vulnerable educational communities are overburdened given the limited time and financial resources embedded in the public schooling system. PAR hence involves being sensitive to those limitations that do not allow for engagement and participation in an in-depth research process.

Based on this change of the research focus, we focused on those actors that have an overview over the different aspects of a municipal schoolyard greening program, and that can be considered niche innovators, such as the more active parents' associations that

initiated the municipal schoolyard greening program through a manifesto, architects that implemented both top-down and bottom-up participatory processes for the schoolyard design, organizations conducting educational environmental activities, with teachers, kids, and families, and political and technical actors.

Based on the many interactions with these different actor groups, we adapted the research questions to understand, first, the governance context, second, the multiple objectives and their prioritization, third, an improved collaboration between top-down and bottom-up processes to realize the potentials of the multiple efforts being made, and, lastly, put more emphasis on the role of biodiversity and nature, through an open dialogue and process of learning from each other.

2.3 Triangulation

We followed a grounded theory, inductive approach, screening the data as we collected it and adapting research objectives to new insights gained in the field. The participatory approach described in Section 2.2 has further been complemented with:

- Semi-structured interviews with experts of the national legislative governance framework for environmental and sustainability education.
- Document and archival data analysis (urban planning and educational policies, reports produced by institutional actors and educational communities).

Following, we applied, as initially planned, a triangulation of field-, workshop-, and document-based data analysis. We started with methods helping to situate our research in its complex social-ecological context. The aim was to map all the relevant actors and their (power) relationships, the institutional and governance context, values and dominant paradigms of the high impacts sectors of urbanism and education.

Document and archival data analysis

Document analysis to understand the history, evolution, and overall vision (including values, knowledge types, worldviews) of the municipal schoolyard greening program, consulting relevant policy documents on the regional, national and EU level; overall local urban planning strategies and visions of, e.g., urban climate change adaptation, green infrastructure, biodiversity strategies, education, and child-friendly cities; press releases and published project reports by the city hall and other involved actors; and internal working documents shared by societal partners.

Critical discourse analysis of Spain's education laws since the country's transition to democracy, complemented with interviews with policymakers and members of pedagogical social movements. The objective was to trace the evolution of discourse in the education sector, the establishment of a dominant paradigm of education as a factor for economic growth and the influence of international institutions like the OECD in this process, as well as the emergence of pedagogical social movements and their capacity to integrate transformative elements into education policy.

Technical report on Urban Heat mitigation in schools: Spatial prioritization for greening interventions in Vitoria-Gasteiz. This report explores the importance of creating cooler and more comfortable school environments, with a specific focus on spatial prioritization and distributive environmental justice through the development of the Heat Vulnerability Index, as a measure of the societal demand for reducing urban heat through greening interventions.

Field-based research

Ethnographic approach: participation in meetings with institutional actors and in events organized by the city hall regarding the municipal agenda of co-education, etc.

Semi-structured Interviews: we have carried out face-to-face interviews with the different actors (institutional and members of the broader educational community) to understand their specific positions. The objective was identifying the plurality of different

perspectives (pluralising) and those perspectives underrepresented in the narrative of the case (politicising) and the implementation of the project by the institutional actors (embedding).

Based on these data types, we have collected a list of key potentials and challenges for transformation, that provided the basis for co-producing strategies for green schoolyards as a leverage point for transformative sustainability education and challenging dominant paradigms in the education and urbanism sector. We thereby aimed for a workshop design that is aware of the scope that the current legal framework for formal education allows for applying transformative approaches and in how far the legal framework poses a barrier to this.

Workshop-based methods

A **collaborative mapping** exercise was carried out with the interdepartmental team responsible for the municipal schoolyard greening project. The objective was creating a first overview of all the actors with a stake in the schoolyard greening project, the types and conceptualizations of nature in the case study, identifying some key interactions in the SES, and identifying institutional and legal frameworks the case study is embedded in.

A series of three multi-actor workshops bringing together both educational community and institutional actors to discuss aspects of the current municipal schoolyard greening pilot program, focusing on its governance configurations and more specifically on the visions and objectives attached, current challenges and potentials, and the role of biodiversity.

3. Case Study Contextualization

3.1 Multidimensional Presentation

This case study is embedded in the urban context of Vitoria-Gasteiz, administrative capital of the autonomous region of the Basque Country, Spain. The mid-sized city of around 250.000 residents is located on the plain of Alava. The municipal territory consists of an urban center with an extensive network of green infrastructure which is enclosed by a peri-urban green belt of 35km, that again is surrounded by an agricultural belt and a mountain range in the south. This makes it the largest municipality in the Basque Country. In 2012, the city received the European Green Capital Award for its four decades long trajectory of environmental and sustainability urban planning, including the areas of green infrastructure, mobility, agriculture, and environmental education. Since then, many other awards and participation in international networks followed, which made the city become an internationally recognized pioneer in advancing urban and peri-urban sustainability (Neidig et al., 2022).

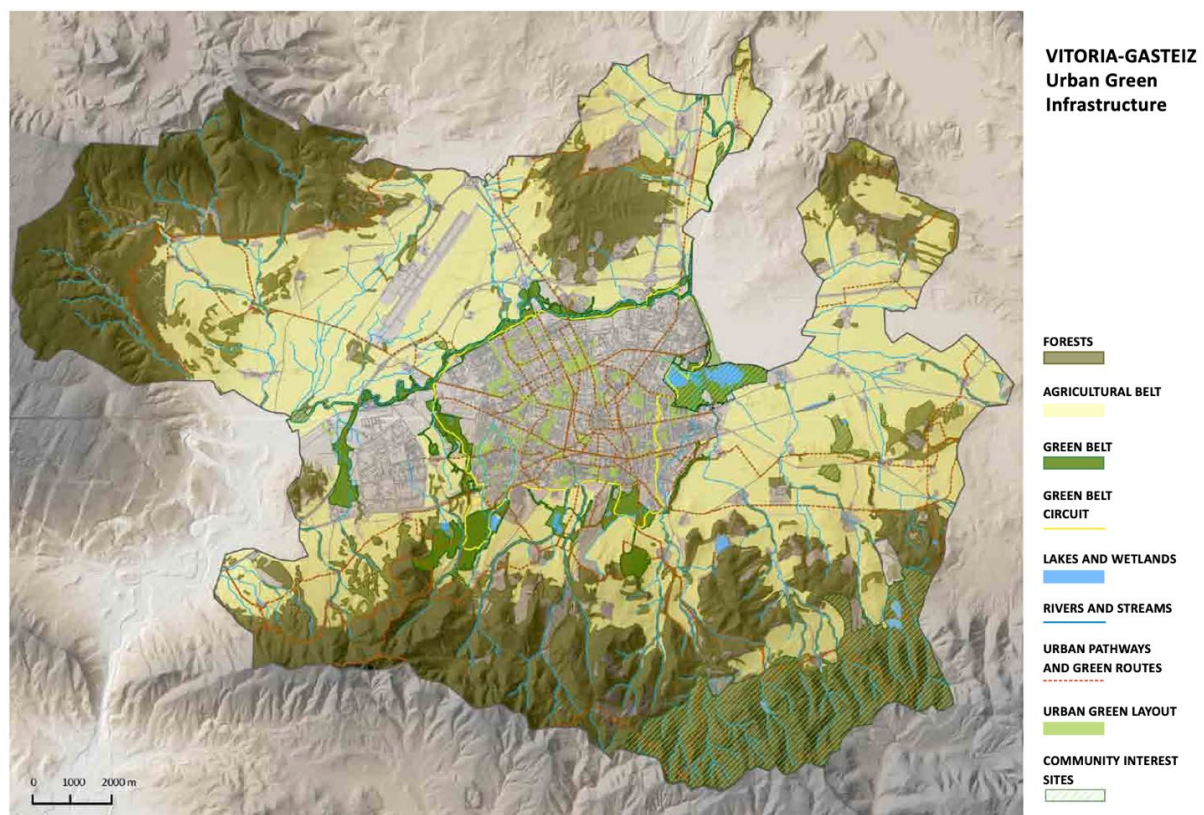


Figure 2 - Urban green infrastructure of Vitoria-Gasteiz, Source: Environmental Studies Centre, Vitoria-Gasteiz City Council. 2014. The urban green infrastructure of Vitoria-Gasteiz. A proposal document.

Most of the city fabric has been built in the second half of the 20th century. Except for the medieval historic city center and some neighborhoods in the city's south, most of the neighborhoods were developed during the urban transition from an agricultural to an industrial economy in the 1940-80s. In that period, the city grew fivefold given the influx of industrial workers from other parts of Spain, and following a top-down planning design of wide urban spaces, mainly for car use. Despite the high fluctuation of political parties passing through the city hall, environmental thinking has been dominating the urban evolution over the last few decades. This has also led to the renaturalization of many of the 1940-80s built neighborhoods (Verdaguer Viana-Cárdenas, 2006). Next to urban greening initiatives, (sustainable) education has also been part of the urban vision of Vitoria-Gasteiz. For example, the city signed the international Charter of Educating Cities

committing thereby to embed education as life-long learning into different aspects of urban planning, moving education from the physical space of schools towards a city-wide process. Despite this political commitment, until now, public school environments have only received few of the city-wide renaturalization efforts. That is, the municipal standard schoolyard – especially in public schools – still consists of fenced, asphalted surfaces with very little to no shaded areas.

The schooling system in Spain, and specifically in the Basque Country, is marked by a high percentage of private and semi-private schools, resulting in less of half of the children attending public schools. This dual structure in the Spanish education system enables educational segregation (Murillo & Guiral, 2024). This is exacerbated even more in the Basque Country given its different language models of teaching in Spanish and Basque. There are only a few schools teaching entirely in Spanish, while more educational centers are shifting to a mixed language model or teaching merely in Basque. Resulting, there is a high number of foreign-born kids concentrated in the few schools following the Spanish model, while local children tend to go to those schools teaching in Basque – which are often private and semi-private schools.

The high index of migrant children in these schools presents educational challenges and leads to higher rates of class repetition. This in turn gives public schools a bad reputation and leads native children to move away to other, often semi-private or private, schools, leaving these schools almost completely segregated. The migrant parents in these schools face many challenges that are more urgent than the topic of schoolyard greening, such as learning the language and finding work and accommodation. Furthermore, the language barrier makes participation initiatives such as schoolyard greening very hard (Fieldnotes from meeting with actors).

3.2 Key Actors and their Impact on Worldviews

Institutional actors

The **CEA** has a long trajectory in working on (peri-)urban environmental innovations. As the environmental think-tank of the municipality of Vitoria-Gasteiz initiated in 1986, its main objective had been the integration of nature into both the urban long-term vision and strategy and the physical cityscape, through the implementation of concrete renaturalization projects and the formulation of strategies, such as the one of biodiversity², green infrastructure³, or climate change adaptation⁴. One of their first stellar projects was the restoration of a dried wetland in the peri-urban area – now a Natura2000 site embedded in the 35km long green belt surrounding the city –, and that kickstarted the implementation of a holistic city-wide green infrastructure network (Orive & Dios Lema, 2012). CEA's work also includes environmental education programs, that have contributed significantly to raising awareness of the city's residents regarding the environment and sustainability over the last few decades.

Based on CEA's work, among others, the **city hall of Vitoria-Gasteiz** managed to create an international urban brand around greening, especially through the 2012 European Green Capital Award that brought significant economic return to the city. Embedded into the city's greening narrative, CEA's discourse on urban biodiversity mostly centers on more technical concepts with underlying instrumental human-nature relationships, such as ecosystem services and nature-based solutions (Neidig et al., 2022, 2023). This can also be found in the concrete framing of the schoolyard greening program, in which nature is thought through climate change adaptation, its aesthetic value, and its learning value for

² Vitoria-Gasteiz city council. 2014. Estrategia para la conservación de la biodiversidad del municipal de Vitoria-Gasteiz.

³ Environmental Studies Centre, Vitoria-Gasteiz City Council. 2014. The urban green infrastructure of Vitoria-Gasteiz. A proposal document.

⁴ Vitoria-Gasteiz city council. 2022. Plan de Acción de Clima y Energía Sostenible de Vitoria-Gasteiz (PACES 2030).

children. Following, the introduction of native species and of species important for biodiversity plays only a secondary role, as the primary focus is not on improving biodiversity directly but creating connection between children and nature (i.e. addressing the underlying driver for biodiversity loss of disconnection from nature). This connection is targeted, for instance, by introducing 'attractive' plants that children can interact with, such as fruit trees or aromatic plants.

The **City Hall's Department of Education** – as the administrative entity of the schoolyard greening pilot program - focuses more on the social and relational aspects of nature. That is, green schoolyards and their nature-based design are thought to enhance inclusivity (through e.g. gender equity) and practices of co-education. The most segregated schools are selected for participation in the pilot program to improve their educational learning environments. The work of the Department of Education includes, next to the overall program administration, the educational accompaniment of schoolyard greening via a partner organization. This happens, e.g., through the provision of materials and through workshops with both teachers on how to integrate the schoolyards into teaching, as well as with children and parents bringing families closer to nature by experiencing the urban green spaces, e.g. of the green belt.

The third city hall entity involved in the schoolyard greening pilot program is the municipal **Department of Maintenance's** responsible for the schoolyard maintenance before and after the schoolyard transformation. The Department of Maintenance's understanding of biodiversity is embedded into a paradigm of cost-efficiency, being subject to many budget cuts and limited resources. Following, a prioritization of concrete over nature can be observed, as hard surfaces, such as asphalted areas, are easier and hence cheaper to maintain. According to those actors, the introduction of biodiversity into the schoolyards would lead to a significantly higher workload, while the municipal maintenance budget has remained the same for the greened schoolyards (as discussed e.g. in the SES mapping workshop).

The local day-to-day educational practices are greatly influenced by **national legislation**, and specifically by the **Spanish Ministry of Education whose education policy has been greatly influenced since the 1990s by OECD frameworks** that prioritize standardization, accountability and the kind of knowledge valued by the market – at the expense of creative, experiential and transdisciplinary approaches required for transformative learning. The current education law developed in 2020, however, marks a shift from OECD discourses. Influenced by environmental movements after the 2019 global environmental protests, its curriculum contains some key social-ecological perspectives, including planetary boundaries and dilemmas and uncertainties regarding growth, and sustainability. It furthermore encourages learning about these topics with project-based, transdisciplinary approaches, which is a key enabler for integrating green schoolyards into teaching practices. Nevertheless, the long dominance of a neoliberal discursive framing of education has led to deep cuts in the education sector (especially in the aftermath of the Euro area crisis) whose effects can be felt until this day, the institutionalization of neoliberal logic of competition between schools and bureaucratic accountability mechanisms. The resulting pressures on school staff suppose a barrier for putting transformative learning approaches into practice, since they require even more time and effort to design and carry out (Ó Riada et al., forthcoming).

Educational community actors

The educational communities are a very heterogenous actor group, including the children, teacher, parents, educators and school staff. Educational community actors participating in the BIOTraCes research activities can generally be described as proponents of the schoolyard transformations. However, over the course of the research, we also encountered voices critical of the schoolyard greening program, including those of some families and teachers.

A key actor driving the schoolyard greening are **parents' associations** of the different schools. They were the initiating factor for the creation of the pilot program: after the formulation of a collective manifesto demanding a transformation of the school

environments to become more safe, healthy, green and co-educative based on an effective co-governance, the municipality responded with a pilot program initially allowing for around 10 schools to be recipients of improvements to their schoolyards. The manifesto specifically mentions the lack of natural areas and air pollution, for which the introduction of biodiversity can be one factor among others to overcome this. Many of the parents participating in the research activities expressed relational worldviews regarding the schoolyards and mentioned, e.g., the objective of enabling children to develop and practice care and stewardship for nature through closer interaction with urban biodiversity.

A key actor needed to utilize the full potential of the schoolyard transformations are the **teachers, educators, and school directories** as they strongly impact the schoolyard's use in the day-to-day educational and recreational activities during school hours. While there are teachers opposing the schoolyard renaturalization as they perceive it as dirty and the removal of needed spaces from children to play due to growth periods of the lawns (own notes on fieldtrip to the schools, 2023), those teachers and educators participating in the workshops and interviews expressed understandings of schoolyards first and foremost as places of play that should allow for diverse, creative and free play, and second, as places of learning. Biodiversity restoration is seen as a welcome side effect, but not a primary goal. However, across the different schools' teachers, there is not one clearly identifiable biodiversity narrative, it very much depends on the individual values and worldviews of each teacher in respect to the role of education and nature.

Ecological actors

Ecological actors in this case can be described as flora and fauna introduced through nature-based interventions at the schoolyard scale, including lawn and weeds, permeable and natural surfaces (e.g. sand or soil), trees and smaller vegetation, wooden play structures, school gardens, and pollinators and smaller animals attracted by the plants and specific elements, such as insect hotels and birdhouses. This flora and fauna have been introduced through a managerial approach, where every ecological element included follows a specific human-centric purpose, in line with an overarching greening paradigm in the urban planning and education sector. To monitor the increase of biodiversity (mainly birds and pollinators) in the schoolyard, the CEA implemented a citizen science project together with the local educational communities. Ecological actors are hence so far not considered as equal actors, e.g. expressed through intrinsic values, but are seen through an instrumental, anthropocentric view of nature.

3.3 Biodiversity Loss Factors

Since the 1940s, local drivers of biodiversity loss can be seen in the parallel processes of urbanization and industrialization (around the automotive sector) in inner urban areas and increasing large-scale agriculture in the peri-urban and rural areas surrounding Vitoria-Gasteiz. This led to the draining of the wetland located in the city's north-east, neighborhoods built above an extensive network of an aquifer system, and encroachment of vast areas of land for urban expansions, both for housing and industries causing both environmental pollution and several inundations. CEA's work since the 1990s consisted of countering the negative impacts resulting from these three parallel processes. They did so by restoring the drained wetland and re-establishing a high amount of biodiversity (now the Natura2000 site of Salburua), and by implementing a green belt surrounding the city, that marks a spatial limit to further urban expansion while having restored many peri-urban areas degraded through industrial activities. Efforts at the inner-urban scale include the implementation of a superblock model to renaturalize many of the neighborhoods built during the 20th century through the provision of a network of green corridors to increase urban biodiversity. The most recent initiatives are targeting a re-envisioning of the agricultural belt towards more sustainable modes of agricultural production and better aligned with local and international biodiversity goals (Neidig et al., 2022; González de Langarica Mendizábal, 2007).

Zooming onto the inner-urban areas, where our schoolyard greening case study is located, climate change is one of the main challenges for urban biodiversity. According to our research partners, many of the local species are not adaptive to the impacts of climate change and are suffering e.g. from urban heat island effects. Consequently, non-native species said to be more heat and drought resistant are increasingly being introduced into the cityscape. The choice of species to be planted in the schoolyards is also influenced by arguments of cost-efficiency of maintenance aiming for “cleaner” nature (less leaves, no fruits), as the city hall has not dedicated more budget to the maintenance of green spaces. This controversy of renaturalizing while keeping costs down puts a huge risk on the success of the greening intervention, as there is an overall tendency to provide financial resources for the implementation of renaturalization programs, but not for their long-term maintenance (own fieldnotes).

Most recently, biodiversity is coming back to the city for unexpected reasons. Urban gardeners sub-contracted by the municipality went on strike from March to October 2025 to demand the same salary and working hours as gardeners directly employed by the city-hall. As a consequence of this strike, urban and peri-urban green spaces have not been maintained, which led to meter-high weeds and wild plants growing all over the city, including the coming back of flower species not seen in forty years. While a dream for urban biodiversity, the situation is causing lots of social-ecological conflicts: an increase of ticks in urban parks with increasing diseases for especially dogs, increase of mosquitoes, perceptions of insecurity as public space is overgrown by plants, security issues especially in relation to wildfires and public health, etc. These conflicts even led to threats to the city councilor responsible. It further affected the schoolyards as they also received only minimum maintenance.⁵

The last driver of biodiversity loss is the human disconnection from and domination over nature. This has become apparent in the ruling paradigms of the broader education sector of the last few decades, also visible in standards for schoolyard design in which nature, if at least, only appeared at the margins. Common practice for schoolyard designs still include asphalted and fenced areas. Many of our research partners, both institutional and educational community actors, comment on the lacking awareness of broad parts of society, including teachers and parents, for the importance of having greener schoolyards. The schoolyard greening pilot program, together with other municipal environmental initiatives in Vitoria-Gasteiz, promote environmental educational campaigns and activities in nature, to counteract this disconnection.

3.4 Culture-Based Dynamics

Concepts describing instrumental human-nature relationships and values are dominating the local political discourse and the broader sector. This also impacts the type of knowledge being used to assess the impact of biodiversity initiatives that draw mainly on technical knowledge. For instance, a strong emphasis can be found on the implementation of nature-based solutions and their direct contribution to increasing climate resilience or the health and well-being of children. The societal partner also mentioned the need to produce technical and scientific evaluations of the program as a way to communicate the importance of this biodiversity innovation to policymakers. Disseminating project impacts through quantitative and qualitative indicators (i.e., technical knowledge) has hence been stated as the form of communication needed to reach policymakers. The participation in a European research project, such as BIOTraCes, hence increases legitimacy of results generated (own fieldnotes, 2024).

⁵ See for example: <https://www.elsaltodiario.com/huelga/jardineros-gasteiz-siguen-huelga-cinco-meses-rendirse>, <https://elpais.com/espana/pais-vasco/2025-05-21/huelga-en-los-jardines-de-vitoria-la-ciudad-mas-verde-de-espana.html>

An instrumental understanding of nature combined with the use of dominantly technical knowledge can further be seen in the choice of species introduced into the schoolyards. Those are chosen, e.g., according to their aesthetic value or for being perceived as less “dirty”, e.g., trees with few falling leaves or fruits. Research partners for example reported the wishes from some schools to introduce aesthetically appealing plants, such as trees with “beautiful flowers” - often non-native species -, but that do not attract a lot of pollinators (such as wasps or mosquitos) for safety issues. Plants are also selected in terms of their adaptability to a changing climate, again favoring the selection of non-native over local species (own fieldnotes, 2024). Overall, nature present in urban schoolyards tends to be reduced to something very curated and nice to look at, while aiming to reduce climate risks, but also keeping maintenance costs low. Following, nature is perceived as instrumental to human well-being and approach through technocratic, managerial structure.

This becomes also apparent through an education paradigm aiming for classroom-based and standardized learning that has been dominating much of the education policies over the last few decades. Project-based learning, including learning through closer contact with nature, e.g. through school gardens, has received little attention and space in guiding curricula. The disciplinary separation of curricula, testing pressure, and competition in national and international standardized tests such as the PISA assessment imply little time and recognition for experiential and transdisciplinary learning. Discursive framings of education as the production of ‘human capital’, which have been popularized by international institutions such as the OECD and the World Bank were embraced in Spain since the late 1980s and 90s to ‘catch up’ to more highly developed neighboring economies after the end of a long period of dictatorship and relative economic isolation. The most recent education law for the first time recognizes the importance of experiential and cross-disciplinary learning, but since current teachers have not been trained on these pedagogies, there is, in parts, lacking awareness and knowledge on how to integrate nature into the curriculum (Ó Riada et al., forthcoming).

However, we have been observing an emerging relational narrative throughout the fieldwork activities, where both institutional and educational community actors emphasized schoolyards as relational spaces where human-human and human-nature relationships are being formed and nurtured, e.g. by practicing care, stewardship and kinship. Concretely, discussion centered around strengthening the role of schoolyards as places of care and community, bringing together children and nature (workshops February 2025). Relationality was expressed, first, through calls for designs that should allow the children to take ownership by becoming stewards of the schoolyard and enable closer interaction and engagement with nature and with each other. Some schools implemented so-called “care” initiatives where older children show the younger ones how to take care of the patio. Some schools further asked for outdoor furniture to create social meeting places that could also be used as outdoor classrooms, changing towards a more embodied and interactive way of teaching.

Second, some representative educational communities expressed the wish of introducing local flora and fauna (“wild, local nature”); such as fruit trees and wildflowers. However, this has been a conflictive issue as “wilder” nature is perceived by some as involving a higher maintenance cost, as generating more dirt which in turn may generate discomfort. Some perceive plants attracting pollinators, such as bees, as a risk for children to be stung. Lastly, local species are struggling to adapt to urban heat island effects (workshop April 2025).

Third, the CEA started implementing a citizen science initiative with the aim to involve the schools and neighborhoods in the monitoring of specific biodiversity indicators, such as the counting of bird and insect species. Next to its educational value, the citizen science initiative is also expected to create a sense of ownership and stronger relational and emotional ties with the schoolyards and their inhabiting biodiversity. This on the long run can also help to approach the maintenance of the space as a community effort (fieldnotes meetings with societal partner, 2024-25).

3.5 Identity-Based Dynamics

Identity-based dynamics play out in a more subtle way in this case study context. Here, we focus on two identity-based aspects that challenge an intersectional approach to schoolyard greening.

First, a controversy encountered in the field activities relates to the pilot program's objective of generating multi-use spaces based on a (gender-)inclusive design. Concretely, it refers to the replacement of paved football and basketball pitches - currently occupying most of the space in schoolyards - with a design allowing for multi-uses and free and creative play. Especially football has a high cultural significance in the Basque Country and after the pandemic a lack of exercise among children is an increased concern for parents. It's replacement with nature-based elements has hence created some push back related to the fear of having less opportunities for competitive sports, especially for boys. Nevertheless, there is an increasing consciousness that the prevalent sports-centered schoolyards, dominated by able-bodied boys, cause gender inequalities and a recognition of the value of schoolyards offering diverse opportunity for play and hence facilitate inclusion of all pupils regardless of sex and physical (dis)ability.

Second, research partners reported on the difficulties to engage migrant families in the schoolyard greening program, given their often-vulnerable situations that make participation in school and nature-based activities more difficult. The Department of Education hence offers activities accompanying the schoolyard greening program, such as weekend trips for families to the peri-urban parks. Research partners reported a huge success of those activities, being able to reach more marginalized families that do not have the habit of visiting green spaces. However, lacking participation of diverse communities in the design and implementation makes it more difficult to integrate plural needs and perspectives more holistically.

In relation to the second challenge, it is important to mention the tendency to stigmatize social meeting places that are not renaturalized yet contain a high cultural and community value for migrant communities. The current framing of the importance of urban nature for overall well-being often contains an implicit stigmatization of those non-green meeting places that are frequented by diverse communities for barbeques and sport activities (volleyball, cricket, basketball). This becomes exemplified by a recent controversy regarding a space of high community value that is planned to be renaturalized according to multi-use and inclusive-design criteria, while overrunning its current uses important for social cohesion. Adjacent to a school, this space is also of high value to the pupils, taking it away has implications on their identity.

3.6 Political/Institutional Dynamics

Lacking political will to prioritize schoolyard greening with long-term annual budget beyond the pilot phase.

So far, 14 schoolyards have been participating in the municipal pilot schoolyard greening program. The city hall, however, still considers it a pilot project. That is, the program has not yet been included in the city's annual budget. Despite the efforts of the municipal administrative and technical staff, it is not clear if the program will be continued beyond 2026. The lacking long-term commitment of the city hall by dedicating a fixed amount of money indicates a lacking prioritization of schools and their environments in the local political arena. Overall, financial resources provided are rather tight and do not allow for wider and more holistic transformation of the schoolyard beyond the removal of hard surfaces and for a long-term assured maintenance through the city hall.

Too complex administrative structure with scattered responsibilities and interests makes inter- and intra-institutional collaboration more difficult.

Administratively, decision-making power can be described as multi-level, including the regional (Basque) government and the city hall and its different departments that are responsible for the different areas of the school (building and patio). The regional government holds most legislative power and is also the entity providing the funds for the schoolyard greening. The different municipal departments are responsible for different aspects of the schoolyards, an administrative structure that is very complex, and results in a rather inefficient governance. For the schoolyard greening program to be successful, all these institutional actors need to collaborate and generate consensus, which is not always possible. It further limits agency of school communities to enact change, as they need to understand and navigate these dynamics, which needs time and resources.

Lacking political standards for schoolyard greening on the regional and national level.

At the Basque Government level, there are increasing funding schemes for inclusive schoolyards. These funding mechanisms have, however, not been fully institutionalized and are therefore subject to annual budget discussions. There has furthermore not been a reform of the regulations guiding the original design of schoolyards at the Basque level. There is a general attitude reflected in regulations at the national and Basque level that the primary criterion for designing a schoolyard should be easy maintenance and thus cost-effectiveness. Among the school communities and especially parents, there is increasing recognition of the values of green schoolyards for wellbeing, inclusion, gender equality, biodiversity and climate adaptation in the concrete school environment, but also beyond. Since these values are, however, not reflected in higher-level regulations for schoolyards, schoolyard designs to this day are based on paving over most of the surface. Depaving and greening these grey schoolyards is then implicated with a high cost, meaning that many school communities value green schoolyards but are unable to transform their schoolyards without institutional support.

Not sufficient institutional support for bottom-up initiatives.

While our case study's initial driver is coming from a social bottom-up demand, the municipal program in its current form is clearly top-down, with the city-hall deciding/ selecting the schools without previous consultation to be part of the greening program, based on, inter alia, a vulnerability indicator, and then also implementing the whole process top-down. As the schools, and the broader educational communities are very dependent on public funds, there is little leverage for them to implement bottom-up ideas and initiatives. Further, those funds are often rather small; to really transform a single schoolyard, schools hence need to apply for different funding schemes. Further, in several cases, school communities invested their own resources to draft projects (e.g. schoolyard designs). These initiatives have not been taken up by the institutional actors, instead, they produced their own project without sufficiently communicating with the schools.

4. Transformative Biodiversity Innovations

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4.1 Analysis of Inclusion/Exclusion Mechanisms

In the following, we describe the exclusion and inclusion mechanisms and practices. The aspects mentioned are, however, not black and white. That is, some of the current practices identified contain trade-offs that can lead to both inclusion and exclusion.

The nature of the municipal schoolyard greening program being constituted as top-down, adult-centric approach creates exclusionary mechanisms and furthers power imbalances:

First, the top-down approach is based on an **adult-centric perspective of children’s needs and well-being**. Children, although primary target group as recipients of the biodiversity innovation, are, as for now, not sufficiently included in the decision making regarding their own schoolyard. This is the manifestation of an overarching societal adult-centric paradigm where children are not attributed to agencies to articulate and make decisions regarding their own needs and wellbeing. This adult-centric paradigm becomes also apparent in the broader hegemonic educational paradigm of the public education sector centering on classroom-based learning to enable standard-based evaluations of pupils (PISA). This educational paradigm has for a long time prioritized cognitive ways of knowing competitive, individual learning, at the expense of other knowledge such as affective and practical ways of knowing, as well as collaborative and relational learning practices that could enable deep connections with nature (Bonal and Tarabini, 2013). While some of these approaches have recently been taken up in educational policy, structures and practices in the education system will take more time to adapt.

This challenges the implementation of alternative forms of learning, such as experimental and embodied methodologies aiming for an increased nature connection that is also more attentive to children’s worldviews and perspectives. The current top-down approach to teaching and education more broadly gives little to no space for those alternative human-nature relationships children are or may be developing. In order to overcome the exclusion of children from the decision making concerning their own realities, there needs to be a shift towards children-centric decision making approaches in which children are considered equal actors that know best what is best for them, through e.g. a real integration and participation in the project design and implementation holding decision making power of the schoolyards design, use, and its maintenance. There is further a need to provide educational spaces that enable children to observe, interact, and learn from and with nature at their own pace and without evaluation pressures (O’Brien and Howard, 2016). Few schools exist that are shifting their educational model, e.g. Escuelas libres (Free schools), however, those are private and hence raise issues of justice in terms of who has access to alternative educational models (WS February 2024).

Second, the top-down, adult-centric approach **prioritizes top-down technical and expert knowledge in the choice of schoolyard design**. Research participants mentioned the difficulties of communicating architectural plans of the schoolyard design to the educational communities not used to the technical language and drawings, which caused misunderstandings in regard to the project design (field notes, meetings with municipal technical staff, 2024-25). That is, the use of technical knowledge posed in some school communities as a challenge towards support for biodiversity innovation as it made the understanding of the planned interventions more difficult. Further, the plants chosen for the greening interventions are those that, according to adult experts’ knowledge, are most beneficial/instrumental, in terms of climate change adaptation and educational impact – however, in respect to the choice of plants we encounter many different perspectives, ranging from local vs exotic plants, wild vs. botanical, “clean” vs “dirty” nature.

The adult-centric approach to the municipal schoolyard greening program with its prioritization of technical knowledge was also mentioned in the multi-actors workshops

(February and April, 2025): participants belonging to the educational communities mentioned that the whole idea of renaturalization of schoolyards and the framing around nature-based elements does ignore the main function of schoolyards, namely of being places of play. While nature is important, the focus here should be on the children and their need for creative and free play, which can be achieved, among others, through the integration of nature. According to these perspectives, the focus on nature-based elements distracts from their core objective of **integrating experimental and embodied play and learning** in the day-to-day educational activities.

Third, the top-down approach embedded in a scattered **administrative structure prevents bottom-up actors from making decisions regarding the schoolyard intervention**, including its design and implementation. This endangers over the long run wide societal support for biodiversity innovation, as it overruns agency of non-institutional actors. In this specific case of a municipal schoolyard greening program this may further be perceived as process of co-optation in which local policymakers may have instrumentalized a social demand for improved educational environments for their own political agendas, e.g. in municipal elections. The uptake of the manifesto for improved school environments into a municipal program translated the program structure into one shaped and decided by institutional actors. This, in part, is also due to complex governance fragmented across many institutional entities that complicates a more inclusive multi-actor process (Interviews with educational community actors, 2024).

Fourth, following the top-down and technocratic approach to schoolyard greening, **on the discursive level there is an emphasis on the instrumental benefits of biodiversity innovation**. The increase of biodiversity, and ultimately more-than-human actors, is considered a welcomed side benefit, but not core objective of a municipal program titled “renaturalization of schoolyards” (multi-actor workshop, February 2025). This overemphasis on the instrumental framing of urban biodiversity challenges a holistic integration of more-than-human actors through prioritizing values relating to care and community and impedes the creation and advancements of emotional bonds of human-nature relationships. While research participants representing educational actors report anecdotal evidence of changed behaviors of children, including practice of care for the schoolyard, its biodiversity and other children, and a reduction of conflictive behaviors since the greening interventions (notes fieldtrip, 2023, interviews with educational actors 2024), these aspects are still only marginal in the political discourse that frames nature through its instrumental contribution to children’s well-being or urban resilience (Kotsila et al., 2021; Neidig et al., 2023). To achieve closer human-nature relationships, the overall narrative of the program needs to be more inclusive of various forms of human-nature relationships. This also includes in-depth evaluations of relationships formed and strengthened by a biodiverse schoolyard.

These mechanisms of exclusion are further being derived from structural injustices, exemplified by educational segregation, that hinder vulnerable communities’ participation and integration into the program.

As a result of the points mentioned above, the overarching question regards one of where lies the responsibility to steer change, that is, who should be the main driver of transformative change in the public educational sector. In this case study, parents are often mentioned as key actors. Without their implication in the program, its long-term success remains questionable. Following, the schools that have been considered successful examples of implementing green schoolyards and a changing perspective on (sustainable) education are those with strong parents' associations. Next to the schools participating in the municipal program, there are also some schools that organized the schoolyard transformation bottom-up. This happened in schools with very engaged parents, with in most cases stronger socio-economic profiles. Following, schools lacking a very active and engaged parents’ association – as often the case in more marginalized communities – have shown more difficulties in accepting and maintaining biodiversity innovations. This is deeply embedded in broader societal structures and dynamics of environmental/climate (in)justices.

Both previous research on green schoolyards and our preliminary findings have shown that the success and sustainability of schoolyard greening tend to depend on a few motivated actors in the school communities that push forward the maintenance of the schoolyard and its integration into school activities. Finding these motivated actors among the most vulnerable schools can prove hard, since these schools and their communities already face a lot of challenges, leaving little “extra” time to dedicate to schoolyard greening. There seems to be, therefore, a trade-off between positively impacting the most disadvantaged groups and empowering those dedicated to transforming schools for nature-positivity.

Despite Vitoria-Gasteiz’ municipal schoolyard greening focus on the most underprivileged and segregated schools, the program could not overcome these deeply embedded structural injustices. Even more, the use of a selection criterion based on vulnerability indicators has caused some frustration on the part of the parents’ associations, as the specific criteria for school selection have, however, not been very transparent. That is, it has not been made public why certain schools were chosen for funding while others were not. Upscaling the project will require the establishment of clear and transparent selection criteria for schools. These need to balance the degree of nature access (both in the schoolyard as well as surrounding the school), school vulnerability (in relation to both climate change impacts, such as heat vulnerability, and socio-demographic factors), and the confirmed commitment of the school communities to the greening project.

Inclusion mechanisms in this case study can be found in the program specificities on the smallest, school-based scale:

First, at the core of this biodiversity innovation is the aim to create gender-inclusive, nature-based schoolyard designs. By replacing gender-coded elements such as football pitches with natural features, the city hall seeks to redesign schoolyards in ways that challenge traditional gender roles and stereotypes. Conventional grey schoolyards often prioritize competitive sports, which tend to reproduce gendered power relations and spatial inequalities. Research has shown that girls, in such environments, typically occupy less space and engage less in physical activity— which is especially important at school age to improve psychological wellbeing, physical health and learning capacity (Raney et al., 2023). While the pilot program aspires to address these inequalities, it remains to be seen to what extent the current design of the biodiversity innovation fosters genuinely gender-inclusive spaces.

Second, the use of a vulnerability indicator as a selection criterion for participation in the schoolyard greening program seeks to support school communities that are most marginalized. Here, vulnerability refers to the socio-economic profile of school members, prioritizing schools with a higher percentage of foreign-born students to reduce segregation among children with immigrant backgrounds. In the Spanish context, the Basque Country has the second-highest rate of school segregation for foreign-born children (Murillo & Guiral, 2024). This is largely due to the prevalence of private and semi-private schools, as well as the coexistence of different language models, which, while promoting the Basque language, also complicate the integration of foreign-born students. The issue is particularly pronounced in Vitoria-Gasteiz, where some public schools are composed almost entirely of pupils with immigration backgrounds. Several of these highly segregated schools were selected for the city’s pilot greening project, with the hope that investment in greener, more attractive schoolyards might help retain local families and counteract patterns of school flight. Nevertheless, renaturalizing public schoolyards alone cannot resolve the broader structural issue of educational segregation (Cairns, 2018).

Third, a deeper involvement of children fosters a sense of ownership over the biodiversity innovation and encourages them to care for the schoolyard, its biodiversity, and their school community. Schools that implemented more comprehensive participatory approaches reported positive outcomes regarding children’s sense of ownership and belonging, supporting the development of relational values such as care, stewardship, and community. This was also highlighted by participants engaged in educational and participatory activities within the municipal greening program. Some

schools went further by introducing a “care program,” in which older students teach younger ones how to look after the schoolyard and its living beings. Such initiatives can strengthen human–nature and human–human relationships essential for building more inclusive, caring societies. However, these practices remain exceptions and largely depend on the initiative of individual schools and parents. Embedding children’s participation into the program structure would require additional time and funding to enable meaningful, program-wide involvement in both design and implementation.

Further, the focus on nature-based design encourages play and interaction with natural elements such as trees and plants. Regular contact with nature may help children develop or strengthen their connection to the natural world — especially those who have limited access to green spaces outside of school (Chawla et al., 2014). These relationships are also meant to be reinforced through teaching, by integrating the green schoolyard into the educational process. This is supported, on the one hand, through educational workshops offered to participating schools, and on the other, by including the green schoolyard in each school’s educational project—a mission statement outlining the school’s vision, objectives, and values.

Lastly, **citizen science programs for monitoring birds and insects can raise awareness of schoolyards as habitats for urban biodiversity while strengthening community connections with nature.** The societal partner is implementing a citizen science program to evaluate the biodiversity impact of the schoolyard transformations, in collaboration with schools and other volunteers. Involving the local communities in the monitoring of flora and fauna aims to democratize science and enhance transparency around municipal biodiversity claims, empowering citizens to both contribute to and critically assess urban greening efforts.

4.2 Niche Innovators and Key Players

Next to the institutional technical actors, such as BIOTraCes’ societal partner CEA and the municipal department of education that lead the pilot program and navigate institutional lock-ins to assure program continuity, the main bottom-up niche innovators in our case have been **the educational communities** driven by parents’ associations and in part supported by individual teachers. They pushed institutions to address the shortcomings of existing schoolyard designs and initiated transformation efforts independently, **acting as key drivers of change within the social-ecological system.** After identifying issues such as contamination and noise from nearby traffic, limited contact with nature, hard surfaces, and gender-insensitive designs, 22 schools and their parents’ associations signed a manifesto in 2021 demanding safe, healthy, and gender-inclusive school environments. Some schools with active parents’ associations further started their own greening initiatives, e.g. by bringing plants to the school, raising money through crowdfunding, selling products, etc. for designs to remodel the schoolyards (interview with networks of municipal parents’ associations, 2024).

This manifesto generated political momentum, leading a left-wing opposition party to introduce schoolyard greening to the city hall, where it passed unanimously in the form of a municipal schoolyard greening pilot program led by the CEA and the Department of Education. The municipality assumed control of the program, whereas educational communities perceive a lack of transparency and coordination with schools and parents’ associations (interviews with local policymakers, 2024). The municipal program furthermore only addresses part of their demands—focusing on greening while omitting others, such as safe school commutes. Implemented by the CEA, the pilot program contains in its design a participatory process, together with the educational communities (parents, teachers, headmaster) of the selected schools, to discuss and contrast the design proposed by the CEA, with the objective to respond to school’s specific needs. The whole educational community could therefore theoretically influence the type of nature introduced, although participation was overall very limited and very few schools did participatory sessions with the school children to determine their preferences for the

schoolyards. The final schoolyard designs did not include an analysis of existing bottom-up initiatives of the schools. Plans that the communities had invested their own time and money into were rejected by the city hall, because the municipal project established Nature-based Solutions as the criterium for the project, whereas some of the schools' own designs included non-nature-based elements, such as new play structures, benches, pergolas, etc. (interviews with technical institutional staff and representatives of parents' associations.)

Following, some of these niche innovators thus feel that their agency (including previous efforts of schools) is not recognised and that there is a lack of transparency and communication from the institutional side. We have therefore engaged with the niche innovators by bringing them into a much needed and so far neglected dialogue with institutional actors, to discuss how institutions can better support existing bottom-up initiatives and build on these, and how information and lessons learnt can be shared better. We aimed for countering their frustration by creating a space for dialogue together with institutional actors and empower them to continue their efforts to create more safe, healthy and sustainable school environments, such as in the multi-actor workshops implemented under BIOTraCes.

It must be noted that the niche innovators among the schools are not the marginalized ones. Vitoria-Gasteiz has one of the highest levels of school segregation of students of migrant origin in Europe. In segregated schools, the rate of pupils of migrant origin is often more than 80%, and the rates of poverty are elevated. Since forming part of a parents' association requires paying a fee and having disposable time, many of these segregated schools do not have organized parents' associations. One of the exemplary pioneers in schoolyard greening was thus a school that presented itself in a participatory budget program where part of the allocation of the municipal budget is put to a vote. This school benefitted from the professional expertise of parents, resulting in a strong parents' association and neighborhood mobilization, which enabled it to present a convincing project and garner enough votes - something that would have been nearly impossible for one of the segregated schools. While the municipal schoolyard greening project prioritized these segregated schools in its selection, the budget was much smaller in this case, meaning that schools still had to organize funding for new play structures to make use of the green spaces, which was again much more difficult for segregated schools without organized parents associations. Talking about the empowerment of niche innovators, therefore they need to consider the material realities of the most marginalized school communities, which are concerned with basic needs such as housing and employment and face language barriers.

The organization carrying out the educational accompaniment for the schools selected for the schoolyard greening pilot can further be seen as another niche innovator. They are promoting innovative teaching practices in and with nature which most teachers did not have any experience with. However, their activities also go beyond the classroom and the schoolyard, with activities that bring the families in disadvantaged schools out to the green belt of the city, unknown to many of the participating families, and trainings not only for teachers but also cafeteria and maintenance staff. Their goal is thus to create awareness among the entire educational community about the importance of nature and about how to come into contact with nature. These sessions and trainings are very promising, since they help spread pedagogical innovations aimed at fostering nature-positivity and have brought children from urban disadvantaged backgrounds into contact with nature for the first time in some cases, which led to overcoming fears and revulsion the children had developed towards nature due to a lack of contact. The agency of this organization is being recognized, since it is contracted by the Education Department of Vitoria-Gasteiz. However, very little time is dedicated for these sessions and trainings. Learning in nature is new to most teachers in the schools that are part of the schoolyard greening project. While the educational department has already organized some workshops on the educational accompaniment to the green schoolyards, there is still a perceived lack of awareness of the importance of learning in nature among teachers. Longstanding teaching routines will furthermore be hard to break (interview with environmental education organization, 2024).

When it comes to **existing inclusive mechanisms where the niche innovators can have an impact, there is the school council on the city level**, which acts as a space to bring together institutional (technical staff) and political actors (city counsellors) and the educational community, e.g., representatives of teachers, parents, labor unions, and school headmasters. This space was created to put forward specific demands, de facto it does not have any decision-making power. However, it was through this space that the schoolyard greening idea was presented to the city hall. It is therefore an inclusive mechanism in theory for the niche innovators to present ideas. The non-institutional actors especially criticize the lack of meetings (it is supposed to meet twice a year, but due to municipal elections not even these few meetings have been carried out in practice, with the last meeting happening in 2021) and the little influence the municipal school council has in practice. However, the existence of this space already holds a lot of potential, so it could be strengthened in future.

4.3 Scalable Bottom-Up Innovations for Transformative Change

This case study of a municipal schoolyard greening pilot program responds to challenging aspects of the business-as-usual of two high impact sectors, the education and the urbanism sector. With business-as-usual we concretely refer to, first, the paradigm of classroom-based learning, standardized evaluations of children furthering inequalities resulting from intersectionalities and human-nature disconnection (Delaune, 2019), second, the marginalization of the public educational system and its resulting educational segregation (Diez-Gutiérrez and Palomo-Cermeño, 2023), and third, a focus on instrumental benefits of urban nature, exemplified by concepts dominating current urban planning paradigms, such as nature-based solutions, green infrastructures, or ecosystem services (Tozer et al., 2020). These broader paradigms impact also the standard design of public schoolyards, that so far have received little attention, especially in respect to gender- and nature-inclusive designs.



Figure 3 - Renderings of a schoolyard transformation of the first schoolyard, 2022, shared with the educational communities and neighborhoods

Before diving into the existing innovations, it must be noted that this case study given its embeddedness into institutional structures of the public schooling system does not contain purely bottom-up or grassroots movements, as the implementation of innovations is only possible through support of specific institutional actors. That is, in this case study's initiatives pushed from the bottom-up are strongly interwoven with other top-down processes. Although the schoolyard greening program began before BIOTraCes—the first schoolyards were renaturalized in the 2012/2022 academic year—it is still too early for a

full before-and-after analysis, as the impacts on biodiversity and human-nature relationships require longitudinal study. Research partners note emerging tendencies, but these remain anecdotal and need deeper investigation. Nevertheless, the program's governance has evolved over time through reflection and evaluation by involved actors, with observable learning leading to adaptations in its structure. The innovation now stands at a critical juncture, as the city hall has yet to decide whether to embed the program in the municipal annual budget after the pilot ends in 2026.

First and foremost, **the municipal schoolyard greening pilot program itself represents a biodiversity innovation. While not purely bottom-up, it emerged from grassroots mobilization by local educational actors in Vitoria-Gasteiz, who collectively signed a manifesto demanding improved public-school spaces.** This manifesto was subsequently taken up by local policymakers as a municipal pilot program for renaturalizing pre- and primary schoolyards. Innovation lies in the cross-departmental collaboration of institutional actors and, at least on paper, a participatory process with schools. It aims to challenge conventional paradigms through long-term goals of co-education, sustainability, and inclusivity. Concretely, schoolyards are envisioned as extensions of classrooms, enabling outdoor learning and creative play through gender-inclusive design. By prioritizing marginalized schools, the program seeks to address historical underfunding and educational segregation. Finally, care for nature and the school community has become an increasing focus, reflecting a gradual shift from instrumental to relational approaches and helping counter early childhood disconnection from and domination over nature.

Whether this innovation has transformative potential depends on its ability to overcome institutional barriers. Currently, the program still emphasizes technical knowledge and instrumental benefits of nature, and its top-down approach leaves room for greater participation by local educational communities in decision-making. A space for dialogue is needed to connect decision-makers with those most affected by the biodiversity innovation. BIOTraCes' workshops have served as connection spaces for educational community and institutional actors, allowing participants to share successes and challenges, and to identify concrete near- and medium-term goals through the lens of transformative potential. Specifically, the workshops brought together actors from the educational communities such as teachers, parents, representatives of the federation of parents' associations, school administrators and a janitor with institutional actors including city councilors, and members of the CEA and education department involved in designing and managing the project, as well as members of the organizations carrying out the educational accompaniment. Workshop 1, held in February 2025, served to establish common priorities for the future of the project between the participating stakeholders and identify successes and challenges that had emerged in the pilot phase. In workshop 2, held in April 2025, actions were co-created to overcome these challenges and ensure a more participatory future upscaling of the project.

In our case study, school-based innovations include garden projects, programs engaging children in schoolyard maintenance, and educational activities fostering human-nature relationships. Their potential for upscale is limited, as they often rely on motivated teachers, parents, or support from institutional actors. Yet these initiatives are crucial for transformative change. Green schoolyards provide opportunities for a relational approach to learning, connecting the school to its wider community and ecosystem. They center experiential, real-world interactions with nature and people, for example through community service learning in the school garden. The transdisciplinary systems thinking and collaborative decision-making skills developed through such initiatives are precisely what education systems need to equip future generations to address complex problems like biodiversity loss. Actively involving pupils in project-based learning can empower them to apply knowledge for change and thus give agency to pupils instead of paralyzing them with despairing information about climate change and biodiversity loss (O'Brien et al. 2013) (van den Bogerd et al., 2025).

The current Spanish education law encourages these pedagogical innovations, and green schoolyards offer a space to apply them. What is still missing, however, is more training

for teachers to become familiar with these new approaches and improving working conditions of teachers by e.g. reducing teacher-student ratios and bureaucratic accountability measures, since developing project-based learning experiences in nature requires more time and effort than simply following a textbook. Key actors for enabling this on the local school level are therefore education administrations at different governance levels, and also universities and their education programs that could offer more training in transformative teaching approaches in nature and labor unions in the education sector who are demanding improvements in labor conditions for teachers (Ó Riada et al., forthcoming).

In the context of the Vitoria-Gasteiz case study, the organization carrying out the educational accompaniment has provided some training sessions on learning in nature that can be seen as an important first step for promoting these pedagogical innovations. The early effects of these innovations have been an increase in interest in the potential of nature for learning and the engagement of children in nature, for example in harvesting fruit in the schoolyard. Further, initiatives such as the care program applied in some schools shift agency of care and stewardship over nature and the community towards the children. Children are thereby being empowered to take ownership over their schoolyard and to create emotional bonds with those spaces they experience daily. This Care Program specifically has the potential for upscale as it can be easily replicated in different educational communities.

Beyond the concrete case study, interview partners referred to the following bottom-up innovations with the potential of upscale and replication in other contexts:

One public school in Vitoria-Gasteiz implemented a thorough participatory design process with children to co-create the schoolyard, responding directly to their needs and wishes. This initiative was entirely driven by the local educational community, which applied for funding through the city's annual participatory budget campaign, where residents vote on community projects. After extensive campaigning and neighborhood support, the school won in 2022, enabling a long-term, child-centered participatory process that placed nature and play at the center. With a relatively large budget of €300,000, the school enjoyed considerable autonomy in project implementation, including flexibility beyond the criteria of the municipal greening program of only including nature-based elements. Today, this schoolyard serves as a local best-case example and inspiration for schools participating in the municipal pilot program. However, schools in the municipal pilot program receive smaller budgets, limiting the scale of their interventions and causing frustration in communities aspiring to similar changes. Access to this bottom-up innovation is also inequitable, as it relied heavily on an active parent association, making the implementation of a similar initiative in a marginalized school more unlikely.

In the Basque Country, alternative educational models such as Montessori and Escuelas Libres are also emerging. These schools emphasize experimental, embodied learning with closer contact to nature, challenging the dominant competitive, classroom-based, top-down teaching paradigm. Most operate as private cooperatives, relying on parental funding, which affects continuity and limits access for marginalized communities. If there are not enough pupils attending a year, some schools have to close down, which leads children to have to change their known learning environment. While they represent niche innovations demonstrating alternative educational approaches, broader societal impact and upscale potential depend on greater recognition and support from public institutions to ensure equitable access.

4.4 Initial Mapping of Interventions

The schoolyard greening process itself represents a departure from the standard approach of paved schoolyards. Bottom-up actions included parents' associations of specific schools bringing plants to schools, initiating schools' gardens, or fundraising for diagnostics and hiring architects draft plans for schoolyard transformations. Further, a cross-collaboration

between different municipal schools consisted of launching campaigns that led to the manifesto for safe, healthy school environments. Participatory design efforts by the CEA engaged selected schools, though time constraints limited full participation.

As for now, there are still many uncertainties if the program will be prolonged for the next academic term. Following, a lot of strategies and/or interventions by institutional technical actors are aiming to call attention to and provide evidence of the importance of the program. They are applying a bricolage approach to funding as they are constantly looking for new and diverse funding sources and grants in order to be able to continue the program (field notes, meeting with societal partner). While this is not necessarily challenging current power structures, it is a strategy to navigate political dynamics to be able to achieve stability and continuity of the biodiversity innovation over the long run. This is critical to ensure equitable benefits for all public schools.

Ongoing evaluations include surveys and teacher feedback (regarding the pilot program and its impact on children's emotional state and conflicts), citizen science monitoring of biodiversity impact (focusing on birds and pollinators), and assessment of internal municipal department workflows and dynamics. The idea of these evaluations is to show policy-makers why schoolyard greening matters. The CEA aims to systematize evaluation metrics, including more precise metrics for the biodiversity and climate adaptation impact, the inclusive use of the schoolyard, and the use of new resources in classes. The city's Department of Education increasingly organizes conferences on schoolyards, co-education, sustainability, and inclusivity, inviting scholars, practitioners, and local decision-makers. These forums are a dedicated space of discussion, also with the goal to re-enforce the importance of the biodiversity innovation towards local policymakers.

Opening schoolyards after school hours to the broader neighbourhood, treating them as community spaces or urban parks is a goal, but is currently not happening in most cases, mainly due to open questions about who would be liable if any damaged, injuries, etc. occur in this time. In a workshop pathways were therefore explored to put this into practice, e.g. by establishing municipal regulations that provide guarantees to schools, as well as increasing maintenance resources (workshop 2, April 2025). Opening up schoolyards could raise awareness of their importance and increase social support for the biodiversity innovation. It also aligns with social demands formulated in the manifesto to shift the schoolyard from a purely school-based space to an integrated part of the wider neighbourhood, including safer streets and public access. While institutional actors aspire to replicate this in the municipal program, limited resources, safety concerns, vandalism, and shared administration across departments are other reasons brought forward as a for why it has not happened yet.

BIOTraCes acts as an intervention fostering biodiversity and human-nature relationships through one-on-one engagement and multi-actor workshops, creating a space to discuss reimagined human-nature relationships. Our perception is that this has helped to draw more attention and ultimately generate a space of reflection for justice and equity implication of schoolyard transformations and the role of biodiversity in it. Bringing these topics to a discussion between heterogeneous actors can be a first step towards an imaginary shift of human-nature relationships. Although there is a formal, institutional space – the commission for schoolyard greening as part of the municipal school council –, that serves on paper as a discussion space regarding the issues of the schoolyard, communication between institutional and educational community actors remains limited. Shared spaces for dialogue are crucial to build trust, exchange perspectives, and adapt interventions to the specific needs of each school. As every educational community is different, there is also not a one-type-fits-all-approach to schoolyard greening.

BIOTraCes workshops have the potential to translate discussions into concrete actions. For example, during the workshops we discussed concrete and feasible actions, such as minimum standards for all public schoolyards in Vitoria-Gasteiz, to assure that all public schools can benefit (workshop 2, April 2025). Further activities under BIOTraCes are planned for 2026, to help translate these workshop outcomes into concrete to-dos for local policymakers. The CEA is further planning to continue some of the BIOTraCes activities

beyond the project's end, including the co-creation of a roadmap for schoolyard greening together with diverse educational actors. In the best case, this can contribute through evidence to a prolongation and stabilization of the pilot into a continuous annual budget. It contributes to creating networks of actors engaged in advancing educational system towards co-education, inclusivity, and sustainability, and clearer formulation and communication of concrete goals and expectations of the different actors involved. Ultimately, BIOTraCes through its participatory action approach and its resulting deliverables and scientific outputs can give more weight to the importance of schoolyard greening.

4.5 Discussion

The municipal schoolyard greening program of Vitoria-Gasteiz can be described as a biodiversity innovation that responds to specific paradigms of both the educational and the urban planning sector. While its three long-term aims are framed holistically around co-education, inclusivity and sustainability, its current form of implementing small-scale greening elements and of limited participation of the educational communities does not allow for a holistic school remaking capable of overcoming structural barriers, such as educational segregation or rigid top-down governance approaches and narrow requirements. Given its institutionalized structure embedded in the public education sector, it draws on a mixture of bottom-up, pushed by the educational communities, and top-down processes, initiated by local institutional actors.

For the biodiversity innovation to be sustainable over the long term, the various processes need to be integrated through co-governance of urban schoolyards, supported by public administrations and institutional actors across scales. Local institutional actors should provide better support for those actions initiated by the educational communities and funded through their own resources, such as the implementation of schoolyard designs commissioned by schools. Furthermore, bottom-up involvement is essential for the innovation to realize its transformative potential, as active participation of educational community actors in its use and maintenance is key to generate long-lasting impact. This, however, opens up issues of justice and equity, as marginalized educational communities, e.g. those with a high number of foreign-born children, encounter many barriers hindering them from partaking in schoolyard transformations.

Bottom-up mobilizations in this case study stem from intrinsic motivation and the educational community's willingness to sustain biodiversity innovations over the long term as exemplified by the collective manifesto that initiated the innovation and communities that independently implemented school gardens or nature-based play equipment. However, their capacity to drive broader change is limited by the complex, fragmented administrative governance, which often hinders or only insufficiently supports these bottom-up initiatives. Further, more flexible requirements for schoolyard interventions would facilitate the implementation of schoolyard elements more aligned with educational communities' needs and wishes, such as the adding of outdoor furniture that would allow for outdoor teaching.

Throughout this research, many actors emphasized that the success of schoolyard greening often depends on at least one active individual—typically a parent or teacher—with parents' associations frequently acting as niche innovators. However, in the public education context, it is difficult to frame bottom-up movements as primary drivers of change, particularly given the structural inequalities in Spain's private-public educational system. The focus should instead be on institutional actors and how they can support—not merely empower—bottom-up initiatives. This involves shifting decision-making power to local educational communities, especially marginalized ones, allowing them to implement small-scale initiatives with minimal bureaucracy. Importantly, this includes giving children agency by moving from an adult-centric approach to one that recognizes them as political actors in shaping their schoolyards.

Following, emphasis should also be placed on niche innovators driving change from within institutions. From the outside, these actions may not seem radical or transformative but introducing incremental concepts into democratic institutions can embed transformation in systemic structures, gradually challenging the status quo and bringing new visions into public discourse. A key unresolved question is how to enhance the capacity for transformative change among marginalized educational communities. How can they be supported without shifting responsibility onto them? What concrete actions can institutions take to assist schools lacking strong parent associations or engaged teachers?

Five years after the launch of the municipal schoolyard greening program, it remains too early to assess its impact on equity at a broader governance level. Attention to vulnerable and marginalized communities is increasing, but it is unclear whether public funding allocations are addressing structural injustices, such as educational segregation. Given the deep marginalization of some schools, limited, one-time funding is unlikely to overcome entrenched structural barriers.

5.1 SES dynamics, interactions, and relations

The SES of urban schoolyards, here focusing on those belonging to public pre- and primary schools, are thereby shaped by governance frameworks of two overarching, multi-level public sectors, namely the urban planning and the educational sector. Those sectors with their overarching paradigms are enormously shaping the way schoolyards are seen and governed. In both sectors, there is a tendency to understand the social and the ecological as separate units, with an overall emphasis on the social as prior to the ecological. This

becomes apparent in the human- and adult-centered approaches and framings of both education and nature/biodiversity and their respective governance based on dominant values (instrumental) and forms of knowledge (scientific/technical). Both sectors have further been identified in previous literature as drivers of the extinction of experiences in and with nature and to further disconnection of society from nature. That is, to overcome this distinction and hierarchization of society and nature, new forms of social-ecological relationships need to be formed and included in the way we understand and govern the SES of an urban schoolyard embedded in an urban community. In the following, we describe the current state of the SES of urban renaturalized schoolyards.

SES impact on different actor group

The SES of a schoolyard impacts the multiple actors involved in the biodiversity innovation differently. Overall, in this case study, we identified in previous sections two broader actor groups: Institutional and educational community actors. Institutional actors, while shaping the governance framework and holding the decision-making power, are the ones least impacted by the state of the current SES. Meanwhile, educational communities and their surrounding neighborhoods are the ones directly experiencing its impacts. Educational communities comprise the children and their families, parents' associations, teachers and other educators, and school employees such as cafeteria and maintenance staff. Children are thereby at the center of the biodiversity innovation and hence most affected by the state of the schoolyard. As for now, the status quo of public schoolyards' designs can be described as grey, asphalted areas with a dominance of spaces for competitive sports. These schoolyard designs, first, increase children's vulnerabilities towards climate change impacts, especially heat; second, further inequalities in access to and use of space in relation to gender, (dis)abled bodies, and socio-economic background, and third, are not sufficiently responding to children's needs, including safe and sustainable learning and play environments.

The literature on renaturalization of schoolyards points to a multiplicity of positive impacts with the promise of generating long-term sustainable relationships between younger generations and nature/biodiversity. Applying an intersectional lens, those benefits include increased gender equality and social inclusion by enabling access to urban nature and green recreational and educational spaces for children belonging to marginalized communities, nature-inclusive learning spaces enabling deeper human-nature connections through early-on contact with and care for nature, green child-centered infrastructures, increased resilience towards extreme weather events (e.g. heat), and increased social cohesion at the neighborhood level, by understanding schoolyards as a community space open and accessible to a broader public (see e.g. Chawla et al., 2014; Raney et al., 2023, Frisk and Larson et al, 2011; Cilliers et al., 2024). What remains an issue in the current state of the SES is the uneven distribution of these positive impacts that disadvantages those children and educational communities of more vulnerable and marginalized backgrounds as they face structural barriers to participate in design and implementation, access, use, and maintenance of transformed and green schoolyards. As for now, parents are considered a core driver in assuring that benefits of renaturalized schoolyards reach their children. That is, schools attended by families holding less resources and capacities to get involved in the schoolyard governance process are less likely to experience their full benefits.

Second, a core component of the SES of urban schoolyards is its educational aspect. For that, teachers and educators play an important role in realizing the potentials of renaturalized schoolyards by using them as a resource and space of creative and embodied learning. Given the current education paradigm, that is mostly driven by classroom-based learning aiming for standardized and indicator-based evaluations of pupils (such as in PISA assessments), teachers often lack both resources and knowledge of how to integrate schoolyards holistically throughout the curriculum. While there are more trainings and materials available for teachers, they report on many structural, administrative, and practical constraints hindering the implementation of a more child-centric, embodied and

experiential style of teaching steering towards closer human-nature relationships, including evaluation pressures, safety and insurance concerns, families with diverging values and expectations regarding education (Ó Riada et al., forthcoming; Workshop 1, February 2025; Workshop 2, April 2025). Nonetheless, the role of teachers for assuring that the benefits of green schoolyards reach all children, regardless of their genders, (dis)abilities, or socio-economic backgrounds is essential. Teachers and educators can hence be considered as important facilitators of the biodiversity innovation.

Third, there are increasing calls to understand the SES of an urban schoolyard as part of the wider neighborhood, that is, as an urban park that can be used after school hours by diverse neighborhood community members (Flax et al. 2020; Stevenson 2020). This would move the understanding that schoolyards merely belong to pupils attending the respective school towards a meeting place that can enhance social and intergenerational cohesion at the neighborhood level. Despite most schoolyards still being closed after schooling hours for humans, the wider neighborhood is nonetheless already profiting from the renaturalization efforts, in form of increased biodiversity in the neighborhood as green schoolyards are embedded into a network of green spaces and corridors offering habitat and space for movement of more-than-human actors (Clauzel et al. 2025). Although mentioned as a long-term objective of schoolyard greening, as for now, administrative hurdles, open questions about responsibility and insurance, the fear of vandalism, and lacking political will (in form of an increased budget for maintenance) are often put forward as a reason for why most schoolyard have not been opened for a broader public yet (Workshop 2, April 2025).

Decision-making processes and power relations between relevant actor groups

Processes of decision-making are highly complex as different aspects of the schoolyard governance are scattered across different public bodies on the municipal and regional level. Decision-making thereby follows mostly a top-down logic, whereby municipal and regional policymakers allocate necessary funds and decide over the criteria for their use. In the specific case of the schoolyard program, those funds are coming from two regional ministries (of education and health), and from the city hall, that is, requirements for how to use those funds may differ according to the funding body which complicates their use on the school level. The municipal administration has a certain, yet limited, leverage of adapting the implementation of those funds to the realities of the schools. The municipal administration further holds the authority over physical transformations of the school environments of the urban public pre- and primary schools. Concretely, in this case study, the municipal administration could decide the criteria for the schoolyard interventions. However, the decisions over which schools to intervene at and how much funding to allocate are coming from the councillors of the city hall. Consequently, there is a lot of uncertainty in respect to the continuity of the schoolyard greening program which depends mainly on the political willingness to prioritize the improvement of degraded educational spaces, by dedicating parts of the annual city budgets to, among other things, the renaturalization of schoolyards.

The municipal school council is the formal space that should enable the participation of the municipal educational communities in the decision-making. It is designed as a space where local politicians, municipal technical staff, the educational communities (represented by teachers and parents' associations), and labor unions representing the different educational employees meet and discuss relevant topics. In practice, this space however has been criticized for not fulfilling this function. For example, the schoolyard-specific commission of the municipal school council has only met twice in 3 years. That is, the educational communities – while main recipients of the biodiversity innovation – have very little decision-making power over their schoolyards. Furthermore, if they want to enact change over their own space, they are facing complex, complicated and inefficient administrative obstacles that are hard to overcome. Little changes in the schoolyard thus require complex paperwork and agreements across different city hall departments. This challenges bottom-up initiatives on the smallest scale. Looking at the city-wide SES of

schoolyards governance, there are hence clear and unbalanced power dynamics that hinder an equal participation of those actors mostly affected by the biodiversity innovation – the educational communities, and especially the children. This also challenges the long-term stability of and equality within the SES.

The current paved state of most schoolyards greatly limits the direct impact educational communities can have to introduce nature into the SES without administrative support to initiatives such as bringing plants to school or introducing raised-bed school gardens. Depaving and greening schoolyards has, however, proven to be a popular proposal in votes on participatory budgeting. A neighbourhood in Vitoria-Gasteiz thus voted to green a school in a participatory budgeting election, while most recently, greening eight schoolyards garnered the most votes in Bilbao's participatory budgeting vote⁶. Participatory budgeting is thus a mechanism for broader civil society to affect municipal budget decisions towards greening schoolyards. It must be noted, however, that this can benefit already privileged neighbourhoods and schools, since these are the most likely to be organized and have the resources to put forward proposals.

Types of knowledge informing decision-making and biodiversity framing

The governance of SESs of urban schoolyards is mostly based on technical and scientific knowledge. Given the high level of institutionalization of the biodiversity innovation of schoolyard greening, it follows those “universal” types of knowledges dominating the broader urban planning sector. Technical concepts, such as nature-based solutions or ecosystem services based on a more instrumental value system and applied similarly across diverse socio-cultural contexts are thereby significantly determining the local governance. This includes both the discursive framing of the biodiversity innovation, e.g. its contribution to climate change adaptation and resilience building, but also its physical aspects, such as the choice of plants and nature-based objects to be put in the schoolyards, that adheres to international standards. (Positive) scientific evaluations of the outcomes of the schoolyard greening intervention are thereby core decision criteria for local decision-makers to decide over the prolongation of the municipal schoolyard greening program. Biodiversity's and nature's contributions to children are hence measured and evaluated through indicators, i.e., the dominance of technical and scientific knowledge undermines other types of knowledge, such as experiential or traditional knowledge that children and other actors receive through interactions with the environment and the community. A few initiatives, nonetheless, show the potential to shift this shortcoming. For example, adjacent to the schoolyard greening program, the municipality employs a citizen science project. While this is to generate scientific knowledge about the success of the biodiversity innovation through lay people, it also enables a process of embodied learning – and the generation of experiential knowledge –, as the participants are brought closer to interact and observe biodiversity generated by the schoolyard greening program.

When it comes to the wider education system, the Spanish educational framework, guided by frameworks of international organizations such as the OECD, has long prioritized standardized, cognitive knowledge geared towards textbook-based classroom learning. The latest education reform, however, has for the first time recognised the role of place-based, situated knowledge, and promotes transdisciplinary project-based learning, which presents an opening for novel pedagogical approaches in nature. However, since teacher training has so far been focused on transmitting disciplinary knowledge in classroom settings, these innovations will require changes in teacher training to come into practice broadly (Ó Riada et al., forthcoming).

Ecological functioning of the SES and direct drivers of biodiversity loss

⁶ See e.g., <https://www.deia.eus/bilbao/2025/10/14/bilbainos-priorizan-naturalizacion-ocho-patios-10214347.html>

The ecological aspects of the SES of urban schoolyards are very much manicured and controlled by humans. Every “natural” element is following a specific objective, mostly for human well-being, and is hence maintained if it “serves a purpose”. That is, plants are chosen for their educational or play aspects or for their resilience towards a changing climate, e.g. for their cooling effects. Hard surfaces are replaced by permeable, natural soils to allow for water drainage and cooling. Some plants or elements are also chosen as they attract insects or birds or offer a habitat for them, such as flowers or insect hotels – to enable learning in and from nature. That is, the schoolyards are also understood as embedded and connected to the city-wide green infrastructure, including urban parks, gardens, renaturalized streets and overall green corridors that are thought to facilitate movement of urban fauna.

While biodiversity loss in cities has been driven in the last decades by urbanizations and industrialization processes, over the last two decades local efforts have been made to re-introduce biodiversity into the urban realm. However, as research participants report, locally native urban biodiversity is increasingly endangered by climate change, where many species, such as the local oak, are struggling to adapt to the higher temperatures in urban areas. Overall, the ecological components of the SES are understood through a dominantly anthropocentric lens, further strengthening a domination of nature by society. While this is the dominant view, we also identified voices throughout this research calling for schoolyard designs including “wilder” nature (=less manicured), so that children can learn about local biodiversity. That is, there are different perspectives on the ecological aspects of the SES emerging and entering the local discourse.

The manicured approach to the management of nature by the city council has recently been subject to great discussion in the face of a months-long strike of the municipal gardening department. The vast growth of urban nature this has caused has on the one hand led to many complaints towards the city council by citizens used to manicured nature, which expressed concerns about threats to public health, while sensationalist messages about snakes and ticks among the weeds have been circulating online. On the other hand, the increase in urban biodiversity caused by the lack of mowing, etc., has opened the discussion to more ecocentric perspectives on urban nature.

Interestingly, there has been a social-ecological perspective emerging as well, based not on increasing biodiversity by doing away with gardeners and leaving it to its own devices, but which combines the struggle for decent working conditions for gardening workers with improving biodiversity. In a move to reduce costs, the city council has in recent years increasingly subcontracted gardening tasks to private firms paying lower wages. These private contractors, however, lack knowledge of the local ecosystem and of which species are native or invasive, for instance. Instead, calls for the city council to again employ more specialized municipal garden workers that can promote species of interest have emerged. Apart from the higher labor costs this would entail, fears remain among the city council of a lack of understanding by citizens for measures to increase biodiversity long-term, such as protection areas from mowing. Nevertheless, the mayor has announced that the effects of the gardener’s strike are being closely monitored and due to the emerging biodiversity, a reduction of mowing cycles is being considered⁷.

Values underpinning decision-making processes

Following the dominance of technical and scientific knowledge, instrumental values are those determining the political and discursive framing of the schoolyard greening program. Emphasis is thereby on the instrumental benefit to children, including nature’s contributions to social inclusivity, gender equality, and climate change adaptation. Specific nature-based elements are also selected under a logic of cost-efficiency (low maintenance) or for its aesthetic value. While not as dominant as instrumental values, research

⁷ See e.g., <https://elpais.com/clima-y-medio-ambiente/2025-06-20/una-huelga-de-jardineros-en-vitoria-provoca-una-explasion-de-flores-si-se-deja-que-se-desarrollen-las-plantas-la-biodiversidad-se-multiplica.html>

participants are also drawing increasing attention to relational aspects of the biodiversity innovation. During the multi-actor workshops, participants, for instance, emphasised those values that relate (i) to human-human relationships through nature, i.e., community building, collaborative play between children, and care for each other and the broader community, etc. or (ii) to closer human-nature relationships, including care for nature and closer interactions with nature (workshop 1, February 2025). Thus, the program of renaturalization of schoolyards is not aiming primarily for an increase in biodiversity, but for biodiversity to fulfill diverse social functions, both instrumentally and relationally, intrinsic values of nature are only on the margins. The increasing focus on the schoolyards' relationality may be taken as an indication of a diversification of values in the overall narrative of the municipal schoolyard greening program, however, it remains to be seen if those relational values will also be acknowledged in the political dimension/ decision-making.

Political, cultural and institutional power dynamics

The SES of an urban schoolyard is embedded in a multi-level governance structure, in which higher scale regulations, but also discourses determine the local realities and possibilities. National educational laws and regional regulations and requirements for schoolyards, such as international best practices for nature-based initiatives trickle down to the local scale. Local institutional actors are then required to follow those higher scale politics and overarching narratives that, in part, do not meet the local needs and specificities. That is, to enact transformative change locally, institutional actors must navigate those higher scale politics and respond, e.g., to funding requirements that may be at odds with local needs. This leads, for example, to a bricolage approach to funding, in which multiple funding strategies are used to prolong the pilot schoolyard greening initiative locally. This enables local administrative staff to collect more evidence for the need for and importance of the biodiversity innovation that is needed to win mid-term political support, but it also limits local planners in challenging overarching, higher scale nature-exclusive narratives, logics, and structures. The dominant narrative on the governance of the SES of the Basque Governance recognizes a need for transformation of current paved schoolyards. Nevertheless, the values guiding this need for change are mainly promoting physical activity in an inclusive way that considers the diversity of pupils (cultural, ethnic, age, sexual, functional, etc.). Thus, paved schoolyards are seen as an issue because they mostly offer opportunities for competitive sport, which leads to an unequal use (especially between boys and girls) and therefore large differentials in physical activity. This perspective comes from the health department of the Basque Government, and associated funding lines therefore aim primarily at promoting physical activity in an inclusive way. Nevertheless, introducing natural elements into the schoolyards is recognized to achieve this in the guidelines for transforming schoolyards of the health department of the Basque Government (Basque Government 2019). While biodiversity is thus not prioritized in the dominant narrative, it does open opportunities, both by providing funding lines that can be used for greening schoolyards and for highlighting the role of nature in achieving social goals in schoolyards such as health and inclusivity.

Embedding the local SES in the high impact sector

In the urban planning sector, the re-introduction of nature and biodiversity to urban environments has been increasingly put forward as a solution to many urban challenges across the globe, e.g. environmental degradation resulting from the industrial city or stagnant economic growth. Following, the "green city" has thereby developed into a dominant sector paradigm to increase, first, resilience towards climate change impacts, and second, to generate economic growth on the local scale. To operationalize this "green city", decision-makers across scales apply a managerial, technocratic logic. In respect to the governance of the local SES - especially through urban environmental and sustainability planning, this led locally, inter alia, to an orientation of the local discourse regarding biodiversity towards what is considered "standard" and "best practice" globally,

that often overrun local place-based ecological and community needs. It further led to a governance process that is mostly top-down and through a managerial approach and has been criticized for leaving too little space for real participation of residents and with that local needs and vulnerabilities are not sufficiently taken into account (Neidig et al, 2023 and 2024).

In education policy, there is a change happening in the dominant narrative, which is opening up possibilities for transformative learning in and through nature. Since the 1990s, the education policy discourse has been dominated by framings of the OECD based on human capital theory, which view education mainly as an input for economic growth and promote the standardization of education to make it comparable internationally e.g. through PISA tests and foreground the kinds of knowledge valued by markets. In recent years, however, aspects of transformative learning have entered the policy discourse, such as inviting different forms of knowledge through experiential and embodied learning, contextualization of knowledge and interdisciplinarity. This is also reflected in the current Spanish education law and curriculum, which was introduced in 2020 and to which different environmental and pedagogical renewal movements contributed. Such an opening up of the curriculum is an important precondition for integrating renaturalized schoolyards into teaching practices. Decades-long neoliberal approaches and austerity in response to the Eurozone crisis in the later 2000s / early 2010s, however, have left schools with few resources to carry out more elaborate and time-intensive transformative educational approaches and teacher training in these innovative approaches is so far lacking (Ó Riada et al., forthcoming).

Economic structures' impact over the SES

While the SES of urban schoolyards is not directly embedded in market dynamics, it is nonetheless affected by an overall neoliberal logic that dominates both the urban and the educational sector. The focus of local decision-making on integrating urban nature/biodiversity can also be explained through a nonlinearization of the urban globally. Nature and biodiversity are thereby, next to its other benefits, also considered for its contribution to economic growth, e.g. through rising real estate prices and gentrification processes generated by urban greening, low-carbon, and smart initiatives. In the local case-study context, urban renaturalization, sustainable mobility, and low-carbon initiatives have been priorities of urban planning over more than two decades. Despite this local, political focus on generating a "green city" and up-valuing most of the public space, open spaces of school environments have been politically highly neglected. This may also be since school spaces are not directly linked with economic growth (instead, e.g. public green parks have been directly linked with increasing real estate prices). The covid-19 pandemic brought these shortcomings to light and helped shift attention to the urgent need of generating improved learning and play environments for the youngest, also under the lens of public health. Nonetheless, it is unclear whether this increased attention on school environments will be translated into a long-lasting governance priority.

The market-orientation of education policy due to dominant framings of education as a factor for economic growth has in the past marginalized place-based knowledge and learning in and through nature that can happen in renaturalized schoolyards. Innovative concepts such as learning situations (situaciones de aprendizaje) introduced in the new curriculum, which emphasize transdisciplinary and experiential learning, however, now enable novel learning approaches that integrate nature into teaching.

Assessment of biodiversity challenge and related biodiversity trends in the high impact sector

Currently, nature-based solutions are dominating urban planning agendas. This is, in part, due to their expected contributions to multiple challenges, including climate change, biodiversity loss, and societal challenges (such as increased climate vulnerabilities of marginalized communities). Given the dominance of NbS globally, vast monitoring and

evaluation methods have been developed with the goal of an efficient assessment of their effectiveness in urban planning and are being applied across diverse socio-geographical contexts. As Goodwin et al. (2024) found based on a global assessment of 226 NbS initiatives, most evaluation methods focus on quantifiable, ecological indicators, as those indicators have “A history of standardization and pursuit of objectivity” (Goodwin et al., 2024, p11). Overall, there is a stronger focus on those ecological indicators relating to climate change challenges than to biodiversity challenges. Indicators used to assess NbS contributions to biodiversity are, e.g., those concerning restoration, novel ecosystems, ecosystem management, or ecosystem protection (ibid.).

One way to collect this data is for example through citizen science projects that invite residents to collect information on bird, insect, and plant species they discover around their neighborhoods. While helping to monitor the urban biodiversity, those initiatives also help to increase both awareness and knowledge about local biodiversity and its challenges. This could also help to tackle the extinction of experience and an increasing ecological illiteracy. One of the major biodiversity challenges encountered in this case study relates to human disconnection from the natural world, this also relates to lacking education regarding biodiversity. Studies conducted in the Basque Country with secondary school pupils found that children lacked important knowledge regarding native, local species, what authors called a ‘Native Species Awareness Disparity’ (Barrutia et al., 2022). This disparity was found even more in children growing up in urban areas than those in rural areas.

Current enablers and barriers for transformative change

The SES of urban schoolyards - in its current state of governance, regulations, and broader paradigms determining the human-nature relationship - contains both barriers and opportunities for transformative change towards a nature-inclusive society. The multi-level governance embedded in two high impact sectors of urbanism and education with their past and current dominating paradigms is still based on unequal (power) relations between different social and ecological aspects of the system. However, as actors navigate the current state of the SES, their initiatives and innovations can be considered challengers to current lock-ins.

Overall, one of the strongest barriers towards transformative change of the SES of urban schoolyards lies thereby in its current top-down governance approach that, on the one hand, puts the burden of driving transformative change on educational communities facing limited resources to enact change, while on the other hand, giving them little leeway to participate in and implement their own vision of transformative schoolyard governance. That is, those mostly impacted by the state of the SES are the ones holding the least decision-making power. This governance structure further leads to an unequal distribution of the possible benefits of schoolyard greening, whereby those with more agency to enact change are more likely to maintain the biodiversity innovation. This deepens already existing structural environmental injustices.

Concretely, lacking minimum standards for green schoolyards on the municipal (and higher) scales and too complex administrative procedures make the implementation of the biodiversity innovation more difficult. So far, there are no minimum requirements for schoolyards in terms of renaturalization. This means that greening efforts can vary significantly in their impact and may not always be distributed equally across the diverse educational communities due to lacking financial resources assuring the participation of all public municipal schools to participate in the schoolyard greening program. Hence, there is a need to establish minimum requirements across all public schoolyards. Second, the complexity of the administrative structure, with responsibilities scattered across various departments and governance levels, makes it difficult for the educational communities to implement their own initiatives, bottom-up, as they need permission from different entities with different requirements. To navigate this, educational communities need both the knowledge regarding these administrative procedures and the resources (time). This complexity effectively acts as an institutional lock-in, resisting more adaptive and inclusive governance approaches.

Another barrier determining the success of the biodiversity innovation lies in the increasing human disconnection from nature. This becomes apparent in the specific schoolyard greening program in the voices raised against schoolyard greening, e.g., for its safety concerns (children falling of trees they are climbing on or being stung by a bee) or perceived dirt (children playing in the mud as perceived as dirty, uneducated). Rejection of the schoolyard interventions is also coming in relation to the gender-inclusive design that are by some perceived as taking away opportunities for competitive sports, such as football. This disconnection is also apparent in the corresponding high impact sectors relevant for the urban schoolyard governance that are following a neoliberal paradigm that puts nature above society, as described above.

Besides these barriers, however, we encountered throughout our research a relational narrative shift. This can be seen for example in increasing calls from a variety of actors demanding a stronger emphasis on the relational value of schoolyards in their governance and political framing. This shift implies slower and longer participatory processes that enable the educational communities, and specifically the children, to partake in the decision-making process in a way that their needs and perspectives are at the heart of schoolyard transformations. There has been a visible process of learning since the start of the municipal program that led to an adaptation of requirements and processes to overcome previous shortcomings, leverage program successes and respond to the educational communities' feedback. That is, technical institutional actors already apply strategies to overcome those barriers resulting from local governance structures and can hence be considered niche innovators.

Overall, there are indications of a value and paradigm shift visible in the educational sector (see above). That is, on the national scale, the latest education law enables new forms of learning and teaching that are more tailored towards creating sustainable and caring human-nature relationships. On the local level, there are increasing calls for the educational communities to implement relational ways of teaching and learning, also in the framing of the local biodiversity innovation.

5.2 Vision: What alternative SES could be?

In this narrative of the social-ecological system of urban schoolyards, social and ecological actors, processes and relationships are considered equally important. The system is both nature- and society-inclusive. This means that relationality is at the heart of the biodiversity innovation's narrative. Schoolyards are thereby understood as those physical places that enable deep social-ecological relationships and interactions, between children, their wider (educational and neighborhood) communities, and more-than-human actors. The municipal schoolyard governance is hence designed in a way that strengthens relationality through schoolyard greening. For example, decision making is highly participatory and involves the educational communities, - and specifically the children - in the schoolyard design, implementation, use, and maintenance. Through a better integration of children in the decision-making process, children take increased ownership over the schoolyard and its different elements, moving from adult-centric to child-centric approaches. The children become stewards and carers of biodiversity, also through embodied and experiential learning.

This shift to a purely relational schoolyard also attributes more agency to biodiversity and its many more-than-human actors moving through or inhabiting the schoolyards. That is, biodiversity is not only desirable because of its many contributions to people, but because of its intrinsic and relational values. Schoolyards are thereby becoming important urban biodiversity hotspots, attracting many different native and non-native species finding safe habitat in those urban educational spaces. Plant species are thereby selected for the cultural, traditional, and intrinsic values they hold, following local and experiential knowledge next to the knowledge that has been collected through collaborative citizen science projects.

The administrative and political structure has been simplified to facilitate schoolyard greening for those educational communities that want to implement it themselves. Educational communities have the agency to enact smaller changes on their grounds without complex administrative processes. This includes an improved collaboration between institutional actors and educational communities, e.g. through regular multi-stakeholder meetings, political support for the educational communities, including continuity and stability of the program through an annual municipal budget, and political commitment to renaturalize every municipal schoolyard following common minimum requirements and concrete objectives of schoolyard greening decided by the municipal educational actors. Local political decision makers put sustainable learning environments as a political priority, following regional and national education frameworks that propose a public educational system based on values such as inclusivity and sustainability - and that enable alternative forms of learning and teaching, including on early-on training of future teachers, e.g. in universities programs.

The transformation of the SES of urban schoolyards towards a long-term sustainable, nature-inclusive biodiversity innovation includes the participation of multiple actors in the decision-making process. This involves dedicated participatory processes together with children, but also teachers to identify their needs and perspectives. Those participatory processes with sufficient time and resources dedicated to them are implemented over the course of a minimum of one school year and involve the children in the design and even in the implementation. The schoolyard governance has been rethought as a co-governance in which the specific educational communities are being given more leeway to implement initiative bottom-up. Children are taking ownership of their schoolyard starting with designing its play and relax elements, that are mostly nature-based. They help, where adequate, in the implementation of those designs, e.g. through painting or building. Children further have a say in how to maintain and use the schoolyards, in collaboration with the broader neighborhood community.

Further, part of the municipal annual budget is dedicated to schoolyard greening. This assures that all public schools can benefit from renaturalized schoolyards that follow some minimum requirements for nature-inclusive educational spaces. That is, trees, permeable soils, water fountains, nature-based play equipment, garden areas, and flora and fauna co-inhabiting the urban schoolyard are becoming the norm of urban schoolyards designs, assuring that all children, independent from their socio-economic background, can enjoy green schoolyards. The political commitment and actions to improve the municipal public-school environments contribute over the long run to making those schools more attractive to a wider population. Children from diverse backgrounds, both local and those migrated from faraway places, are attending, playing with and learning from each other. That is, green schoolyards are one of many contributing factors to fight educational segregation. The political attention and commitment to improve public schools has also shifted the responsibility for driving change on the local scales, away from parents and teachers towards the institutional, public sector that has taken the responsibility to provide adequate governance frameworks improving the degraded situations of many schools just a few years ago.

Schoolyards are seen and governed as complex, yet fulfilling social-ecological systems. That is, they fulfill many social and ecological functions (e.g. of social cohesion, climate change adaptation or habitat for urban biodiversity), while being places where social-ecological relationships, interactions and co-dependencies manifest. Schoolyards are hence places of creative play, but also offer quiet and relaxing, and places for alone time, meeting places for the neighborhood, stimulating learning environments, and habitat for more-than-human actors

5.3 Discussion

The social-ecological system(s) in which the biodiversity innovation of urban schoolyard greening is embedded in are currently presented with multiple lock-ins resulting from a

complex governance framework, dominating biodiversity narratives of human domination over nature that trickle down from the relevant high impact sectors of urban planning and education. Zooming on to the SES of urban schoolyards governance on the municipal scale, we can detect an imbalance in the current state of the SES. This imbalance can be found, on the one hand, between social and ecological components, and, on the other hand, between different actor groups. More concretely, there is a human domination over nature (i.e. biodiversity) and a power imbalance between institutional and educational community actors, and between educational communities of different socio-economic backgrounds.

Narratives regarding biodiversity that dominate the overarching high impact sectors have a huge impact over how the local SES is being governed. This also relates to the type of values and knowledges used to frame the local biodiversity innovation.

However, we see initiating narrative shifts that may implicate an overall paradigm shift locally, where relational aspects of the SES are coming more and more to the fore and receive a stronger emphasis. The question remains how these relational aspects, such as fostering nature connectedness in school children, can be translated into concrete policies and program schemes. To overcome issues of justice in access to green school environments, these need to be enshrined as minimum standards for all schoolyards, instead of relying on mostly competitive funding lines. This is especially clear in the Spanish context of dual public and charter / private school system, which has led to severe school segregation and where public schools accommodate most of the children from migrant families. These schools are systemically disadvantaged in competing for funding for schoolyard greening and public greening initiatives need to focus on these most marginalized schools, while considering their situation and providing all the resources needed.

The broad recognition across both civil society and local and regional governance of issues of gendered use of space that paved schoolyards cause is an important leverage point towards a generalized paradigm shift in viewing schoolyards. This has triggered a wide agreement for the need to transform these spaces. While green elements are a clear part of visions for transformation of schoolyards in both policymaking and civil society, there is a need to elevate the role of nature and especially intrinsic and relational values of nature. This is especially important in the policy narrative which is framed within the perspective of Nature-based Solutions and therefore disproportionately highlights instrumental values of nature.

Another leverage point that is changing the vision for schoolyards is the need to adapt to climate change. While this is still not a central motivation in Vitoria-Gasteiz due to its comparably mild climate within Spain, schoolyard greening in cities further south in the country such as Barcelona is principally motivated by the need for climate shelters. Climatic considerations in the design of schoolyards are therefore likely to increase in the future as temperatures rise. However, these examples have also shown tendencies towards framing nature narrowly as a Nature-based Solution or technical 'fix' for the problem of heat islands in schoolyards. To be transformative, greening intervention must therefore be seen as a leverage point in itself for triggering a holistic rethinking and remaking of the school. Further opportunities for leverage here are the new education law and curriculum, that opens up opportunities for integrating nature into teaching through innovative learning approaches, as well as the fact that schools need to integrate the schoolyard in the schools 'educational project', giving them the opportunity create a new nature-inclusive narrative and mission statement.

The main barrier constraining these leverage points from triggering a generalized change in schoolyards is inertia in the standards for schoolyard design both at the regional and national level. These standards still prioritize cost-efficiency and therefore lock in paved schoolyard designs due to their easy and thus cheap maintenance. Without changes in these standards that recognize nature's benefits for the inclusiveness of schoolyards, climate adaptation, sustainability education and nature-positivity, change towards green schoolyards will not be generalized. Transformation is therefore currently limited to the municipal scale. At this scale, participation and local co-governance is an important

leverage point, since greening interventions have only proven to be successful if they directly responded to the needs of the individual school.

6. Locally Tested Interventions

Authors: Julia Neidig and Liam O’Riada

6.1 Evaluation of strategies in action

Introduction

The case study of a municipal schoolyard greening program in Vitoria-Gasteiz results from a demand from the city’s diverse educational communities to improve local school environments that got translated into a municipal pilot program run by different city hall departments. The case study hence offers multiple insights into strategies that are both bottom-up and top-down driven and that resulted in an increasing degree of learning between institutional and educational actors. Many of the strategies aim to navigate institutional dynamics, including inertias, to allow a continuation and stabilization of the biodiversity innovation over the long term. The case study’s institutional focus results from its embeddedness into public sectors of education and urban planning and the strong involvement of the local administration - also in the form of BIOTraCes societal partner.

Current strategies in action

Current strategies in action can be clustered in (i) bottom-up strategies implemented by the educational communities themselves and (ii) top-down strategies implemented by institutional actors, mainly municipal, involved in the public education system. This distinction results from the governance structure of schools in which local administrations are holding most of the decision-making power over transformations of the school environments. Bottom-up strategies have then been put in place when institutional processes are blocked by institutional inertias or inaction. Most of those aim for changes at the scale of the respective educational community. Top-down strategies refer to those actions taken by institutional actors trying to steer change from the inside. Lastly, (iii) refers to strategies that are targeting educational paradigms, such as top-down and classroom-based teaching, and offer tools for a better integration of the biodiversity innovation into the school day-to-day.

1. *Bottom-up strategies to improve local school environments*

Strategies initiated by the municipal educational communities included a collective demand in the form of a manifesto in 2020 to the city hall that called for an improvement of the municipal public schools in the context of the covid-19 pandemic. This was accompanied by different initiatives at the school level, such as fundraising campaigns (e.g. through crowd funding or selling products) to carry out diagnostics of the schoolyards by specialized companies or to employ architects to make new designs for improving the school environment. Some schools further implemented their own projects, e.g., school gardens or nature-based play equipment. These interventions, while contributing to a biodiversity increase in the schoolyards, were mostly framed towards new ways of environmental education (e.g. nature-inclusive and project-based learning), to increase inclusivity and gender equality, and to achieve higher agency of the local schools regarding the governance of their own schoolyards. While the manifesto has been taken up by the city hall in the form of a municipal pilot schoolyard greening program, individual efforts of educational communities have not received sufficient support from the municipal administration. For instance, many of the schoolyard plans drafted by architects hired and financed through the schools were not taken into consideration for the interventions implemented under the municipal pilot program.

2. *Top-down strategies targeting institutional dynamics and governance*

The creation of the schoolyard greening pilot program was driven by two municipal entities: the CEA (BIOTraCes’ societal partner) and the Department of Education. Strategies for program implementation employed by technical and administrative staff of those two

entities involved the setting of criteria for the concrete schoolyard interventions (e.g., allowing only nature-based interventions and prioritizing marginalized public schools through the selection of a vulnerability criteria). As the pilot program is approaching its end (as of 2026), current strategies are targeted towards achieving a city hall decision regarding the transformation of the pilot into a long-lasting program through dedicating a fixed annual budget. This includes creating a systematic strategy for greening all schoolyards in Vitoria-Gasteiz, which can be presented to the next municipal government after the elections in June 2027. Until then, concrete strategies involve a bricolage approach to funding to enable a stabilization of the program, i.e. funding is derived from different grants and organizations across different policy scales, often also with differing requirements. It further includes scientific accompaniment, studies, and results for generating evidence of the program importance (through collaborations with research projects, e.g. BIOTraCes, and research groups of the local university). Collaborations between the CEA and the University of the Basque Country also extend to offering training programs for teachers that address the lack of knowledge about how to integrate nature into teaching and summer schools aimed at a wider audience interested in schoolyard greening. Institutional actors are further adapting the program structure and implementing a first test in a school between 2026-28 in which a whole academic year will be dedicated to the participatory process with the respective educational community. Funding has so far been only secured for the participatory process (and the design). However, having a ready to implement design will also add pressure to local policy makers to vote in favor of a prolongation of the schoolyard greening program.

3. Strategies addressing the use of schoolyards in day-to-day education

This set of strategies aims to provide concrete tools to integrate renaturalized schoolyards into curricular and extracurricular activities. Consequently, these strategies aim to generate both awareness and knowledge of how to make better use of the transformed schoolyards, so that the biodiversity innovation can unfold its full potential. This is driven by various actors, such as the city hall, the local university, and different societal organizations working around issues of environmental education. The aim here is to overcome top-down and nature-disconnecting ways of teaching, moving towards a whole-school approach. The university, for instance, is organizing an accredited course for teachers on how to use schoolyards in natural science teaching. The city hall organized various conferences bringing together a broad range of actors to exchange knowledge with other school renaturalization programs and teaching. And lastly, local environmental organizations prepare and share teaching materials and activities for teachers to implement in curricular activities.

Transformative potential

Both bottom-up strategies and those aiming for a better integration of schoolyards in the day-to-day learning are responding to dominant education paradigms that follow a top-down and classroom-based learning model, furthering social inequity (e.g. through gender-exclusive schoolyard design). These strategies aim for shifting this paradigm towards a learning approach that enables all children to interact and engage with nature - fostering relational values (Lange 2018). Here, schoolyards should be understood as both outdoor classrooms and social-ecological relational spaces. Over the long run, this holds the promise to create stronger ties between the younger generations and nature needed to advance towards a nature-inclusive society. The manifesto written by the local educational communities further exemplifies an intent to achieve a higher degree of agency over decisions regarding the urban school environments, envisioning a co-governance of the schoolyards that more closely involves the educational communities.

Strategies by institutional actors, while not specifically targeting dominant paradigms, are used to navigate lock-ins and barriers resulting from institutional governance structures and current dominant paradigms. As those strategies are a response to a social demand,

they can be seen as a process of trust and alliance building by engaging, collaborating and learning from the educational communities. One of the overarching aims of these strategies is to create green schoolyards especially for marginalized schools and to achieve a full embedding of the biodiversity innovation in the municipal governance context by forging a political decision of a fixed annual budget. Political support for schoolyard greening, although only a small factor, can contribute over the long term to fighting educational segregation by putting more attention on the public schooling system. It further contributes to generating more social-ecologically nurtured spaces and processes that are deepening human-nature relationships.

Indirect drivers

The structural conditions these strategies are responding to concern, first, the privatization of education driving educational segregation in the Basque and Spanish context and resulting from an increasingly underfunded public education system. By targeting those public schools that are most marginalized, one goal is to increase attractiveness of public schools by improving public educational infrastructure. Especially those top-down implemented strategies aim to generate more awareness of local policymakers regarding the importance of green and healthy school environments, also with the goal to put public education locally as a priority in urban planning.

Second, some strategies are targeting cultural resistance towards new modes of teaching that results in part from an increasing domination over and disconnection from nature, also driven by an extinction of experience that attests a decrease of opportunities allowing for close contact and interactions with nature, especially for younger generations (Soga & Gaston, 2016). For instance, resistance towards more project-based and embodied learning is coming from a culturally deeply embedded neoliberal, i.e. competition-based, paradigm that sees education as a way to increase human capital and following economic growth. In that paradigm, project-based learning is seen as a barrier to successfully compete in standard-based international assessments, such as PISA (Delaune, 2019). Cultural resistance can also be found in the narrative of urban nature that sees nature as something aesthetic, ordered, and instrumental to human well-being (Angelo, 2021). In this narrative, engaging with nature, e.g. playing with soil or plants, climbing on trees, observing insects attracted by flowers, is perceived as dirty or risky. Daily interactions with nature may hence overcome this nature-detached paradigm.

Despite the pilot program's specific focus on vulnerable schools, social inequalities nonetheless currently limit the success of the biodiversity innovation. This is due to the fact that a big responsibility of implementing further action, using, and maintaining the schoolyard falls on the educational communities, and specifically the parents' associations. Consequently, schools with a high percentage of marginalized children tend to have a less active parents' association as parents face many structural barriers, such as socio-economic pressures, time constraints, and limited institutional support, that exclude them from engaging in schoolyards greening and other educational activities. Consequently, those most profiting from the schoolyard transformation in the program's current governance context are those schools where parents act as driving agents. Over the long run, this risks an increase of the gap between marginalized educational communities and those attended by families with a higher socio-economic profile.

Scalability

A main factor for the municipal schoolyard greening pilot program to arise in Vitoria-Gasteiz is the policy exchange with other cities, including the learning from other initiatives. Barcelona's *patis x clima* (schoolyards for climate)⁸ with a project framing focusing on heat vulnerability, initiated in 2017, has often been mentioned as a reference point by

⁸ <https://thegreenballoon.org/patisxclima/es/>

various actors. Following, Vitoria-Gasteiz' schoolyard program can already be seen through the lens of *policy mobilities* (see e.g. Temenos and McCann), that is, a replication of best practices implemented elsewhere adapted to the local context. Schoolyard-specific funding schemes on the regional (Basque) level were further supportive of this policy exchange, as they enabled the city to implement their own initiatives. The city has thereby been always connected to other practitioners or experts, e.g., through the organization of conferences or the participation in Spanish and international city networks.

The pilot program's processes of scalability can also be found in the municipal context of Vitoria-Gasteiz: First, over the course of the pilot program more educational communities have been participating in the schoolyard transformation than initially planned. Second, schools participating later on in the program were or are looking for inspiration at those schoolyards already implemented, hence enabling an exchange of experiences locally. Third, some schools are developing and implementing initiatives bottom-up where possible, e.g., by adding more nature-elements to the schoolyard or by drafting programs and projects, such as the care program in which children take care over the schoolyard and the younger ones. Forth, technical administrative staff has been able to continuously prolong the pilot program beyond its initially set end date, by finding and securing more funding sources through a bricolage approach that builds on a scattered funding approach through diverse funding bodies (Neidig et al., 2024).

The scaling of the biodiversity innovation at the municipal level contributed to an increasing communication between institutional and educational community actors, e.g., in the form of feedback sessions, which allowed for an adaptation of the pilot program to its earlier successes and shortcomings, indicating an improved partnership between top-down and bottom-up actors. As a result of this, a long-term participatory process is in preparation that aims for a co-creation of a roadmap for future action together with educational communities that will be presented to local policymakers.

Symbolic framing

In all these strategies discussed above, we observed throughout the research an increasing emphasis on the relationality of schoolyards, e.g. through fostering care, stewardship, and inclusivity. This relationality can be seen in demands from educational communities, specifically parents, for more embodied and nature-inclusive learning approaches in the public education system, but also in goals formulated by the societal partner CEA to increase ecological literacy through e.g. a citizen science program aiming to bring urban resident closer to their surrounding biodiversity. Strengthening relational values in the broader discourse and narrative attached to schoolyard greening holds one of the biggest transformative potentials, as it helps generate over the long-term deeper human-nature relationships (also through alliances between diverse social and ecological communities). For instance, the first harvest of apples in one of the renaturalized schoolyards generated a visual image of children engaging with "newly discovered" biodiversity - through harvesting fruits. This image was shared across local media outlets⁹.

Conclusion

Strategies applied in this case study entail to different degrees potential for transformative change. Bottom-up strategies, such as the collective manifesto, were the initiating driver of this biodiversity innovation. It was successful in kickstarting a municipal pilot program, however, over time the driving actors shifted towards institutional actors. With this shift, bottom-up processes lost some momentum, and as for now, are less active in pushing forward new transformative ideas. Consequently, the rapid institutionalization of the social demand for improved learning environments then translated into a top-down managed

⁹ <https://www.noticiasdealava.eus/gasteiz/2024/10/09/centro-escolar-zaramaga-servicios-vitoria-patio-verde-8789174.html>

program. Nonetheless, there is an ongoing process of co-learning that leads to a better understanding of educational communities' needs and following an adaptation of the pilot program structure. It now depends on the city hall decision to prolong the municipal schoolyard greening program to fully embed the biodiversity innovation in the municipal governance context. Over the course of BIOTraCes, a relational turn in the overall schoolyard greening narrative could be observed, which indicates an opening up that may lead to an increasing pluralization within the biodiversity innovation.

6.2 Enablers and disruptors

Introduction

The municipal schoolyard greening program is an initiative by the municipality. In its current governance configuration, different city hall departments are responsible for its design, implementation, and maintenance. The biodiversity innovation hence shows a high degree of institutionalization which allows us to gain deep insights into barriers, such as institutional inertia, but also opportunities resulting from a long-established institutional awareness and support of nature-inclusive initiatives in the urban and peri-urban areas (Neidig et al., 2022, 2024).

Enablers

The municipal schoolyard greening program is embedded into broader governance frameworks that have been favorable for the program design and implementation. At the national level, the new Spanish education law introduced in 2022 has for the first time put sustainability at the center stage, recognizing in its preamble that "given that the education system cannot be oblivious to the challenges posed by global climate change, schools must become a place of stewardship and care for our environment"¹⁰. It openly invites experimentation with the curriculum and encourages innovative practices such as community service learning. The legal framework in the education system has therefore opened up unprecedented space for pedagogical innovations such as learning in nature in green schoolyards and recognizes community service learning (such as for instance maintaining urban green spaces or growing food for the community in community gardens) as equally important to passive learning in the classroom (Ó Riada et al. forthcoming).

This policy change on the national level has further been accompanied by schoolyard-specific grants released through the regional government, that funded most of the schoolyard greening pilot program at the municipal level. While in the Basque context these grants mainly aim at promoting physical activity in an inclusive way, there is a recognition that greening schoolyards can be a way to achieve this, by offering more diverse opportunities for play than the competitive sports played on paved schoolyards. This context of "schoolyard greening-favorable" governance enabled other municipalities to implement holistic programs, such as Barcelona's patios for the climate program. These "best practices" from other cities served then as an inspiration in the local context and delivered assurance to local policymakers for the concrete program implementation.

These favorable political visions on the European, Spanish and Basque level certainly factored into the local city hall decision to implement a pilot program which proves at least political awareness, here in form of a political consensus, for the importance of improved school environments and willingness to dedicate municipal budget for a pilot program. This momentum opened up by multi-scale policy visions has been used by niche innovators inside local administration that know how to navigate the inner-institutional dynamics (with its barrier and lock-ins). This enabled the creation of the pilot program, also through garnering local political support and is now aiming to prolong the pilot in order to

¹⁰ Ley Orgánica 3/2020, de 29 de Diciembre, Por La Que Se Modifica La Ley Orgánica 2/2006, de 3 de Mayo, de Educación, Pub. L. No. Ley Orgánica 3/2020, BOE-A-2020-17264 122868 (2020). <https://www.boe.es/eli/es/lo/2020/12/29/3>

renaturalize more schoolyards (see above). Through participation in research projects, university campaigns, and conferences institutional actors further increase visibility for the program which may lead to a broader public supporting the biodiversity innovation.

Disruptors

Structural disruptors challenging the schoolyard greening can be found in the highly privatized education system that enhances educational segregation. Public schools are more vulnerable, also due to the lack of resources, and have to cater to a broader range of needs of marginalized children. Often, they also lack the resources to implement “extra” initiatives such as school gardens, as those initiatives tend to be driven by parents or individual teachers. While the societal partner, through the establishment of a vulnerability criteria for the school selection, is aiming to increase attractiveness of those schools, the renaturalization of their schoolyard is not sufficient to overcome educational segregation as this requires political willingness across the regional and national scale to tackle the shortcomings of the educational system in a holistic manner. In some of the schools that participated in the pilot program, the educational communities are lacking knowledge and resources to fully integrate the transformed schoolyard into the day-to-day activities and to provide the maintenance needed. This generated frustrations, e.g., for a more marginalized school, where the schoolyard renaturalization has been perceived yet another burden added to the many responsibilities of teachers at underfinanced schools (interviews fieldtrip, May 2023).

Additionally, complex administrative structures of the municipal public schools make bottom-up initiated actions difficult as the administration of those schools is scattered across different institutional entities. To be able to enact change, educational communities must have the knowledge and resources to navigate these complex administrative structures. Often, the bureaucratic hurdles are too big to overcome. This strengthens a rigid top-down approach, in which the administration is the only decision-making actor as can be seen, e.g., in the way criteria for the schoolyard greening program were set, the strict (and too short) timelines and in the implementation of the actual greening effort that is scarce of real participation of schools. The societal partner has not been able to overcome this barrier yet, also due to their embeddedness into the institutional structures being a municipal entity. While small aspects of the pilot program have been adapted, such as more planned meetings with schools throughout the schoolyard design phase, it is not yet sufficient to create a real co-governance of the schoolyards. This may risk long-term societal acceptance and support of the biodiversity innovation currently implemented top-down.

Cultural disruptors can be found in the imaginaries attached to urban biodiversity that visualize nature as clean, ordered, structured, and aesthetically appealing and as instrumental to human well-being. This can be seen in technical concepts dominating urban planning language, such as nature-based solutions (Kotsila et al., 2021), and in how urban landscaping is understood, namely often focusing on ornamental plants or cut lawns. These imaginaries attached to urban nature result from an increasing disconnection from and domination over nature (Muradian & Pascual, 2018). While this biodiversity imaginary can also be found in the schoolyard greening program, e.g. in the choice of plants, there are increasing intentions to overcome this cultural disruptor. Those include, e.g., a citizen science program to monitor and learn from urban biodiversity or nature-based activities offered to families, such as those organized by the societal partner CEA¹¹.

Policy Attunement and Mismatch

This case study is embedded into the governance framework of two broader public sectors, namely the education and urban planning sector. At the European level, the tendency of

¹¹ <https://cea.vitoria-gasteiz.org/porta1/es/w/programa-de-conservacion-de-patios-escolares>

both sectors to frame guiding visions under the overarching banner of sustainability aligns well with the local schoolyard greening objectives and overall narrative. Education falls under the responsibility of the Member States, European strategies regarding education are only guidance. Nonetheless, several research partners have been referring to them to help ground local action in higher-scale policies. The GreenComp, the European reference framework for sustainability competences, for example offers support for education and training programs for lifelong learning around sustainability¹². As for urban planning, the schoolyard greening program fits well within the various European green strategies and visions, such as the European mission for 100 climate neutral cities, EU Biodiversity Strategy 2030 and the EU Green Deal, as it promotes urban planning based on low-carbon and green infrastructures, e.g. through the implementation of urban nature-based solutions. However, those urban sustainability strategies have also been criticized in previous literature for proposing rather shallow, technocratic solutions that are often claimed to be universal while neglecting local needs, histories and realities (Neidig et al., 2022). Consequently, a too close alignment with higher scale policy vision may enable the embedding of transformative action locally - however, it also challenges a pluralization of narratives attached to the biodiversity innovation by being detached from place-based notions.

At the national level, the most recent education law from 2022 integrates sustainability and project-based learning in the national education policy (Ó Riada et al. forthcoming). While this has opened up possibilities at the discursive level, teachers participating in the BIOTraCes February and April workshops[6] reported on the difficulties and structural barriers to integrate these new policy visions in day-to-day teaching and learning activities - also because a neoliberal education paradigm has been the guiding paradigm over several decades and is still so much embedded in teaching practices and the management of schools. That is, for the national policy shift to permeate day-to-day teaching practices, a paradigm shift needs to occur throughout the many aspects influencing educational practices. Research participants mentioned the need to adapt university programs of education and to restructure the school administration, shifting from a school management approach borrowed from private companies towards one that understands schools as public democratic institutions. The new education policy promoting embodied, project-based learning experiences in nature furthermore needs to be followed up with improvements in teaching conditions for teachers, such as reducing student-teacher ratios and overall teaching hours, since these approaches require more resources from teachers and are hard to carry out with large class sizes.

In Spain, the autonomous regions have control over a large part of the curriculum content and provide funds for the local action. The government of the Basque Country has released important funding schemes that enabled the municipality to implement some of the schoolyard greening initiatives. Those funding schemes aimed for example for more inclusive schoolyards. At the same time, standards or minimum requirements for green schoolyards are still missing. Even more, some policies, such as the requirement of football and basketball pitches in every schoolyard, work against their own inclusive schoolyard funding schemes as they make it more difficult to renaturalize schoolyards through gender- and nature-inclusive design.

Conclusion

The societal partner organization is due to its institutional nature very connected to multi-level policy visions and strategies and holds the capacity to navigate and use them to enact change locally and to advance schoolyard greening. It can be said that the local biodiversity innovation has been in parts driven by its connectedness to those higher scale sustainability policies, including their overarching narratives, which ultimately also factored

¹² Bianchi, G., Pisiotis, U. and Cabrera Giraldez, M., GreenComp The European sustainability competence framework, Punie, Y. and Bacigalupo, M. editor(s), EUR 30955 EN, Publications Office of the European Union, Luxembourg, 2022, ISBN 978-92-76-46485-3, doi:10.2760/13286, JRC128040.

in for local policymakers to consent to the pilot program. However, the links to dominant sustainability imaginaries challenge locally the implementation of new, alternative imaginaries much more rooted in local needs and perspectives.

6.3 Failed and successful practices

Successful practices

1. Bottom-up schoolyard transformation

One of the most successful practices has been a bottom-up schoolyard transformation implemented by a local educational community in 2021-24 drawing on a close collaboration of the school community, the parents' association, and a local architecture firm. The educational community presented the idea of a schoolyard transformation to the annual municipal participatory budget contest in 2021, an initiative run by the city hall to which every resident can vote for one project presented. The project with the most votes will be realized, with (financial) support from the city hall. After a strong campaign in the neighborhood, the schoolyard initiative received most votes and became realized in 2024 after a two-year long participatory process with children, parents and teachers to co-design the new patio. The schoolyard transformation has been finished in 2024 and is now open for use for the broader neighborhood after school hours.

Many research participants referred to this project as it is considered locally a success story of creating a beautiful green schoolyard that is supported by and contributes to the creation of social cohesion within the wider neighborhood. Parts of this success story result from the project not being bound to strict and narrow nature-based requirements, like those guiding the municipal pilot program. This gave the educational community leverage to implement a holistic approach responding to the specific needs of the educational community, creating a multifunctional schoolyard with both natural elements and new play equipment. The slower paced participatory process that was stretched over two years further enabled a deep involvement of children in the collaborative designing of the schoolyard. However, it also caused quite some frustrations for those schools participating in the municipal pilot program as they expected a similar outcome. Yet funds and time dedicated to the municipal program are much more restrictive and not sufficient to generate a schoolyard transformation of the same scale as this specific initiative.

2. Spaces of dialogue

Successful practices are also those that aim to generate an improved flow of information and communication, e.g. through shared spaces of dialogue. This includes increased feedback loops and evaluations of the implemented schoolyards, e.g., in form of surveys and direct communication with the educational communities, but also research activities implemented through BIOTraCes, such as the February and April 2025 multi-actor workshops¹³.

Based on the direct feedback channel between institutional and educational community actors and on the internal evaluations by institutional actors, many aspects of the program structure have been continuously adapted. For instance, more activities with children are being implemented, such as painting the schoolyard during the design phase or crafting small models with the desired schoolyard design. This has helped to increase children's ownership over the schoolyard transformation. Further, an extra session to contrast schoolyard design with educational communities has been added, i.e., one-on-one session with the educational communities have been increased from two to three. Knowing that this is still not sufficient, the technical institutional staff is now piloting a new process that dedicates two years to the schoolyard renaturalization. A new schoolyard is planned for 2026-28, that involves a whole year of participatory process and trust building. While

¹³ Workshop February 2025: with 15 local institutional and educational community actors active in the schoolyard greening program to identify program visions with a prioritization of concrete objectives and current challenges hindering the objectives from being met.

funding has been secured for the participatory process, more funds need to be found for the actual project implementation. However, having a longer participatory process with the school is hoped to exert some pressure on local policymakers to provide funds for the actual implementation.

The multi-actor workshops implemented through BIOTraCes created a space of dialogue for people to meet and discuss the current program objectives and visions, its barriers and potentials and concrete future action points. The process brought together a broad range of actors involved in the schoolyard greening, that have not interacted before (such as city councilors, technical administrative staff, teachers, parents, school employees, and researchers). Participants really appreciated having the chance to exchange and learn from other actors' perspectives. As facilitators, we often encountered the challenge to steer conversations away from things not working well towards identifying concrete action points for positive futures. Participants asked for more of those spaces of dialogue beyond BIOTraCes, especially between those that are main recipients of the biodiversity innovation - the educational communities - and those responsible for its governance - institutional actors. These spaces also helped to bring narratives of schoolyards as relational places more to the fore, as many participants emphasized the relational aspects.

Failed or less effective practices

Too holistic framing of objectives let to frustrations

The overarching pilot program's objectives have been framed very holistically – namely through a contribution of the schoolyards renaturalization to achieving inclusivity, co-education, and sustainability. While this holistic framing has been useful to connect a municipal pilot program to broader policy visions (see Section 2.2), locally this practice has contributed to generating frustrations on the site of the educational communities. This results from an unrealistic expectation of restricted funds and limited possibilities of actual schoolyard transformations' contribution to those ambitious goals stated above. The broad framing of the program as a practice of generating a positive narrative surrounding the schoolyard greening program also for public and political support hence had the opposite impact on the ground as it raised expectations of those educational communities participating the pilot program that were in part disappointed by the rather small scale of actual interventions in the schoolyards, e.g. reduced to the replacement of hard surfaces with permeable soils and the adding of trees and lawn areas. Based on past frustrations resulting from too high expectations, communication channels have been improved, also to be on the same page from the first contact with the selected educational communities until the schoolyard's opening for use. Further, the February 2025 multi-actor workshops was used to disentangle and reduce the multiple objectives attached to schoolyard transformations based on renaturalization efforts.

Critical Gaps and Missed Opportunities

The following points, among others, were raised during the BIOTraCes multi-actor workshops, when discussing the current pilot program's challenges (see below, Co-learning during the section 6 - D2.4 preparation).

Lacking municipal minimum standards for green schoolyards: the creation and implementation of a municipal schoolyard greening program would have been the perfect opportunity to decide on the political level on a long-term strategy for improved school environments, by setting some minimum standards for each municipal schoolyard, including e.g. minimum percentage of green coverage and of permeable soils or a minimum number of nature-based play equipment. Having these minimum standards signed by local policymakers could have acted as a long-term commitment to the educational communities. This list of minimum standards to be fulfilled by all schoolyards is needed to fully embed the biodiversity innovation in the local context.

Too little time dedicated to participatory process: More meetings with schools would have been needed to better communicate expectations and limitations, and to enable a trust building between educational communities and institutional actors, especially with marginalized communities, such as those with a high percentage of foreign-born children. To facilitate the participation of marginalized families in the schoolyard co-design and -implementation, participatory processes must counter concrete barriers of participation, e.g., by using translators to communicate project details in different languages, and to facilitate workshop-based activities. Lacking participation of marginalized families challenges a full-on pluralization and empowerment through the biodiversity innovation.

Too narrow framing of nature-based interventions: The mere focus of schoolyard transformations through nature-based elements led to an exclusion of specific needs stated by some educational communities. For instance, some schools asked for smaller, shaded amphitheaters that could be used as outdoor classrooms. Those would have needed structures built from non-natural materials, which fell outside the nature-based requirements for materials. Having the infrastructure of an outdoor classroom, however, would still bring children closer to their surrounding biodiversity. As for now, too little shade is available in the schoolyards, as planted trees still need to grow. That is, more flexibility in terms of concrete schoolyard elements could have led to better and quicker usable outcomes, generating hence broader acceptance of the biodiversity innovation.

Closing these critical gaps could contribute significantly to transformative change by, first, embedding the innovation in the municipal agenda through enforcing minimum requirements for renaturalizing all municipal schoolyards. This will counter some of the structural barriers as it assures similar interventions in both marginalized and more advantaged educational communities, closing the gap of school segregation. Second, it enables a pluralisation and empowerment of the educational communities through implementing a longer participatory process that assures that the school's needs are really heard and taken into account. Widening the criteria for concrete interventions would further allow to better respond to specific needs and plural perspectives.

Conclusion: Lessons and Future directions

Reflection on those strategies listed above have led to an adaptation of those aspects of the pilot program's structure that could more easily be tackled. That is, in a first intent, there has been an increase in feedback sessions to contrast schoolyard designs and accompanying activities with children. While these program adaptations show good will of institutional actors, they were not sufficient to allow for full and real participation of the educational communities. Hence, the decision was made to prolong the schoolyard greening process from one to two years – starting with a participatory process for one schoolyard in the academic term of 2026/27 reaching over a full year. Here, funds are only secured for the participatory process, not for its implementation in 2027/28, which raises many risks.

The most recent decision to co-create a roadmap for schoolyard greening together with educational actors is a big step towards overcoming many of the challenges stated above. The creation of this roadmap is planned for next years and will build on BIOTraCes' efforts in creating spaces of dialogue and concrete content discussed there. This process is open to all the research participants and educational actors, with the hope to develop a concrete action plan for the "universalization" of the pilot program locally. That is, BIOTraCes' societal partners are hoping to achieve through this process the commitment of the city hall to renaturalize schoolyards of every municipal public school.

6.4 Co-learning

Introduction

Co-learning in the case study of a municipal schoolyard greening program happened through continuous shared reflections and interactions between the societal partner CEA, the researchers, and other relevant actors, such as other relevant institutional actors, and most importantly, actors representing the educational communities. The spaces for co-learning were those that enabled a deep listening and exchange of perspectives, such as in one-on-one meetings and interview settings, collective spaces in form of regular meetings and discussion sessions between researchers and societal partner, and in multi-actor workshops.

Co-learning as a principle and method

Co-learning has been at the heart of this case study. Informal moments of sharing experiences, impressions, and personal understandings of transformative change have thereby been the starting point to understand each other's positionality, including one's guiding values. Moments of co-learning were most inspiring when actors were able to leave their predefined roles (e.g. city hall technician, city councilors, or even the one of a researcher) and were able to speak from personal points of view. Following this observation, our aim as researchers was to create informal spaces that enabled a safe sharing of one's own worldviews and paradigms. Often, meetings in more formal settings, such as municipal office spaces, followed more formal structures – where participants spoke from the perspectives of their professional/ institutional roles. Workshops hence were conducted in a classroom of one of the schools participating in the municipal schoolyard greening pilot program. We also noticed the effects of trust building over the project duration. That is, getting to know each other on a personal level improved levels of communication and flow of information, hence an important pre-condition for co-learning.

A final observation, over the course of the BIOTraCes, initially diverging perspectives from researchers and societal and research partners became more aligned. This also results from an increased understanding of each other's perspectives, and the challenges they encounter in their day-to-day. This approximation towards each other has been essential to understand the current biodiversity innovation's potential and shortcomings. Beneficial to this process was a mixture of one-on-one interactions, smaller group conversations with a few actors and bigger group discussions, e.g. in the workshops. The conversations in smaller groups were essential for trust building between the diverse actors and researchers. This again was needed to effectively facilitate workshops and to create safe enough spaces of dialogue.

Co-learning during the D2.4 preparation

This deliverable was created based on two of the multi-actor workshops implemented under BIOTraCes, and several meetings with the societal partner CEA to directly discuss topics relevant for this deliverable. In the workshops, we implemented different methodologies to discuss the following research questions with actors representing institutional entities, other researchers and educational communities, i.e., teachers, parents and school staff. Concretely, we zoomed onto (i) Overarching objectives and visions of schoolyard greening, including their contribution to transformative change, (ii) Current program successes: How have they been achieved (e.g. strategies, actions taken)? Which factors were helpful for the objectives to be achieved (e.g. institutional support, creative freedom, social demand)? Who has been driving the success? (e.g. collaboration between different actors)? (iii) Current program challenges: Why is it considered a challenge? Which factors are blocking the objective from being achieved (e.g. lack of institutional support, of creative freedom, of political frameworks, etc.)? Who and how are actors currently working towards overcoming those challenges (e.g. concrete strategies or actions)?

The workshops were further used for scenario development, including a strategy at the individual school level and a structural change, identifying actions that can realistically be

implemented to achieve the common vision and resources needed for the actions (such as (i) money, collaborations, spaces, education or training, policies and programs and (ii) actors who hold these resources and are needed to implement the action, e.g. key community partners, organizations, or experts). Then, we discussed facilitators and barriers of each scenario. We raised the following questions: Do the scenarios privilege a specific outcome at the expense of others within the vision, i.e. are there any trade-offs between the scenarios? More specifically, how do the actions consider the different profiles of the schools (with emphasis on existing inequalities between the different educational communities)? The workshops findings were further complemented with reflections from researchers' participation in internal cross-departmental meetings of local institutional actors regarding the municipal schoolyard greening program, and specific discussions that took place in regular meetings between the researchers and the societal partner. The workshops, however, were the most important space for the creation of this deliverable, as they brought together actors that would usually not meet, to reflect on successful and less effective strategies and actions currently applied, and to learn from those reflection for future interventions – under the lens of just transformative change. As facilitators of those spaces, it was sometimes difficult to lead the conversation towards identifying positive future pathways, including concrete (and realistic) actions. Because this was the first time representatives of educational communities and institutional actors had a dedicated discussion space, conversations tended to circle around challenges and failures. As a result, one major takeaway was to understand the necessity to provide spaces to discuss negative processes to be able to advance from there towards positive futures. Those moments were also needed for trust building between the different actors participating which ultimately also enabled the emergence of new perspectives, such as one of relational schoolyards.

Based on these discussions, the societal partner is currently preparing a participatory process for next year (2026) to co-create a roadmap for a municipal schoolyard greening program together with multiple actors involved in this biodiversity innovations. The process is supposed to build on and continue BIOTraCes efforts.



Figure 5 - Building a collective vision of schoolyard greening for transformative change (Multi-actor workshop, February 2025)

Co-learning dynamics in the case study

Concrete examples of co-learning that can be found in this case study include, first, interdepartmental meetings between various institutional entities involved in the schoolyard greening program to some BIOTraCes researchers were invited to. In those meetings, institutional actors shared the program updates but also challenges they were encountering in their day-to-day responsibilities in this program. Second, co-learning happened in those feedback sessions between institutional actors and educational communities in the design phase and post schoolyard transformation to understand educational actors' perspectives. Third, BIOTraCes workshop served as a pilot for a longer

participatory process currently in the planning to co-develop a joint action plan in form of a roadmap for future schoolyard greening initiatives.

Moments of co-learning were supportive of aligning in part diverging visions (especially across the different city hall departments involved in the schoolyard greening pilot program). However, more spaces would have been needed from the beginning of the pilot program to dedicate time specifically to the exchange and alignment of expectations. This would have been needed also to counteract frustrations resulting from a mismatch of expectations and actual implemented schoolyard transformation. Over the course of the pilot program, and through the constructive discussions during BIOTraCes workshops, more importance has been given to the creation of those spaces. This becomes visible in the planned schoolyard intervention that dedicates a full year to a participatory design process and through the collective process planned for the creation of the roadmap.

Despite the intentions to create more participatory spaces and improve communication between institutional and educational community actors, decision-making and overall governance settings are still organized in a top-down manner. To move towards a co-governance of urban schoolyards, decision-making power must be shifted to those actors most impacted by the biodiversity innovation. This includes the creation of more spaces facilitating the participation of vulnerable families which is needed to be able to fully pluralize imaginaries and policies related to schoolyard greening. Disagreements remain regarding the scale of the concrete renaturalization efforts, weighing up increased maintenance costs vs. actual improvements of the schoolyards, and more broadly, to what extent educational community actors should be “granted” more agency to enact change locally – considering schools being embedded into a public schooling system and hence subject to political shifts on different policy scales.

Conclusion

Over the course of BIOTraCes, more spaces of dialogue were created. These are the first steps for trust building between diverse actor groups whose relationship is also marked by power imbalances. For instance, decision-making power falls on institutional actors, educational communities are often excluded from those rigid top-down spaces. Since the initiation of the pilot program, more spaces and processes for co-learning have been implemented, first, between those institutional actors responsible for the program implementation, and second, between institutional and educational community actors to improve communication channels and share feedback. BIOTraCes workshops have helped to draw importance to those spaces of exchange of visions. While there are still power imbalances prevalent, future initiatives are aiming for a better integration of the educational communities in the governance process.

6.5 Testing of interventions

Introduction

This case study tested the current administrative structure of the municipal schoolyard greening pilot program and its resulting narratives, including its overarching vision and objectives and the success and barriers of current actions. Testing the “governance” intervention is needed, as the current overarching municipal pilot program structure severely impacts the state of the biodiversity innovation, namely the through renaturalization measures transformed schoolyards. Adapting the governance structure hence can help to overcome current lock-ins and injustices holding the biodiversity innovation from unfolding its full potential, including institutional inertias and social exclusion. This may support specifically processes of pluralization and empowering.

Description of the testing process

Testing happened through an iterative process. Interviews and field trips to the schools were conducted with the societal partner and educational communities. The interviews were used to identify diverging perspectives in respect to the municipal pilot program and to understand the first challenges encountered by diverse actors. Based on these interviews and other field interactions, the workshops were designed to discuss in a multi-actor setting the shortcomings, but also potentials of the current structure of the municipal schoolyard greening pilot program (see section about “Co-learning”). Several meetings with the societal partner were used to discuss in-depth perceptions and learnings from the evolution of the pilot program and the research process under the lens of transformative change.

In this process, two key questions arose: (i) What role can schoolyard greening really play in improving a highly neglected public schooling system? (ii) What are the justice and social equity implications for marginalized communities, if much of the transformative potential of renaturalized schoolyards depends on efforts of local educational communities, and especially on support from the families? Those questions were open questions that guided reflections throughout the research process yet remain in big parts unresolved. It needs to be stated that the societal partner of this case study is the Center of Environmental Studies, a municipal entity, that holds some of the decision-making power over the schoolyard governance, including the schoolyard design, the criteria used for the schoolyard transformation, the selection of participating schools, and the implementation of the participatory processes. Following, the societal partner represents one that holds power over the biodiversity innovation and its relevant actors.

Results

Stakeholder engagement and participatory processes

The municipal schoolyard greening pilot program entails from its beginning a so-called participatory process with the aim that educational communities can state their needs and wishes regarding a schoolyard transformation. Over the course of the program, and through increasing feedback from educational communities, also in the BIOTraCes workshops and field activities, an incremental adaptation of this process has happened. The first schoolyard transformations involved a participatory process with the educational communities of only two one-hour sessions, in schoolyard transformations implemented since autumn 2024 an additional session was added. Following, while the participatory process so far implemented has by no means the form of a full and real participation that was able to include more marginal educational communities sufficiently, the institutional program coordinators are showing increasing awareness. As an outcome of co-learning (especially through feedback from the ground), the whole process of schoolyards transformations is now being prolonged from one to two years. More time and resources dedicated to the participatory process is also hoped to, first, set and manage educational communities' expectations from the beginning, and second, achieve a better involvement of schools in the design, implementation, and maintenance of the schoolyard. This will help to generate a feeling of ownership over the schoolyard – needed for transformed human-nature relationships over the long run.

Impact on policy and decision-making

While political commitment of the city hall is pending to fully embed the pilot program as a long-term initiative in the local municipal budget, with the goal of renaturalizing all the city's schoolyards, institutional technical staff is applying diverse strategies aiming for a prolongation of the program. The fact that smaller aspects of the program have already been adjusted based on internal and external feedback shows that governance arrangements are flexible enough to be shifted. The most important sign for shifts in institutional practices is the abovementioned co-creation of a roadmap for future schoolyard greening, together with educational actors.

Community-level changes and social perceptions

Overall, throughout our interactions with research participants, we noticed an emerging emphasis on the relationality of schoolyards, i.e., to understand them as spaces where closer human-human and human-nature-relationships are formed and nurtured. While relationality does not play a significant role in the program's current framing, it has been increasingly the center of conversations surrounding a redefinition of program objectives, such as enhancing children's caring relationships with each other and with biodiversity. It can also be hypothesized that with an increasing number of schoolyards being renaturalized, social perceptions of the biodiversity innovation increase. First biodiversity monitoring efforts through a citizen science program, in which 12 volunteers and some schools participated to observe birds and pollinators, showed a (visible) increase in urban biodiversity. This can have a positive impact on e.g. the neighborhood's perception of the program that is directly affected by the biodiversity increase.

Reflections on the intervention's transformative potential

The question of whether schoolyard greening is indeed a step towards transforming the way we think, interact and relate with our social-ecological environments, remains contested. Some parents demand greener and healthier school environments for their children to create early-on memories in nature, while other parents still see renaturalized schoolyards as dirty and risky. Local policymakers emphasize its contributions to overcoming educational segregation and to increase urban biodiversity. Most revealing of the more structural challenges the biodiversity innovation is encountering were conversations with teachers critical of the municipal schoolyard greening program: they see schoolyards first and foremost as places of play and recreation. They shared experiences of how trees and lawns that are closed for the use of children due to needed growth periods are taking away necessary spaces for children to run. According to them, the current form of the schoolyard greening program is only a small drop on a highly neglected public schooling system that needs much more attention in many other areas than an additional tree in its yard, opening many questions around the justice implications of the biodiversity innovation in question.

Observing the evolution of this biodiversity innovation, a key transformative moment can be found in its initiation where social mobilization led to the formulation of key demands presented to policymakers. This was then taken up in a municipal pilot program for schoolyard renaturalization. However, its initial governance structure can be understood as a set-back from transformative change. Here, rigid administrative structures, top-down decision-making and lack of real participation of educational communities reinforced common lock-ins of institutional practices of local climate actions. The co-learning through ongoing reflections and feedback, however, shows promising avenues for an opening up of the governance structure to become more inclusive of those actors the biodiversity innovation is targeted to.

Open questions for future strategies

The future of this biodiversity innovation depends on the political decisions to prolong the municipal program by dedicating a fixed annual budget to enable the renaturalization of all public municipal schoolyards. Future strategies will depend on this decision. If there is no political consensus in favor of the improvement of educational environments, strategies will need to aim for an increasing politicizing and embedding of the biodiversity innovation by achieving political awareness and commitment. There would further be the need to develop strategies that allow for actions and initiatives merely driven bottom-up by the educational communities. If the city hall decides to fully embed schoolyard greening into the municipal budget, the most urgent future strategies should aim for achieving a pluralization and a better empowerment of marginalized educational communities. Guiding questions concern here how to increase and facilitate participation of marginalized families in the schoolyard greening and its use? How to open up the overarching program narrative to become more nature-inclusive?

6.6 Discussion

Introduction

This case study of a municipal schoolyard greening pilot program gave deep insights into the institutional functioning, its resulting barriers and opportunities, and the multiple factors influencing its implementation on the ground. Through accompanying the program over the last three years and observation of its evolution in response to feedback and changing conditions it can be said that while there is a potential to foment and nurture deep human-nature relationships from an early age, structural barriers, such as top-down governance, lacking political commitment, connections to higher scale political discourses are still constraining transformative change. The case study drew importance to the trust-building through continuous dialogue, evaluation and learning processes and could show that local governance frameworks are flexible and can be adapted if supported by institutional niche innovators and policymakers.

Main insights from testing the interventions

Shifts in governance frameworks can occur, but they occur slowly. Especially on the local scale, institutional actors hold a certain agency to enact changes, e.g., through incrementally adapting program structures as a response to processes of learning. These small shifts can be understood as levers to exert pressures on policymakers to enact further change – if supported by a social demand and embedded into institutionalized knowledge (e.g. through participation in research projects, collaboration with the university, or through technical knowledge exchange). Examples encountered in this case study include, e.g. the manifesto turned into a pilot program, and the many ways institutional, technical staff find to prolong the program, e.g. through a bricolage funding approach or through participation in research programs. However, adapting rigid top-down governance structure towards overcoming the lack of real participation and the exclusion of historically locally rooted needs takes time and requires deep efforts of trust building and the safe sharing of one's perspectives, values, and knowledges in relation to the biodiversity innovation. It further requires honesty and transparency in formulating reachable objectives and expectations regarding the impacts, both positive and negative, a renaturalized schoolyard can have. This includes openly recognizing that schoolyard greening at the scale implied in this case study is not enough to address the many shortcomings of a neglected public schooling system. If program goals are not communicated rightly, this will lead to frustration and decreasing support from the educational communities to take part, and even more, ownership over changes of their school environments.

Aspects that showed promise or traction

The creation of spaces of dialogue through BIOTraCes research activity consisted of a first space for the multiple actors involved in this schoolyard greening program to come together and share and discuss the overarching vision attached to the schoolyard greening. This was a necessary step to understand actors' divergencies and align expectations while being realistic of current barriers. This step was further needed to start a process of trust building between institutional and educational community actors. It has now been taken up by institutional actors with the idea to create a participatory process with diverse educational actors, to define a future roadmap for municipal schoolyard greening. Again, this is an indication of a willingness to adapt, to make changes. Trust building takes time but allows for new perspectives to emerge. Those new perspectives need to be communicated effectively and convincingly to policymakers and be integrated in a framing of the biodiversity innovation, so its narrative is mirroring the plural perspectives attached to it. That is, if the relational narrative of schoolyard greening will permeate into its overarching program structure and framing remains to be seen.

Remaining challenges and areas for further work

Although the latest Spanish education law from 2022 indicates a policy shift on the national level and hence opened up a window of opportunity for shifting overarching education paradigms towards a whole school approach, there are still many barriers for its practical implications locally – also resulting from educational segregation marking the Spanish education system. Currently, educational communities are lacking the resources to adapt to and implement those changes in the day-to-day learning activities. That is, for the policy changes to effectively trickle down to the local level, concrete strategies and action plans need to be formulated and pushed forward by policy makers across the different scales, overcoming rigid administrative structures. As for now, the lacking political commitment to prolong the municipal schoolyard greening program is a barrier to the full-on integration of the national policy shift locally. It is further challenging a full-on pluralization of the biodiversity innovation locally as it undermines local perspectives and needs and challenges the implementation of the new relational education paradigm in day-to-day activities. Structural barriers to embedding a co-governance of the schoolyard and to overcome educational inequalities, as encountered and discussed in this case study, are currently the biggest constraints to transformative change.

Final messages and perspectives for future strategies

To move this biodiversity innovation of schoolyard greening to one that is fully politized, empowering, embedded and pluralized, and nature-inclusive, concrete actions must be implemented that adhere to the ambitiously framed goals of achieving co-education, inclusivity and sustainability through a schoolyard transformation. This requires, first, a political decision to provide sufficient resources needed for a long-term sustainable implementation, use and maintenance of the biodiversity innovation. It requires, second, the full-on integration of the educational communities into the decision-making process in a way that this attentive to their capacities and that allows them to enact change in their day-to-day activities without facing too many administrative barriers. For this, regular spaces of dialogues need to be created that allow for both sharing of experiences, but also for having a real voice in the final decision-making. This is needed to remake and democratize the current schooling system towards one that puts needs of children first and foremost.

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CER Herders' knowledge for biodiversity

D2.5 - Hungary

December 2025

Authors

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Funded by
the European Union

Summary

The Hungarian team of BIOTraCes project is working together with traditional Hungarian herders. There are approximately one million hectares of grassland in Hungary. Half a million hectares of these are not only suitable for grazing but actually require grazing in order to preserve their natural values. These are species-rich, ancient grasslands with high biodiversity and ecological importance. The preservation of these areas is in the common interest of humanity. According to experts in all aspects of conservation and ecology, extensive grazing is now essential for maintaining grassland ecosystems and biodiversity. On the other hand, proper grazing requires specialised people: traditional herders and conservationists, with expertise in both areas. The number of herders is decreasing rapidly, not because they are unnecessary, but because society, including especially conservationists and those involved in grassland management, has not yet realised that, without herders, it will be impossible to sustainably manage and properly maintain these biodiversity-rich grasslands. Due to rapid socio-ecological and economic changes, herders need to adapt and innovate continuously to survive. They need tradition-based innovations, developed through both herders' knowledge - old and new knowledge - and scientific understanding. (Traditional herding for the future: transforming understandings and policies.)

As part of the BIOTraCes project, our main goal is to explore these opportunities for innovation and to help pastoral communities and wider society to implement these innovations. We want to achieve radical changes in how people think about and value traditional herding and herders, and in the regulations and support systems created for them. We work together as equal partners with herders to develop our specific goals. Pastoralism is an ancient occupation that constantly changes and adapts to the world. However, in recent decades, many new policies and regulations have made this adaptation more difficult – even when their stated aim is to support herding. The Hungarian case shows that today, the ancient profession of herding is often seen as an outdated tradition, despite its many benefits to society and its vital contribution to the preservation of natural values. Under the good care of herders, pastures and the livestock play a key role in maintaining biodiversity, while providing high-quality meat, milk, and many other valuable products derived from plants inedible to humans. We tend to ignore a fact proven over thousands of years of human history: when done properly, grazing is the only agricultural activity that, while maintaining biodiversity, is itself a sustainable form of land use. In the current era of climate change, pastoralism - highly adaptable to changing conditions - and the traditional ecological knowledge associated with it are of crucial importance for the future of humanity. (Traditional herding for the future: transforming understandings and policies.; Lelea M.A. et al 2024)

Our case study has national coverage: we aim to find herders in every region of Hungary, document their knowledge and lives, and connect them with herders in other regions. We would like to promote their self-organization not just from outside, as a researcher, but provide possibilities for creating their own system for their representation. We are the first in the country to strive for the fullest possible professional and social cooperation among the country's herding communities, as there has never been a such a threat to the survival of pastoralism. Of course, we must take into account numerous aspects of research and social ethics in our work. We work together with a strongly isolated social group that is marginalized both externally and internally and has a unique cultural and social background, which poses numerous external and internal challenges for both researchers and the herders who work with them. Through our activities, we seek to help middle-aged and older herders continue working as respected professionals and remain in the occupation. We also support young people in becoming herders, staying in the profession, and developing their skills. Another important partner in these efforts is the "Hungarian Women Herders Group" (3) founded in 2021, whose members are women and girls working in pastoralism in Hungary. We have started to organise some special meetings for herders - in some occasions with other stakeholders and decision makers involved - to make discussions and find solutions about their basic problems. These meetings are called "The Forum of Hungarian Herders" (2.;4.), which had two big and some smaller meetings with

the help of our project. We are also trying to initiate international connections between and among herders, researchers and decision makers. This is why we have organised several conferences and meetings, with the contribution and participation of foreign colleagues. Thanks to these meetings, the herders' worldview and their social and technological ideas have taken on new dimensions in many cases (1.;5.;6.;7). Because of the work of the last three years, numerous practical examples have shown the beginning of a positive transformation in the intellectual and technological background. The transfer of knowledge that has already begun and useful innovations are also necessary to preserve the traditional ecological knowledge of Hungarian herders in the present and in the future. (MÁL articles, 2024-2025.)

In summary: today, it is not only the climate, the weather and our natural ecological environment that are changing dramatically. Herders are also affected by new influences from society, conservation and agricultural regulations, animal welfare and health, subsidy systems, etc. Biodiversity and food security in Hungary both require that pastoralism be maintained in the future. However, in order to survive and maintain knowledge, the herders need help in many aspects. It is this adaptation, the development of a new generation of 'conservation herders', that we are trying to stimulate in this project. (Traditional herding for the future: transforming understandings and policies.)

1. Case Study Introduction

1.1 Justification of the importance of the case study

Hungary's extensive grasslands conceal countless natural treasures and can be considered one of the country's last refuges of biodiversity. Grasslands are not only valuable in terms of biodiversity conservation but also play an important role due to their carbon storage capacity and can play an extremely important agricultural role in the face of drastically changing ecological and climatic conditions. This is why it is important for us to find sustainable ways to use these grasslands that help preserve and regenerate biodiversity. Local communities and stakeholders have access to millennia-old technologies and centuries-old traditional ecological knowledge at the local level for maintaining grasslands. Accordingly, we began our research with the social group that has the strongest interest in the preservation of grasslands and the maintenance of their health and biodiversity, and which is equipped with traditional ecological knowledge: Hungarian herders. (Béres Mihályné, Márki Piroška, 2006; Bíró M. et al, 2019)

1.2 Explanation of the focus of the case study

Hungarian pastoralism has a history that goes back several centuries. The science of maintaining healthy grasslands and their long-term sustainable use is in their hands for hundreds of years. The increasingly rapid and drastic ecological, climatic, economic, and social changes of the last 150 years have presented them with unprecedented challenges. The number of Hungarian herders is declining day by day, and within two decades they may be on the verge of complete extinction. Continuity cannot be achieved solely by preserving old knowledge, e.g., by training new generations of young herders and creating the right conditions for them; knowledge must be gathered and synthesized through the mutual work of scientific tools and traditional communities.

1.3 Research questions addressed by the case study

Our research group aims to collect and preserve the knowledge and experience of grassland management and traditional pastoral grazing practices for future generations. However, due to changing circumstances, these need to be further developed and innovated, which in some cases is the domain of other disciplines and communities. Our questions and tasks are therefore:

- Collecting the traditional ecological knowledge of marginalized Hungarian herders and livestock farmers related to livestock and pastures as widely as possible
- Further developing traditional knowledge to meet the challenges of our time, developing, testing, and continuously improving innovations
- Synthesize the collected knowledge and then communicate it in an ethically and culturally appropriate manner to society and to stakeholders in the sector and on the topic
- Train specialists who are proficient in both traditional and innovative knowledge, so that they will be able to maintain the biodiversity of grasslands in the future
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1.4 Reading guide

The Hungarian case study should not be approached exclusively from the perspective of a single discipline. Here, we must give space to the social sciences, agriculture and agroecology, ethnography, nature conservation, and a wide range of scientific research backgrounds in order to interpret the current situation and challenges surrounding Hungarian pastoralism in the appropriate context.

2. Research methods and application of PAR

2.1 Role of Societal Partner

The partners involved in our research work are primarily Hungarian herders, secondarily researchers working with herders, and in some cases the same actors at international level. In fact, the joint work with the herders began long before the BIOTraCes project started. As we are talking about a socially and economically segregated and marginalised community for historical reasons, we have to adapt a great deal to the ethical and cultural expectations they have of us in our work with them.

Hungarian society in general is not aware of the professional value of herding and the potential of its knowledge and practice in animal husbandry and nature conservation. They are mostly seen as traditionalists because of their unique clothing and tools, which have been greatly enhanced by the development of tourism in the Hortobágy region over the last century. The realistic social perception of herders is not helped by the fact that many livestock keepers employ people who can be paid easily and cheaply due to their slack lifestyle and who have nothing to do with the herding profession but rather act as simple guardians of the livestock. If we would like to draw a map of relationships about their society, then - in addition to numerous internal social tensions arising from historical reasons - many other stakeholders involved in nature conservation, agriculture, and animal husbandry tend to view them with distrust or even hostility, rather than treating them as potential partners and allies.

Researching and exploring the traditional ecological knowledge of pastoralists is impossible through interviews and indoor discussions only. In all areas, it is necessary and appropriate to be involved in the life and real field work of local herder communities. However, cultural differences mean that we cannot do this as strangers with a notepad in our hands. Consequently, working together with herders, both physically and mentally, is the practical backbone of our research, which builds considerable trust and relationship with our partners. The fieldwork and discussions necessary to synthesise the patchwork data shaped the tasks and priorities to be initiated and completed within the BIOTraCes project.

Summarising the experience gained from working with herders and drawing conclusions should not be done with a one-sided research attitude. Considering the drastic positive and/or negative consequences this may have on their lives, the correct identification of the results and the necessary follow-up cannot be done without the involvement of the social partners of the project. Moreover, research ethics and the cultural context of the Hungarian herders require that results and objectives are established jointly and collaboratively. This is why we have tried to keep the results of our fieldwork in constant consultation with the herders. There is no material or publicly stated goal that has been presented in relation to them that has not been subject to the opinion and agreement of their community or of those directly involved. This approach has been implemented not only in communications to external media channels, other stakeholders and decision-makers, but also in communications within and between herder communities in different regions. (Kis J. et al, 2017; Lelea M.A., 2024)

Herders are fundamentally people who live and work in the landscape. They maintain and manage the landscape, ecosystem and community in a sustainable way - this is their main activity, what we are researching! Accordingly, it is not their prescribed task to advance and assist our research, and despite their willingness to contribute, they cannot be overburdened with tasks related to our research and activities. By providing insight into their physical work, their contribution to the participatory action research process results in the creation of a previously unseen database and social knowledge. The main lines of our research, the processes of synthesizing the knowledge and experience we have gathered, and the subsequent decision-making are determined by the herders in such a way that we strive to involve them as much as possible in accordance with their own abilities and intentions. Therefore, we work together with the Hungarian pastoralists' community as partners at every stage, including the compilation of the necessary research topics and questions, the outcome of participatory research, the planning and preparation

of decision-making processes, and the development of professional communication. Without their knowledge, cooperation, and contribution, this case study could not have been created. In this respect, our results are directly or indirectly linked to their names in every step.

The herders can benefit in many ways from our joint efforts and cooperation. These benefits include expanding their network of contacts and professional knowledge; gaining experience in Hungary and, in some cases, even traveling abroad; assistance provided by our physical participation in certain work processes; the definition, communication, and even achievement of professional and social goals that are beneficial to them; learning opportunities related to other successful agricultural examples and social processes; increased internal cohesion within the herding community; etc. The joint effort is underway to ensure that Hungarian herders' society and traditional ecological knowledge can be maintained. So it is not only them who are fighting for their own interests, but we ourselves are also continuing our work towards the same goals. In order to shape the social, economic, and ecological factors necessary to achieve these goals, we need to form alliances between different sectors, which we are striving to establish first and foremost between herders and researchers, as well as other experts in nature conservation and agriculture, decision-makers, and other stakeholders (2).

2.2 Collaborative Research and Application of PAR

Participatory research at the level of a particular person is made up of several parts. Physical work and observations in the field with the herder are fundamental and have several functions. Culturally, herders are more accepting of individuals who show not just a superficial interest but a deep willingness to engage in their work. In doing so, they gradually reveal more and more of the often-hidden details of their work, sharing more and more of their thoughts and experiences about their profession. In our case, this means not only a relationship between researcher and researched, but also a profound human and professional relationship. If we want to bring individuals or their opinions to the public for a purpose, we can build on the trust we have previously established and invite herders who are often closed to community engagement. In such cases, we always agree our common goals and possibilities in advance, giving all the information and support to the herder in person, so that no one is inconvenienced or unexpected. In this way, not only do the particular herders take on previously unanticipated tasks, but many also become experienced in representing their own interests and ideas. In the case of publications, we also only create and allow to be published material to which all participants involved - specifically the herders in question - unanimously agree and commit. We will also only disclose the names of the herders who contributed to the opinion in pre-agreed cases. In this respect, we will also seek to assist both professional colleagues and non-professional stakeholders and media in cases that arise in our environment. (Molnár Zs., 2017; Molnár Zs., 2018; Molnár Zs. et al, 2019; Molnár Zs. et al 2023)

We also seek to play a vital community-building role in the lives of herders. Although they themselves regularly refer us to familiar herders who are worth working with, many do not know herders from other regions. We can help them in this by opening up new contacts between the people and communities we have identified, which they typically welcome. In doing so, we seek not only to strengthen local communities, but also to serve the common interests of herders and pastoral communities across the country.

In our work with herding communities, we need to be more careful to balance and equally represent the views of different regions and groups from different backgrounds. The different geographical, natural, economic and social backgrounds of different regions cause different problems in the lives of herders, in addition to the fact that most of the problems in the sector affect them in common. For this reason, different solutions are considered to be appropriate and relevant, which should be addressed separately at local and national level.

The main opportunities for national consultations are the series of the Forum of Hungarian Herders (2.;4.;7) that we organise. To these events, we invite herders from all over the country who are most concerned by the issues we want to discuss. This is an effective way of discussing the main issues, the current state of our work and what we need to do next. In fact, one of the most important self-checks in our work is provided by these occasions. The meetings have a key networking and informative role, both among the herders themselves and between herders and other stakeholders. In a pre-arranged way in these meetings, we try to invite experts who can provide the herders with relevant information on current issues, or who we consider worthwhile to inform them about the situation and the views of the herders. It is hoped that this process will increasingly reach the decision-making levels, while the country's herders may even develop their own advocacy. Meetings will be thematised not only by topic but also by the participation of invited herders. For example, there have been meetings specifically for young herders and women pastoralists with different objectives. (MÁL articles, 2024-25)

What is unique about the stakeholder engagement approach is that we are not just data collectors and synthesizers of the case study, nor do we just act as mediators between specific stakeholders. The characteristics of the cultural milieu we are dealing with and the objectives we are pursuing require our necessary partial inclusion in pastoralist society. Although we are not present among them as herders, we are already received as outsiders with a specific position in their society. This gives us a much greater scope to gather and organise their opinions and to effectively understand the tasks and processes taking place in their society and on their farms.

The basic methodological and chronological sequence during the PAR was as follows: It took us many years, in some cases decades, to personally contact the herders and establish personal and professional relationships with them. With the professional and social experience gained from individual herders, we were able to map the characteristics of their society much more effectively. Since the professional and behavioral characteristics of herders vary within the country for historical, social, geological, and ecological reasons, it took many years of working together to understand the national dynamics of herder society. Only then could the interdisciplinary meetings be successful and mutually beneficial for our own project. From this point on, the different methods reinforce each other. The meetings also provide an opportunity to consolidate and clarify individual opinions, and lay the foundations for the next steps in thinking and decision-making. So, after a meeting organized by us, the herders considered what was said there to be a significant step forward in their thinking, which they continue to refer to later on. In addition, however, countless opinions are formed on an individual level on the issues at hand, which can be discussed again at future meetings. The individual thinking of the herders and other stakeholders participating in the meetings is greatly aided by smaller discussions following the meetings, during which they clarify the lessons learned in their own environment. The process is self-generating in that individuals can gain new perspectives on their own knowledge while also contributing to community thinking in many areas. Thus, individual and community-level research almost immediately merged into a development process with a unique structure, thanks to the nature of the herding community. Furthermore, the structure of the meetings we organized allowed for clear statements to be made regarding who supports which initiatives, individuals, and opportunities. This greatly assists the work of our research group, as it clearly outlines the social and economic boundaries between stakeholders. Interactions spread visibly among stakeholders, from personal observations to national consultations, strengthening interactivity and the transfer of knowledge through previously unknown or unsystematic methods at all levels.

Since we meet with herders in person on numerous occasions as part of participatory action research, and consult with them by telephone or other methods, we cannot refer to our conversations with them as interviews. In the process of our work, we have come into contact with more than 200 herders and livestock owners. (MÁL, 2024.06.) In addition, we have not even mentioned the representatives of other stakeholders. With certain individuals, we have consulted on only a few relevant occasions. However, with active,

professionally and personally committed, experienced herders, the consultations represent countless occasions. With some individuals, there are monthly, half-monthly, or even weekly dialogues, which, if referred to as interviews, would amount to hundreds or even thousands of interviews after these years. However, for ethical and cultural reasons, we do not record the content of these conversations. Furthermore, in many cases it is not appropriate to name individuals, nor would this contribute to the internal processes of the herders' community. For this reason, the easiest way to refer to the project task is to use the statements made at the major events we organized. The list below summarizes only the main events organized by us, and events we contributed as part of the BIOTraCes project, for develop to the results of our case study.

We use this list for bibliography at our deliverable:

1. Herder Conference at Olaszfalu
2. First Forum of Hungarian Herders
3. First National Meeting of Hungarian Womenherders Group
4. Second Forum of Hungarian Herders
5. II. Biodiversity Conference of Debrecen
6. National Agriculture and Food Exhibition and Fair
7. National Meeting of Hungarian Womenherders Group, and herder families

Table 2 - Main research events in CER Case Study

	Date, place, name, organizer	Participants	Aims and description	Results
1	2023.05.19-20. Olaszfalu, Hungary Herder conference at Olaszfalu CER	7 Hungarian herders (man and women) 3 CER team members 4 Hungarian researchers 5 researchers from other nations 3 herders from other nations	The herders were not only participants, but presenters of their own knowledge for the first time. An international outlook for herders and researchers on the state of pastoralism in Europe. International networking and knowledge exchange among herders, and between herders and researchers.	Preparations for the UN IYRP (2026); Networking between herders and scientists working with herders; Presentation of goals and ideas for Hungarian herders; Discussing methods to empower women herders.
2	2023.09.29. Szolnok, Hungary First Forum of Hungarian Herders CER	19 Hungarian herders 3 CER team members 8 decision makers	The first direct interaction between herders and decision-makers. We were looking for common policies, opportunities for cooperation, and talk about transforming the funding and regulatory system. Discussion about the diverse perspectives and options of maintaining pastoralism in Hungary.	Gathering connections for IYRP among decision makers. Realistic information provided to decision-makers about the situation of Hungarian pastoralism. We got a promise about national subsidies for pastoral grazing.
3	2024.03.02. Hajdúsámson, Hungary	20 women and girls working in pastoralism, and	The meeting was a basic stone for building up social coheresion in the Womenherders Group.	Communication has been started about the basics regarding the group's existence and operation.

	First National Meeting of Hungarian Womenherders Group CER, Hungarian Womenherders Group	their companions or families 2 CER team members 5 staff members of media platforms 3 other guests from local institutions		Making plans for IYRP within the group.
4	2024.02.20. Szolnok, Hungary Second Forum of Hungarian Herders CER	21 young and middle-aged herder 3 CER team member 1 nature conservation ranger	Drawing up plans to collect the traditional ecological knowledge of Hungarian herders and discussing the possibilities of using and transferring the knowledge collected. We discussed with the herders the practical issues of setting up a herders' school for the first time.	We assessed the willingness of herders to transfer knowledge and to participate in training young herders. We were gathering contributors for communication activities and IYRP plans.
5	2024.03.27-28. Hortobágy, Hungary II. Biodiversity Conference of Debrecen Biodiversity, Water Management and Climate Change Competence Centre and CER	Around 50 researchers, conservation rangers and farmers 14 CER team members (5 from our research group, as participants)	The conference topics were reintroduction, regenerative agriculture and habitat management with grazing animals. Discussion of strategies and options for grassland conservation and management, with national coverage.	Discussion of strategies and options for grassland conservation and management, with national coverage.
6	2024.09.19. Budapest, Hungary National Agriculture and Food Exhibition and Fair Professional conference Agricultural Marketing Centre	Around 50 professional visitors of the occasion 1 CER team member 2 herders 2 regenerative farmers	Professional panel discussion about the methods and opportunities of livestock grazing in the aspect of climate change. We were the moderator of the discussion, with invited guests of the profession.	We identified potential points of contact between the two sectors that could influence our work and the activities of herders in the future. This applies to both practical work, intellectual background and marketing activities. The researchers present recognized that regenerative livestock farming works on the basis of traditional pastoral grazing technology.

7	2025.10.11. Fülöpháza, Hungary National Meeting of Hungarian Womenherders Group, and herder families CER	20 women and girls working in pastoralism 11 herders 2 American researchers 3 CER team members 6 staff members of local institutions	There were isolated sessions for male and female participants. The men were discussing the characteristics and problems of grazing areas and pastoral systems in Europe With the presentation of an American researcher. The women were holding the second national meeting of the Hungarian Womenherders Group, with the lead of an other American women researcher working with pastoralists worldwide.	We identified the main problems of the grazing systems ecologically and in regulations across the EU. A significant part of Western European innovations is also present in Hungarian tradition. These practices, which are considered innovations in nature and climate protection throughout Europe, are known to hungarian herders and in many cases are still carried out today.

2.3 Triangulation

We have been using most of the listed methods of D2.1 since 2005 in various local communities and found them useful and doable. Knowledge co-production and collaborative research are key to us.

In our case study, the first research method was Field-based participatory research, because we needed to get to know the culture and daily life of the herders and gain their trust (- see the answer to the first question). This trust building with the herders started many years ago, before our case study began. Only then could we move on to the following research methods.

From the Workshop-based methods we generally use the focus-group interviews next to the One-to-one and Face-to-face interviews. Once we have generally assessed each herders' opinion on the key issues needed, we generally want to extract a common opinion in order to achieve our goals. However, for cultural and other reasons, we did not want to aggregate the results externally. Instead, we have convened the herders on several occasions (1.;2.;4.;6.;7.) and on several topics to collectively formulate a position on the necessary issues, which we can then present to the stakeholders and decision makers involved. A very important aspect is that we try to ensure national coverage and diversity: we try to invite young and older herders and women herders from different geographical and social backgrounds, from all regions of the country - this is a crucial but very difficult task for researchers working with herders. This is the reason we have already organised Focus Group Meetings and Dialogue workshops and used them to make networking among herders and between herders and other stakeholders.

From the side of Documentary/Historical research methods, we have not been able to do significant work, because we have only a few incomplete sources about the history of herders and their impact on biodiversity in Hungary. Reliable information (for the last 150-200 years or so) on this is more likely to come from narratives of herders still living today.

The methods we have chosen and used to ensure triangulation have not changed throughout our research. Basically, we have no intention of changing the mechanics of the thinking of herders. For this reason, the methods we used did not cause any significant internal tensions in our results. Our task was rather to expand the herders' knowledge and, to this end, to expand their network of contacts. The results, tasks, and main guidelines were thus determined by the herders themselves for our research group. Our research group made rather some proposals as solutions. It is important to note that: not only

researcher perceptions are considered as results, but those affected by the processes also play a decisive role in determining the results. We focus on fulfilling the tasks and goals we have collected that can be justified by the professional and human reasons and needs of herders. Thanks to this method, all stakeholders can use the part of the case study that they need and want. For example, some herders are simply gathering information to transform the mindset and infrastructure of their own farms. Others are trying to expand their network of contacts or initiate discussions with groups of stakeholders and decision-makers. In some cases, larger communities can also benefit from the use of the information collected, as they would otherwise have no other way of accessing it (basically for lifestyle reasons). In this sense, we cannot rank our methods or their results according to their outcomes, as each has a different impact on individuals and society, fulfilling different and incomparable roles. When triangulation of methods, we must pay particular attention to the current state of social networks and ethical expectations.

3. Case Study Contextualization

3.1 Multidimensional Presentation

In Hungary, there are more than half a million hectares of grassland that require traditional pastoral grazing to survive. In many cases, these are protected grasslands of high natural value, with outstanding biodiversity value also. The preservation of these areas is in the common interest of humanity. According to experts in all aspects of conservation and ecology, extensive grazing by Hungarian herders is now essential for maintaining grassland ecosystems and biodiversity. Through grazing, treading and dunging, livestock influence the vegetation and micro-cover of grasslands and, through this, their rich fauna and natural processes. The grazing of extensively grazed livestock requires appropriate temporal (year, month, day, period of the day) and territorial distribution and planning, depending on the weather, according to what the herders believe is needed to maintain healthy grasslands. Maintaining a healthy grassland - and thus biodiversity - is an elementary goal for herders, as it enables them to sustain and increase the livestock that provide their livelihoods. This is why the saying is common among herders around the world: "the herder sees the pasture through the mouth of the livestock". Accordingly, herders have been fighting for centuries to ensure the survival and health of grasslands and thus biodiversity. (Traditional herding for the future: transforming understandings and policies.; Ujházy N. et al, 2020; Molnár Zs., 2017)

Hungarian herders were once a more or less culturally segregated social group within the Carpathian Basin. Their tasks required them to adopt a completely unique way of thinking and a physical and mental attitude in order to survive. Historically, the process of urbanisation and social restructuring in Hungary was relatively late and different from that in Western Europe. This is largely the reason why an ancient social class - the traditional pastoralism, with its archaic characteristics and outlook on life - is still present in our country. They are the in-born herders who have been working in this profession for many generations. It is a particular characteristic of them that to this day they remain consciously separate from other members of society, and the skills of their profession are typically passed down within the family. In the old days, this was important in a competitive professional context, as the more successful herder was entrusted with the job, who was better able to increase the number of livestock. In addition to the in-born herders, there are a number of herders working in the profession who have learned the trade in some way from outside. They tend to integrate more easily into today's society, use new technologies more freely and are more willing to pass on their knowledge. Even today, there are still visible human and professional divisions between the two types of herders, but more and more of them are realising the need to work together. In general, the profession is ageing, and the issue of replacement is therefore crucial for the future of Hungarian pastoralism. As their numbers are decreasing, the survival of their traditional ecological knowledge is hanging by a thread. That is why it is so important to pay special attention to young herders and the women who work in pastoralism and bring families together in herding, as they hold one of the keys to the survival of the profession. (Lelea, M.A. et al, 2024)

Hungarian society in general is not aware of the professional value of herding and the potential of its knowledge and practice in animal husbandry and nature conservation. They are mostly seen as traditionalists because of their unique clothing and tools, which have been greatly enhanced by the development of tourism in the Hortobágy region over the last century. The realistic social perception of herders is not helped by the fact that many livestock keepers employ people who can be paid easily and cheaply due to their slack lifestyle and who have nothing to do with the herding profession, but rather act as simple guardians of the livestock.

In Hungary, pastoral grazing is regulated by, among others, the agricultural sector and nature conservation. In the past, nature conservation interests and regulations were dealt with at a separate ministerial level. Today, the only department of the Ministry of Agriculture, the Department of National Parks and Landscape Protection, deals with nature conservation regulatory issues. The regulations laid down here apply to all the National

Park Directorates in the country, which are in fact given a purely executive role. What is most important in terms of the structure of the system is that state nature conservation is heavily influenced by agrarian values and interests, with a fundamental lack of independent expert guidance in this area. In the final analysis, what we have today is mostly 'agri-nature' land management. In many cases, support schemes call on herders not to intervene - i.e. to leave areas untended on the grounds of nature conservation interests. A particular problem across the country is the drying out of land, with grassland weeds becoming terribly intense and increasing rapidly. Furthermore, subsidies and the nature conservation regime contribute strongly to inequalities in pasture ownership and use. Restrictions on the time and space of the grazing season are causing increasing financial and natural problems for herders. Animal husbandry and animal health administration and bureaucratic tasks place a disproportionate burden on livestock farmers, distracting them from their animals.

The relationship of state conservation to herders shows interesting contradictions. Livestock are mainly seen as a land management tool or as property that entitles them to subsidies. The actual pastoral work, tasks, values, benefits and interests associated with them are in many cases not even known to middle-aged and senior managers. As good herders are becoming fewer in the country, there is a fundamental shortage of labour. Recently, this is being compensated for by marketing, developing and disseminating technical advances such as electric fencing, chip-based unique identifiers, etc., which are intended to keep livestock without human presence, claiming that this creates a more natural environment for the animals. However, Hungary's grasslands are now shrinking and fragmented, so it is essential to positively influence the vegetation of grasslands through grazing. In addition, unmanaged livestock present owners with serious challenges and problems in carrying out proper management. The decision-makers involved in extensive livestock farming, whether in the fields of nature conservation, agriculture, animal welfare, animal health or livestock production, are not aware of the situation and the challenges facing the sector. (2.;7.) (Pásztorok és természetvédők video series, 2018.)

3.2 Key Actors and their Impact on Worldviews

The main characters of our case study are the traditional Hungarian herders and their various communities: herding communities of regions, young and older active herders, women in pastoralism; pastoralists born in and outside the profession; private (owning their own livestock) and employed herders, etc. In addition to these, livestock keepers who are not or only partially engaged in genuine pastoral grazing are actively involved in the topic we are researching. These people are just as involved in the natural-market-economic-regulatory environment, but they are also already using tools and technologies that are very different from those considered traditional. Local communities may be affected, and their positive or negative perceptions may influence the situation and opportunities of local herders. In terms of the regulatory environment, several distinct segments can be distinguished (2):

- General national and international standards for agriculture and animal husbandry – Ministry of Agriculture
- National and EU nature conservation standards - Ministry of Agriculture, the Department of National Parks and Landscape Protection; National Park Directorates
- Animal health and welfare
- Breeders' organisations for native and other farm animal breeds in our country

According to experts in all aspects of conservation and ecology, extensive grazing by Hungarian herders is now essential for maintaining grassland ecosystems and biodiversity. Through grazing, treading and dunging, livestock influence the vegetation and micro-cover of grasslands and, through this, their rich fauna and natural processes. The grazing of extensively grazed livestock requires appropriate temporal (year, month, day, period of the day) and territorial distribution and planning, depending on the weather, according to

what the herders believe is needed to maintain healthy grasslands. Maintaining a healthy grassland - and thus biodiversity - is an elementary goal for herders, as it enables them to sustain and increase the livestock that provide their livelihoods. This is why the saying is common among herders around the world: "the herder sees the pasture through the mouth of the livestock". Accordingly, herders have been fighting for centuries to ensure the survival and health of grasslands and thus biodiversity.

Hungarian herders were once a more or less culturally segregated social group within the Carpathian Basin. Their tasks required them to adopt a completely unique way of thinking and a physical and mental attitude in order to survive. Historically, the process of urbanisation and social restructuring in Hungary was relatively late and different from that in Western Europe. This is largely the reason why an ancient social class - the traditional pastoralism, with its archaic characteristics and outlook on life - is still present in our country. They are the in-born herders who have been working in this profession for many generations. It is a particular characteristic of them that to this day they remain consciously separate from other members of society, and the skills of their profession are typically passed down within the family. In the old days, this was important in a competitive professional context, as the more successful herder was entrusted with the job, who was better able to increase the number of livestock. In addition to the in-born herders, there are a number of herders working in the profession who have learned the trade in some way from outside. They tend to integrate more easily into today's society, use new technologies more freely and are more willing to pass on their knowledge. Even today, there are still visible human and professional divisions between the two types of herders, but more and more of them are realising the need to work together. In general, the profession is ageing, and the issue of replacement is therefore crucial for the future of Hungarian pastoralism. As their numbers are decreasing, the survival of their traditional ecological knowledge is hanging by a thread. That is why it is so important to pay special attention to young herders and the women who work in pastoralism and bring families together in herding, as they hold one of the keys to the survival of the profession. (MÁL articles, 2024-25)

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In terms of animal husbandry, nature conservation and cultural and historical values, the relevant decision-makers have a very important role to play. Decision-makers in different sectors have different levels of awareness of the current situation of pastoralism, although this typically means under-awareness. This also implies that they are very differently affected in their perception of herding. According to ethnographic and cultural-historical perceptions, pastoralism is highly valued in the country, but there is almost no insight into it and no interest in its future and practice among professionals. In general, economic decision-makers are completely uninformed about the existence, tasks and challenges of the herder profession.

Among the actors, conservationists (mainly the conservation rangers of the national parks), who are responsible for the enforcement of conservation rules and thus interact with the herders, are given a prominent role. The relationship between conservationists and herders is very mixed, with many positive examples of cooperation and many very negative examples across the country. The relationship between nature conservation and pastoralism is a sensitive issue in our case study. In theory, the two sides should be strong and inseparable allies when it comes to protecting and maintaining grasslands with high natural value (and even other grazable areas, such as certain forests, buffer zones of protected areas, crop rotation that preserves grasslands in changing climatic conditions, etc.). Nature conservation appeared at the state level in Hungary 50 years ago, so from the perspective of pastoralists, it is a relatively young field of science and environment. In contrast, the last 50 years have brought about such total regulatory and ecological restructuring that it has led to the marginalisation and disappearance of herders. In most cases, conservationists view herders and farmers as partly responsible for damaging nature, destroying protected natural environments and species populations through their irresponsible behavior. At the same time, however, they ignore the following: herders have completely different knowledge about the same species and they have much broader experience of how the landscape works (at the local level, even personally, over several generations). Conservationists, on the other hand, impose their own scientific approaches on livestock farmers through international and domestic regulations without explaining their necessity or perceived reasons. Of course, this happens on both sides, deepening the professional and human divide. Young conservationists graduating from higher education institutions typically start out with a negative narrative and a lack of knowledge about farming and herding. What is needed, however, is respectful and ethical communication. In general, it can be said that the implementation of nature conservation regulations and infrastructure has mostly negative implications for herders, and negative feelings prevail because of them. Knowledge transfer and communication are mainly achieved through the mediation activities of our research group. It is encouraging that the negative attitude outlined above is slowly, step by step, being turned into a positive one. (Bíró M. et al, 2019; Kis J. et al, 2017; Molnár Zs. et al, 2016)

Important actors in our research are the farmers who employ herders to work alongside their own livestock. The number of herders is also decreasing, as farmers are in many

cases seeking to replace the work of herders with technological means, thus saving on salaries and other difficulties. In addition, they are also motivated by the fact that there are fewer and fewer people who are really skilled and competent in herding. Thus a self-expanding process has been set in motion towards a reduction in the number of herders.

The economically dominant role is played by the traders and market actors who take over the goods produced by the herders. In our country, the strongest current income of herders comes from the sale of livestock, specifically from livestock exports. This situation creates a strong vulnerability for the country's livestock farmers and herders.

Although our case study is specifically concerned with the survival of knowledge and community of traditional Hungarian herding communities, our results may be indirectly but strongly influenced by the opinions of different sectors of Hungarian society. The society in general is, on the one hand, uninformed about the situation and work of herders and, on the other hand, has less and less demand for local products produced by herders (livestock, meat, milk and milk products, wool, other products related to herding culture). It is precisely for this reason that the perception of Hungarian herders in society as a whole is highly mixed and extreme.

We are among the actors, researchers ourselves. The social group we are researching and helping culturally requires some level of social integration into their own community. This is a very great responsibility and requires caution, since we now have a nationally significant profile in herding society and in some respects influence on the external and internal processes around herders.

What all these actors have in common is that they directly or indirectly influence a social group - the Hungarian herders - whose knowledge and presence are essential for the restoration and conservation of grassland biodiversity. In our country, we can generally consider the positive traditionalist perception of herders as well as the fact that they are considered as the most outdated by the agricultural sector. Moreover, while the role of extensive grazing livestock in nature conservation is not denied by any professional circles, the perception of herding, which is intrinsically linked to this, is often a different matter. In fact, the state and interest of biodiversity maintained by herders is often discussed only from the point of view of nature conservation.

3.3 Biodiversity Loss Factors

The biodiversity status of grasslands in Hungary has been increasingly degraded in recent years due to increasingly intense and extreme weather conditions. Due to agricultural activities and conservation-grassland management standards and practices, the condition of soils is worsening. Compacted soils are not well aerated and cannot absorb the water from rainfall. As a result, water loss through evaporation is increasing, and the landscape has become critically dry in places as a result of almost two centuries of misguided water management in the Carpathian Basin. In order to meet nature conservation and animal welfare/animal health requirements, the optimal use of grassland have been replaced by a schedule of necessary works (e.g. cutting hay, harvesting) and grazing, which is linked to natural processes. A few decades ago, these dates had a different effect on the landscape, but today, interventions carried out at the wrong time and in the wrong way are damaging nature. In addition, for animal health and welfare reasons, livestock keepers are required to use chemicals whose mechanisms of action on their natural environment are not, or only partially researched and understood. According to the results of a research performed as part of a separate LIFE project, researchers from the HUN-REN Centre for Ecological Research have demonstrated that the improper use of ivermectin-based chemicals used in animal husbandry to kill external and internal parasites releases neurotoxins into the protected and beneficial environment of grassland communities. On January 25, 2025, researchers from two research institutes, veterinarians, herders and farmers had a meeting at Fülöpszállás (Hungary) to discuss the results of this research. During the dialogue, not only scientific results were presented, but also implementation methods and practical advice were discussed. At the same time, no similar studies have

been conducted on countless other chemicals. The way in which certain substances are used properly is not sufficiently publicised. By similar processes, humans are seriously destroying grassland flora and fauna, e.g. the disappearance of dung beetles and other insects, and the loss of certain elements of the food chain. The drying of the landscape has led to an aggressive and, in some places, massive weed encroachment, further reducing grassland diversity.

The biggest problems for biodiversity and grasslands are drying landscapes, poor soil conditions and impoverishment of grassland flora and fauna. This affects the work and livelihoods of the herders and farmers who live and work in these areas. Herders cannot survive without grasslands and their associated biodiversity, but the biodiversity associated with grasslands cannot survive today without herders. At the same time, herders are becoming fewer and fewer, an increasingly marginalised group in the socio-economic-ecological context of our times. (Molnár Zs. et al, 2017)

3.4 Culture-Based Dynamics

The Hungarian herders - and specifically the herders born into the profession - are a distinct social class with a long history, yet they still exist today. In fact, Hungarian society in general has long forgotten the social classes and orders of past centuries. The herders are the only survivors of the old social orders. Consequently, they are trying to integrate into the society of our time in a different way, thinking differently about herding and the socio-economic-ecological environment that surrounds it today. Relatively new concepts, such as conservation, animal medicine, etc., are often incomprehensible to them and in many respects harmful to their work processes and the natural environment. Their practices, developed over centuries, have been radically transformed in recent decades, forcing them to keep livestock in a way that is totally out of step with the rhythms of nature. They are the ones who have the most intimate, up-close knowledge of natural processes in their own area. In many cases, they have accumulated experience over several generations regarding the functioning of the landscape surrounding them, whose dynamics and changes they constantly monitor. They have adapted the characteristics of their livestock to the characteristics of the landscape in their own style, including breeding and consciously shaping the behavior of their livestock. It results from this that every herder has their own grazing style, which the livestock also follows and learns through generations. So there is a common knowledge that is based on the same principles throughout the country, which every herder understands and applies. In addition, they integrate local modifications and minor individual innovations into this knowledge system according to the characteristics of their natural environment and their own needs. It follows that it is not possible to fully compare and evaluate the knowledge of herders everywhere and in all circumstances. They have a personal attachment to the pastures, the wildlife to be found there, and especially to their own animals - in most cases, even to individual animals! They know the behavior, habits, and physical characteristics of each of their animals. There is an internationally universal saying among herders, which is expressed similarly in almost every corner of the world: "herders see the pastures through the mouths of their animals." Therefore, grazing and shaping their natural environment are not based on individual fashions. Everything is subordinated to the needs of their livestock, which in most cases (but not exclusively!) also promotes the preservation of the protected natural values of the landscape. They are part of an innumerable count of interconnections and complex physical and emotional systems, which in today's world are typically not taken into account by society and other stakeholders.

In contrast, conservationists are typically less or not at all informed about the conditions and needs of grazing livestock. However, they do have useful knowledge - even international experience - for the conservation of certain species and the long-term maintenance and biodiversity enhancement of some areas, which herders do not know in such detail. In many cases, grazing livestock are mostly just a tool for nature conservation to keep protected grasslands in good natural condition. The concept of nature conservation does include certain cultural-historical values and cultural landscapes that are explicitly

linked to centuries or millennia of anthropomorphic influences. At the same time, however, it cannot deal with the people and activities responsible for the formation and preservation of these landscapes. Today's nature conservation experts generally have different conceptual systems, expectations, and social backgrounds, making it difficult for them to find common professional and human ground with farmers, and especially with herders, who have a very different identity. (Pásztorok és természetvédők video series, 2018)

In addition, the entry of modern animal husbandry approaches, technologies and knowledge into extensive livestock farming has become inevitable. Of course, protected area regulations provide some barriers to the spread of modern practices, but it is not advisable to exclude them completely. Different stakeholders in different sectors evaluate these methods according to their own perspectives. In many cases, this means exclusivity to one (modern or traditional) methodology and knowledge system. Of course, there are also procedures and individuals that combine the two, which should be the next step in adaptation. In the future, it will be necessary to combine old successful methods with newly proven ones. At the moment, it is largely the task of researchers, to promote and communicate this kind of methods. (2)

The objectives and values in these three respects are very different, currently causing very widespread social and professional problems. Our aim is to encourage stakeholders to work together in the long term to create the hybrid knowledge that will ensure the survival of herding for present and future generations - and thus the conservation and restoration of biodiversity.

3.5 Identity-Based Dynamics

Our case study is about a group that is marginalised in many ways. Within the pastoral community, further marginalisation can be observed. These are mainly related to age and occupational ranking. In our work, we pay particular attention to active herders, young herders and women in pastoralism (1.;2.;3.;4.;7.). Religion, ethnicity, sexual orientation and other factors do not influence the pastoral community from within or without. It is important to note that there are no measures at governmental or policy-making level in Hungary that specifically affect certain groups of herders either favourably or unfavourably in the aspects discussed. Individual cases may occur, but we are not aware of any such cases at the moment. The main problem is the general marginalisation of herders in professional and social terms.

3.6 Political/Institutional Dynamics

In terms of policies, it is a fundamental fact that policy makers are completely unaware of the presence of traditional herding in the country. In addition, pastoralists have no meaningful advocacy and are unable to speak up on behalf of their communities. Accordingly, policy decisions ignore the interests of herders. Where sectoral standards in agriculture and nature conservation are necessarily addressed to livestock keepers by a relevant body, they are typically unaware of the needs, demands and practices of herders. There is currently no political will to resolve such sectoral tensions or to refine regulations. In addition, international regulations and the national regulatory system separately provide an extremely rigid, difficult to change and not at all adaptable environment. The EU and national support system also does not support management in the interests of biodiversity and society, which is particularly critical in the case of declining numbers of herders. In the case of protected areas, the main subsidy is to encourage herders to leave the areas as long and as fully as possible, which in turn leads to biodiversity and economic degradation of the areas. Moreover, state nature conservation nowadays has more of a monitoring and enforcement function than a real professional and community interest, or even a proposal-making role. There is a marked degree of institutional powerlessness, while at the same time there is no coordination of professional objectives and interests, either top-down or bottom-up. Established practices and structures rigidly resist the necessary changes,

preventing the adoption of more effective biodiversity management strategies. Moreover, these strategies and methods do not allow the local adaptation of regulations, subsidies and, consequently, economic practices. (2)

The relevant regulations are formulated at the highest level by the EU. Due to climate change, several of these can be considered completely outdated. In Hungary, decisions affecting nature conservation are primarily made by the Ministry of Agriculture and its various sub-departments during the process of legal harmonization. In addition, the General Directorate of Water Management represents interventions and guiding narratives related to water management. All of these regulations were shaped according to the weather and ecological conditions experienced in the second half of the last century, as well as social demands. Since then, there has been no significant change, even though there is an urgent need for it: the system maintained by outdated regulations is causing increasingly serious and, in many cases, irreversible damage to our remaining natural environment year after year.

A major problem is the drying effect of water management measures over the past two centuries, which are still actively pursued by local regulators and water management professionals. Although there has been talk of reinterpreting the drought situation by the end of 2025 and initial consultations have begun, no substantive interventions can be expected in the near future due to a lack of concrete plans and political will. The problem has now reached such a scale that some areas of the country are experiencing increasingly serious demographic distortions and significant migration. At EU level, the design of agricultural and nature conservation subsidies, which have now become inappropriate, is causing problems. Among the nature conservation regulations, the date-based requirements for grassland management interventions (grazing, cutting, etc.) have clearly become harmful. The ban on certain soil cultivation practices (e.g., trimming, fertilizing grasslands) has led to an inexpressible degree of soil degradation. These are just a few of the many regulatory problems. In Hungary, all regulatory systems for nature conservation and agriculture should be reviewed in the spirit of climate adaptation.

In effect, the conservation-economic-socio-political system that has evolved over the last 150 years has used modern needs and policies to exclude people and activities that maintain biodiversity from the landscape, and then to try to maintain it through new practices and regulatory environments. This has resulted in the massive degradation of our biodiversity.

4. Transformative Biodiversity Innovations

Authors: Zsolt Molnár, Bálint Sándor

4.1 Introduction: How this deliverable was created

A fundamental problem in society is that ordinary people and decision-makers do not take into account or even perceive the potential economic power of local communities in extensive animal husbandry. In fact, due to its technological advancement, society as a whole has distanced itself from various forms of traditional ecological knowledge, considering them outdated and unnecessary. As a result, there is no real demand on the part of society for the transfer and preservation of this knowledge, which would serve the interests of the community and humanity in many ways. The problem is in two respects. On the one hand, the internal characteristics of the pastoral society we have researched have so far made it impossible to effectively pass on or even increase and enrich this knowledge. The self-organization and advocacy of herders is extremely low. On the other hand, apart from traditional externalities (e.g., the appearance of costumes and tools at festivals), society does not feel or understand the need to preserve the traditional ecological knowledge of herders. Efforts have been and are still being made in several areas to halt and reverse this process. (2)

In our work, we must first expand the opportunities available to traditional communities in an ethical way, and we must secure their willingness to participate in order to move forward. It is necessary to develop professional representation of herders' interests in the direction of other economic actors, policymakers, decision-making bodies, and society as a whole. At the same time, we need to approach the processes taking place in society in a completely different way than we do with herders' communities.

The Niche Innovators and Key Players featured in our case study are as follows: Firstly, we can name the researchers and our own research group. We strive to play a mediating role between the stakeholders of the case study with different relationships. The second important group is the international research community. On several occasions, within the framework of the BioTraCes project, Hungarian herders have exchanged ideas with foreign researchers working with herders at personal meetings and international conferences. Since a significant portion of the grasslands grazed by herders are protected areas, members of the nature conservation ranger service managed by the National Park Directorates play an important role in our case study. The most important members are, of course, the herders themselves, with whom our joint work began well before the launch of the BioTraCes project.

The interventions and experiments used in our case study can be divided into two groups in terms of whether they have a direct impact on biodiversity conservation and restoration or whether their positive effects are indirect. In the first case, the goal is to maintain activities aimed at preserving biodiversity, while in the second case, the goal is to preserve the knowledge and practices necessary for biodiversity conservation, i.e., the survival of herders and livestock farmers.

4.2 Analysis of Inclusion/Exclusion Mechanisms

In Hungary, the maintenance and support of grazing livestock would greatly benefit not only ecological and livestock interests, but also food security. Yet a fundamental problem in society is that ordinary people and decision-makers do not take into account or even perceive the potential economic power of local communities in extensive livestock production. In fact, society as a whole has moved away from traditional forms of ecological knowledge as a result of technological advances and considers them outdated and unnecessary. As a consequence, there is no real demand from society for the transfer and maintenance of this knowledge - which in many ways would be in the interest of the community and humanity. Of course, in this case we are not only talking about knowledge, but also about a number of traditional ways of life, of which herding is only one element.

Moreover, herders, due to their unique cultural background, also do not pass on their knowledge to others, or do so with greater difficulty. As the number of herders has been drastically reduced, those entering the profession are increasingly likely to be people who are learning from outside. However, the cultural resistance previously expressed by herders towards them persists, making the transmission of knowledge even more difficult. Inevitably, those who start out in extensive livestock production without a herder to guide them are part of the process. In some cases, these people carry out their activities with experience from other cultural contexts, sometimes from other nations, even with extensive marketing activities. This process poses a huge threat to traditional herding, as their own cultural existence and local practical experience, refined over hundreds of years, are being suppressed. In addition, if their views were taken into account by decision-makers or forums on certain issues, herders would not be the ones who would be heard in biodiversity debates and decision-making processes. (A Pásztorok tudása helyi, de alapelveik globálisak, 2023; IPBES Magyar pásztorok ökológiai tudása)

The problem is twofold. On the one hand, the internal characteristics of herders' societies have so far not allowed for the effective transmission of knowledge, or even for its growth and addition. Herders' self-organisation and advocacy is extremely low. Although there are some small positive examples and results, in general they have almost no influence on the decision-making processes that affect them. Moreover, individual herders have in the past been portrayed by the various media as mere curiosities, preserving the past rather than sharing their professional knowledge and experience. On the other hand, apart from the traditional externalities (e.g. the appearance of costumes and tools at festivals), society does not feel and understand the need to preserve the traditional ecological knowledge of herders. In many cases, even middle managers working in the extensive livestock sector do not have the knowledge to manage and work with animals more efficiently and with less harm to livestock and people. As a result, they have no realistic view of the professional skills of the herders and the potential results of their work. The overall result of the process outlined is that herders, to the extent that they are aware of them, have neither social nor economic appreciation. As technology advances in animal husbandry, the human presence is being minimised, thus contributing to the gradual disappearance of the herding profession and knowledge.

Efforts to halt and reverse this process have been and are being made at various levels. In this case, it is again worth taking a closer look at the internal reactions of herders and the processes taking place in society and economically.

Herders - and here it is worth highlighting some of the herders who were born into the pastoral system - are slowly realising the need to pass on their knowledge. Although it has been an extremely slow process for historical reasons due to cultural difficulties, they have clearly started to learn and practice how to welcome and teach young herders from outside the profession. Their advocacy is not expected to develop from internal impulses for a long time, but the need for change has already been expressed. In this respect, our experience is that women in pastoralism are much more effective self-organisers than men. The Hungarian Women herders' group (3.;7.), which was set up a few years ago, is a testimony to this, following the Spanish example. It is of particular importance for the future advocacy body to be able to represent the whole herding community of the country, all its regions and all its participants from different backgrounds. The series of Forum of Hungarian Herders (2.;4.) launched under the BioTraCes project will greatly contribute to the formation of a common opinion and professional image of the Hungarian herding community. During our field participatory research we also try to facilitate this by building personal contacts between herders, even between distant regions. Based on our results so far, we have reached the next stage: if we researchers are asked to formulate opinions, give presentations or even consult with decision-makers (we are sometimes asked to do so), we inform the herders in advance and hold consultations to gather as many opinions as possible. In addition, we try to bring herders with us personally to each of these occasions, so that they can take part in the discussions, represent their interests and influence the processes around them. Of course, this is also a slow learning process for herders (and for ourselves). As the number and intensity of connections increases,

communication between herders and stakeholders and decision-makers with different interests becomes more frequent. Herders are no longer thinking solely on their own behalf, but have begun to think on the scale of a national herding community. This way of thinking could prove very useful in the future, if they are indeed the first to succeed in setting up their own advocacy organisation. (1.;7.; MÁL articles 2024-2025)

That said, you don't necessarily have to think in terms of a single organisation, a single lobby. Learning from the example of the Women herders' group (3.;7), it is worthwhile to help the emergence of several representative groups, organised by territory, age and other principles, each with different needs and difficulties. It may also be useful to have separate representation for each group, in order to avoid the possibility of repeated marginalisation within the herders' community, which could easily occur for cultural reasons. (Csányi Nikolett: Time of women herders; Adrián Szász – Képmás; Élő Anita - VálaszOnline)

We need to approach the processes in society in a completely different way than we approach pastoral communities. Different issues and realities can be brought to the attention of different stakeholders and social groups with different agendas. At the same time, all stakeholders and decision-makers have one thing in common: as private individuals, they all use social media. Since pastoralism is not explicitly involved in any form of policy formulation or other formal organisational initiatives, it is through social media channels that attention can be directed towards them by providing professionally and humanly relevant content. This is obviously not only possible through trade magazines and professional websites, but even more so through platforms that are frequently used by the public (e.g. YouTube). These are the tools that can be used to inform the wider society and in some cases to encourage a response from professional decision-makers and conservation and other stakeholders working with herders.

It would be inappropriate to establish the involvement of herders in policy-making by requiring them to directly perform tasks in designated organisations. At present, while we are trying to introduce and involve pastoralists in person, we are clearly distracting them from their day-to-day work. There is therefore a need to develop professional representation directly involving the herders, but there is a lack of a hybrid intermediary or organisation that can play its role in a professional and ethical manner in the policy-making sub-processes. Therefore, it is not only the development and adaptation of the herders that is needed, but the development of a team with a new approach and hybrid knowledge may be the most appropriate solution. (4)

If the right policy decisions are taken in the future, it is equally important to educate and retrain professionals from conservation and other organisations. This could include, on the one hand, basic information on herding, so that other stakeholders understand the needs and situation of herders. On the other hand, priority should be given to initiating appropriate communication between all stakeholders and all levels of stakeholders.

Currently, there are conservation rangers working in several National Park Directorates who are willing and able to consult and work together with herders. In some cases, this means that they seek solutions, half-solutions and unofficially authorised options that are beneficial for the work of the herders and for biodiversity, by understanding their tasks and their situation. Unfortunately, in these cases, the situation can easily change due to employer policies or even staff changes in the National Park Directorates. Thus, the park rangers in charge can provide very useful ad hoc assistance to the herders, but in the long term this unstable situation can easily change. In the long term, it is essential to set as a long-term objective not only the restructuring of regulatory and support systems, but also the proper education and information, including training of professionals who come into contact with herders, in higher education on the necessary subjects. (2.;4.)

As there are currently only bottom-up initiatives to involve different voices in policy and initiative support, we have very limited room for manoeuvre in terms of the instruments that can be used. In the future, we need to keep a constant eye on emerging opportunities. At the moment, the most rational experience is that independent researchers and experts are best placed to take up the issues of herding, grassland biodiversity and water management with their own unique solutions. As the public sector cannot be relied on to

provide a stable basis for the foreseeable future, we can make our voice heard more effectively through forums organised by others and ourselves, agricultural exhibitions, media platforms that are relevant to the profession and the subject, or through professional communities with a broad (professional or general) audience.

4.3 Niche Innovators and Key Players

We started working with some of the Niche Innovators and Key Players in our case study years ago, while others have already been brought on board through the BioTraCes project.

First, we can name the researchers and our own research team. Our research group has a kind of social networking asset that makes it easier for us to reach e.g. media coverage, middle and sometimes top management decision-makers, various task forces and persons in nature conservation and other professional bodies, etc. These assets were previously unavailable to the main actors in our case study, for the herders. On the other hand, however, over decades of working together, a working relationship - and in many cases a friendly relationship - has developed with the majority of herders, which has gradually made it possible to map their society and their situation, to bring their opinions together and to channel them towards the achievement of objectives. At the same time, it is of key importance to us that we do not want to publish opinions/evidence based on scientific results ourselves. Partnership with herders, according to cultural and other ethical and scientific norms, requires that we are fully equal partners in the process of setting goals and finding ways and methods to achieve them. In fact, our research team is trying to play a mediating role in several contexts. Internally, first of all, by reconciling and translating cultural differences between herders, by refining attitudes that are a source of difficulty, we are slowly succeeding in building a national network of friendships and professional relationships between herders and communities that can work together more and more effectively. By integrating them as an external element into herding society in a unique way, we can also suggest to them ways of thinking about and applying methods, both theoretical and practical, which they are then willing not only to consider but, if our suggestions and ideas are correct, to apply and disseminate among themselves. At this point, we can say that the herders generally acknowledge the involvement of our research team in their cause. In fact, it is more than that. Beyond acknowledgement, they are looking directly for opportunities to ask us for help or for what they believe they can help us with. Our achievements and results are beginning to strengthen the identity, voice and will of the community, as well as their sense of the practical importance of their profession. It also, in some cases, provides herders with opportunities (socially or personally) that they would find unimaginable without working with us. The practices that we propose and embrace are seen by both herders and researchers as having the potential to make a significant positive difference to improving the biodiversity status of grasslands. We ourselves seek to complement, rather than supplant, the traditional ecological knowledge of herders with the useful social, economic and professional practices of the present day, which are slowly being not only adopted but increasingly demanded by herders. We also seek to play a mediating role between different stakeholders and decision-makers in the implementation of biodiversity restoration measures. By synthesising the widely consulted expert opinions of herders (and other stakeholders), we aim to come up with proposals that are appropriate to the current context and system, for the benefit of herders, on practical and regulatory issues, both locally and nationally. Knowledge-sharing initiatives are multi-disciplinary in nature and target groups, but our work has also led to the development of reliable channels of communication within and between stakeholder groups.

The second important group of Niche Innovators and Key Players is the international research community. On several occasions, the BioTraCes project has held face-to-face meetings and international conferences where Hungarian herders have exchanged ideas with foreign researchers working with herders. This process is very positive, as Hungarian herders can learn about foreign practices and international examples in a safe environment. The ideas gathered in this way are adapted by the herders to their own

circumstances and are used in all areas of pastoralism. Natural-ecological conditions have shaped different methods of herding even within Hungary, not to mention the diversity of other countries in Europe. For this reason, practical examples from abroad, for cultural or practical reasons, or because of differences in the herding conditions, often provide Hungarian herders with more theoretical guidance. What they can use more effectively are issues related to the social and economic environment, regulations and support (e.g. building advocacy, social engagement, knowledge transfer/education, land relations, market opportunities and conditions, employer and employee conditions, etc.). In addition, building international relations has several messages for Hungarian herders: a confirmation that not only in Hungary there is still pastoralism, but that there are still herders living and working in almost every part of the world whose work and knowledge is needed by humanity. Pastoralism in many countries has already started long before to exchange experiences and best practices at international level, from which both useful knowledge and strength can be drawn. In addition, for the first time in the history of Hungarian pastoralism, we have reached the point where herders themselves are beginning to develop medium and long-term relationships in international arenas. Through these contacts, they can meet not only researchers, but also herders of other nationalities during personal visits abroad, with whom they can sometimes exchange theoretical and field knowledge. (1) The participation of herders in international conferences, both at home and abroad - which we coordinate - is a powerful support to this process. Here too, of course, particular attention must be paid to research ethics! On our part, we need to be careful about the situation we create for the participants to meet, and we are the assurance to the Hungarian herders that we are seeking to establish meaningful professional relationships for them. When engaging foreign researchers, we also apply the principle that we seek to involve colleagues with due caution and ethics in our joint work. In the longer term, joint work with foreign researchers and herders could even lead to the possibility of adapting international regulations and support schemes in the future.

Since a very large part of the grasslands grazed by herders are protected areas, members of the conservation rangers managed by the National Park Directorates have an important role to play in our case study. We are working with a number of conservation rangers who see and understand the practical benefits of pastoral grazing for biodiversity. Unfortunately, this is not a common perception among public conservationists, so the number of conservation rangers who seek to work with herders is not high. In addition, there is a general mentality in public conservation that conservation regulations are to be respected at all costs, even at the expense of nature. For a long time, there were serious conflicts between conservationists and herders. Today, there are dedicated professionals who are on good terms with herders and are flexible enough to help them to thrive in the area of conservation regulations and their practical implementation. As these relations have long been hostile, building trust between the parties is key to the future of herders and biodiversity. The conservationists who attend our meetings and successfully engage with stakeholders have a great influence on herders. Having experienced positive examples, they often maintain professional contacts and are themselves more courageous in taking initiatives towards the conservation rangers in their area. The number of rangers who have successfully communicated is not yet high, but their constructive example is extremely helpful. Thanks to them, many common conservation interests can be pursued in the field work of the herders. After receiving correct and professional information, herders typically seek solutions that benefit both conservationists and their environment. This not only results in successful conservation management. Herders, who in many cases have a tenancy in a protected national park area, are also in a more secure position, as national park authorities can treat them as partners in the long term, in the hope of continued successful cooperation. On the other hand, herders, in their own interest, are increasingly open to coordinating their own knowledge and methods with conservationists, who can better understand the needs of herders and the necessity of their activities. The conservationists in question must exercise the utmost discretion towards herders and livestock farmers, of course, otherwise this nascent but fragile relationship could easily be destroyed. However, the contribution and involvement of the trusted rangers is fully recognised and supported by the herders. There are opportunities for us to successfully

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develop this relationship further. The Forum of Hungarian Herders (2.;4.) we organise and other meetings we attend provide excellent opportunities for this. (Közös tudásalkotás természetvédő, botanikus és pásztor között. Gondolatok egy tátorjános és más, természetvédelmileg értékes felhagyott gyepterületek pásztoroló legeltetéssel történő kezeléséről és hasznosításáról egy mozaikos kultúrtájban – video; Pásztorok és természetvédők video series, 2018; Pásztorok és villanypásztor – video series)

The main Niche Innovators and Key Players are of course the herders themselves. Our work with herders started long before the BioTraCes project was launched. This gave us the advantage of being able to think beyond the four-year project. The involvement of the herders was very slow and step-like. Getting to know and working with each herder was done individually. In the process of developing good professional and not infrequently friendly relationships, we were often directed to other herder friends. In this way, we were able to get to know their communities and their people in a significant coverage. Although we initially sought to involve them in certain roles, this has now become a reciprocal back and forth in many cases. In effect, the herders involved us in their world in a similar way.

Working with us, they have made significant progress in a number of areas. This applies to the individuals and communities involved. The most important of these is the recognition that Hungarian herders face entirely new challenges and that the survival of their profession depends on their own adaptation. The process, though slow, has reached a tipping point. Even among those herders who were born into the profession, more and more of them believe that their knowledge should not be kept as a secret, but must be passed on to interested young people. Although the issue of replacement raises very serious concerns, pastoralism has one major advantage over other agricultural sectors: it is the easiest to adapt to changing natural conditions. However, they have reached a stage where it is not only possible, but in some cases even advisable, to incorporate into traditional methods elements of new technologies, breeds and practices that they can benefit from. (2.;4.;5.) Our community-building activities also help herders who have come to identify problems to effectively share their opinions and experiences with other members of the community. Herding communities in landscapes with different characteristics, and other communities based on age, gender, animal breeds and technologies, are also undergoing increased transformation and development. This is partly because some of these groups did not exist a few years ago. Examples include the Women herders group, active herders participating in the Forum of Hungarian Herders (2.;4.), the emerging Young Pastoralists group, etc. The engagement of particular herders and communities is handled differently by different stakeholders and interest groups. As there is as yet no officially registered representative body, their views are typically received with mixed perceptions by the profession. In many cases, the civil sector is almost enthusiastic about the herders' manifestations, but at the same time they are not able to deal with them from a livelihood perspective. In most cases they are seen as traditionalists, not as agricultural actors with potential. In terms of the use and consumption of the food and raw materials of animal origin produced by herders, the civil sector could support them with its purchasing power, but the achievements of our modern world have in many cases driven them out of the market for economic or cultural reasons. (MÁL articles 2024-2025)

The results of the work between herders and researchers are difficult to present in that the most noticeable changes are taking place in the development of the herders' personalities and professional skills. We are increasingly successful in opening up the herders' society to the world. They are discovering and developing new social interactions, economic methods, and networks that would have been unimaginable 10-15 years ago given their cultural and social background. In fact, the basic conditions have been created for the potentially emerging new generation of the pastoral society to take advantage of the benefits offered by science, technology, and society more freely. What is more, the currently active generations of herders are also contributing to this process, are learning themselves and, in some cases, trying to pass on their knowledge to young people.

4.4 Scalable Bottom-Up Innovations for Transformative Change

Extensive livestock farming in Hungary is being significantly reduced by intensive technologies and breeds, which often require less labour and in some respects less expertise. Moreover, even in this sector there are already problems with a lack of reliable labour. A further negative factor is that intensive farming methods have become an unsustainable form of farming for mankind in the long term, under today's drastically extreme and changing ecological conditions, with enormous environmental pressures and ecological damage. At the same time, animal products can be fully produced by extensive grazing livestock farming, which would be extremely beneficial to our natural environment and biodiversity. But this requires special knowledge and special people: herders. Today's modern society is unaware of the value that herders can produce meat, milk, dairy products and other goods from grasses that cannot be eaten by humans. In addition to changes in the natural environment, herders are increasingly influenced by various local and international regulations in the fields of nature conservation, agriculture, animal welfare, animal husbandry, commercial activities, etc. In addition, they are marginalised by society in many ways. Policies do not take into account the real needs of the sector and pastoralism in particular is not taken into account.

In our country, there are more than half a million hectares of grassland that require traditional pastoral grazing to survive. In many cases, these are protected grasslands of high natural value, with outstanding biodiversity value also. The preservation of these areas is in the common interest of humanity. According to experts in all aspects of conservation and ecology, extensive grazing by Hungarian herders is now essential for maintaining grassland ecosystems and biodiversity. Through grazing, treading and dunging, livestock influence the vegetation and micro-cover of grasslands and, through this, their rich fauna and natural processes. The grazing of extensively grazed livestock requires appropriate temporal (year, month, day, period of the day) and territorial distribution and planning, depending on the weather, according to what the herders believe is needed to maintain healthy grasslands. Maintaining a healthy grassland - and thus biodiversity - is an elementary goal for herders, as it enables them to sustain and increase the livestock that provide their livelihoods. This is why the saying is common among herders around the world: "the herder sees the pasture through the mouth of the livestock". Accordingly, herders have been fighting for centuries to ensure the survival and health of grasslands and thus biodiversity. (Traditional herding for the future: transforming understandings and policies – video)

The innovations that have been or are being launched from the bottom up for biodiversity include:

Herder schools: International relations and the organisation of the International Year of Grasslands and Pastoralists in 2026, it was discovered that many countries across Europe have herding schools with a long history. Spanish and French schools are the most numerous, but there are also schools, seminars and small courses in Italy and other countries. Many aspects of this are of interest to us, as saving the knowledge of Hungarian herders and setting a new generation on a successful career path is an increasingly urgent key issue for the future of pastoralism. Our long-term plans include the establishment of a herder school in Hungary. Although this will most likely be beyond the timeframe of the BioTraCes project, we can lay the foundations within this framework.

In Hungary, pastoralism is dwindling partly because of the cultural and professional isolation of its own society. On the other hand, young people are unaware of the profession and the opportunities it offers and are not aware of its conditions and do not see it as a realistic livelihood. Although there were courses in sheep farming and extensive livestock farming and breeding in the second half of the last century, these had disappeared by the turn of the millennium. In our opinion, even if a herding school were to be set up in Hungary at this time, the expected number of students and the employment rate of graduates in the profession are highly doubtful. Therefore, we need to look not only at the theoretical and practical knowledge system of the schools and the way in which it is transmitted, but also at the background to the establishment and maintenance of the schools and their

social and professional environment. In this context, theoretical research and information collection have been and are being carried out. Furthermore, we are organising personal contacts so that Hungarian herders and hopefully later on the maintainers and teachers of the Hungarian herder school can meet and exchange experiences with the expatriates first hand.

This innovation cannot be considered traditional, because the traditional herder society has always had strong reservations about people entering the profession from outside over the centuries. Moreover, at no time in our history has there been such a shortage that separate institutions are needed to replace the livestock breeders and herders. By supporting the creation of an institution, herders are therefore initiating innovation within their own society. No significant external support for these purposes has been received so far, but some proposals have been put forward to some policy actors and to the heads of some agricultural training institutions. A realistic plan can be drawn up if we plan to carry out a personal visit to the Spanish herder schools. We must pay particular attention to the following issues:

- Why does Spanish society consider it necessary to maintain these schools? Was there a social need in the first place, or did it have to be created? If so, how was it achieved?
- What were the social, economic and environmental processes that led to the creation of these schools?
- Who founded and maintains the schools and from what resources?
- What is needed to run the schools (space, technologies, materials, resources, livestock for practical education, etc.)?
- Who, how and what is taught?
- What are the key aspects that society recognises as necessary and successful for schools to operate?

The establishment of a herders' school in Hungary would in many ways help the long-term cause of conservation and restoration of herders and biodiversity. On the one hand, the establishment and maintenance of the institution and the creation of employment conditions will involve both governmental and professional executive bodies, which in turn will make the presence of herders a clear signal and a fact for society and decision-makers. Accordingly, the advocacy of herders and the recognition and informed use of their traditional ecological knowledge in biodiversity restoration work may become increasingly important in policy-making. (4)

Knowledge library/archive: within the framework of the BIOTraCes project, an extensive collection of traditional ecological knowledge of Hungarian herders and the physical and intellectual background of working with pastoral livestock, as well as their innovations, has been launched. The knowledge is being recorded through video, photographs and audio recordings. In addition, we try to experience them in their physical reality, as this is how the knowledge and procedures needed to work with livestock can be truly understood. Of course the herders themselves prefer to share their knowledge with others who are willing to actively help them in their work. The material collected and to be collected is extremely varied. On the one hand, the tasks to be carried out around the livestock, and on the other hand, we collect and record information about the herders themselves. The material is handled in several ways. Some materials have already been published - for example on the Wall of Hungarian Herders in the Herders' Museum on Hortobágy. Other material, however, contains information that is sensitive from a personal, regulatory or other point of view (animal health regulations, conservation and agriculture, animal husbandry regulations, animal welfare, personal information, etc.) that would be unethical and inappropriate to share from the herders' point of view. Making much of this material public would have serious negative consequences for the individual herders and their farms. The simple reason for this is that our current society's perception and regulatory system, which is extremely detached from nature and elements of traditional agriculture, does not know why particular traditional practices are necessary and beneficial

to animals, humans and ecosystems alike. In some cases, sharing of materials is not even recommended among herders for cultural reasons. Therefore, we are still looking for appropriate solutions for the use of sensitive materials in the future. What is certain is that, although the society and the regulatory environment of our time do not explicitly seek to preserve or support the survival of traditional pastoral knowledge - in some cases, they actually discourage it - we are working for the future. Changes in the regulatory environment and the anticipated future pressures of ecological change could easily create an increased demand for herders' knowledge. So, in fact, whatever happens to the herders who are still actively working today, we will always have at our disposal the extensive material collected on the traditional ecological knowledge of Hungarian herders and the practical use of modern developments and combinations of traditional elements. (4)

Advocacy, community groups: our case study is about a group that is marginalised in many ways. Within the Hungarian herders' community nationally, there have been small traditional communities since time immemorial and within them further marginalisation can be observed. These are mainly related to age and occupational ranking. In our work, particular attention is paid to active herders, young herders and women in pastoralism. Their representation is not expected to take place for a long time because of internal motivation, but the need for change has already been expressed. In this respect, our finding is that women herders are much more effective self-organisers than men. The Women herders group in Hungary, which was set up a few years ago, is a testimony to this, following the Spanish example. It is of particular importance for the future representative body to be able to represent the whole pastoral community of the country, all its regions and all its participants from different backgrounds. The series of the Forum of Hungarian Herders (2.;4.) launched under the BioTraCes project will greatly contribute to the formation of a common opinion and professional image of the Hungarian herding community. During our field participatory research we also try to facilitate this by building personal contacts between herders, even between distant regions. Learning from the example of the Women herders group, it is worthwhile to help the emergence of several groupings, organised by territory, age and other principles, each with different needs and difficulties. It may also be useful to have separate representation for each group, in order to avoid the possibility of repeated marginalisation within the herders' community, which could easily occur for cultural reasons. The socio-economic-political background and process of setting up interest representation bodies should also be observed from existing practices abroad, mainly in Spain and France. (4)

4.5 Initial Mapping of Interventions

On the one hand, our methods - which differ from the usual policies - are extremely limited, and on the other hand, they typically do not affect any central regulations but rather help to resolve local problems or minor infrastructure and communication errors or barriers through bottom-up initiatives. In order to halt the decline in biodiversity, we must help preserve both the herders themselves and their traditional ecological knowledge. At the same time, we cannot rely entirely on practices that have proven successful in previous decades and centuries, as our rapidly changing ecological, natural, and human environment requires completely different methods and survival strategies. That is why we must consider the innovation of traditional ecological knowledge and its coordination with other scientific disciplines as a goal.

The interventions and experiments used in our case study can be divided into two groups in terms of their direct impact on biodiversity conservation and restoration (e.g., recording the traditional ecological knowledge and methods of herders and transferring this knowledge directly influences the results of land management), or have indirect positive effects (e.g., changes in the regulatory environment, social processes and attitudes, and economic and employment conditions make it easier for the pastoralist community to manage and survive). The two options differ in that one focuses on maintaining activities aimed at preserving biodiversity, while the other focuses on the survival of those who

possess the knowledge and practices necessary for biodiversity conservation, i.e., herders and livestock farmers.

A fundamental principle in the implementation of our case study is that we must make significant use of the traditional ecological knowledge of local communities when developing the local regulatory environment. At present, this is not being implemented at any level or in any area in the agriculture and nature conservation sectors or in physical work. This is a highly unconventional approach, which even the research community must learn through joint work with herders and other local stakeholder communities. The resulting knowledge, communication opportunities, and practical solutions can greatly contribute to positively influencing the biodiversity of the areas managed and affected by herders in our case study. At the same time, the prospects for regulatory changes in the near future are not at all positive. The slow bureaucratic system is unable to respond to the needs and demands arising from ecological and climatic changes. Therefore, we must apply methods that enable us to create knowledge, record it, and maintain it among stakeholders in its functional (physical and intellectual) environment, and develop innovative methods together with stakeholders and other social partners. This leads to another extremely important method used in our case study, which differs significantly from general practices: strengthening local communities by stimulating their internal self-organization through external interventions. We are trying to initiate a self-generating process in which external interventions (such as our empowering activities, community and network building), the personal knowledge expansion and involvement of stakeholders (primarily herders) in issues and processes that affect them will create the need and opportunity for local herders and their families with traditional ecological knowledge to form a national advocacy group and express their professional opinions on social and economic issues that strongly affect them, as well as on the regulatory environment for nature conservation. At the same time, within the current political and infrastructural system, community expression does not represent a real and authoritative means of influencing processes. Accordingly, our goal is to create community group(s) that are uniquely built from the bottom up and can be integrated in some form into the political and economic infrastructure. We believe that this will ensure the development of restraining effects and supportive practices that take biodiversity interests into account. (2.;4.)

When it comes to evaluating methods and results, our task is difficult because our work within the BioTraCes project is only part of our temporal and geographical activities. Our research group began working with herders long before the project started. Establishing effective communication with them, the cultural environment, and the nationwide coverage of our tasks impose temporal and spatial constraints on our work that make it impossible to achieve our goals within a four-year project. In addition, the drastically and extremely rapidly changing conditions in agriculture – and especially in animal husbandry – require us to constantly rethink and innovate. We must constantly review not only the main topic of our case study, but also innovations and opportunities related to our own work processes and methods. Therefore, in many areas of our case study, we cannot report on long-term successes, as unpredictable elements and factors can arise at any time during our work. A good example of this is the emergence of the foot-and-mouth disease virus in the spring of 2025 after 50 years, which fortunately has since been contained in the country. (MÁL articles, 2024-2025)

The methods listed earlier can be considered groundbreaking solutions in every respect, as previously no one in the research community, decision-making circles, or economic environment had represented Hungarian herding on a scientific and economic basis, nor had there been any realistic attempts to do so. (In a cultural sense, numerous efforts have already been made in this regard, but despite their significant value preservation work and other achievements, these attempts have largely contributed to the current outdated and traditionalist view of herding, and subsequently to a sharp decline in its financial and professional standing.) Since our methodology had never been used to approach herders before, we are witnessing a slow but completely unique process – one that naturally comes with enormous professional and ethical responsibility. Traditional research approaches and previous common practices have therefore been completely replaced or transformed in our

work. Obviously, our own research methods were the first to be renewed. Subsequently, with the change in the environment and attitude of stakeholders, the development of common methods and goals could begin, which over time also included numerous social, cultural, scientific, and economic practical innovations. So our most notable achievement is that the Hungarian pastoral community we researched entered into partnership with the research community we represent in various theoretical and practical ways. We are currently working on spreading this as widely as possible, not only in the broadest possible research environment, but also with the aim of further developing and extending the partnership to economic and decision-making actors. At the same time, this is an extremely slow and complex social and cultural process, which left to its own devices would halt the spread of partnerships. Therefore, in order to preserve and restore biodiversity, in some respects it is not the development of scientific results that we consider to be effective, but rather the initiation and implementation of social processes. These processes are expected to play a positive role in maintaining biodiversity in the future, but none of our activities can be considered an exclusive solution. Assessing ecological processes and exploring possible interventions is equally important as identifying the effects of social processes.

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4.6 Discussion

In the Hungarian case study, we strive to ensure the continuity of traditional ecological knowledge, which is essential for the preservation of biodiversity, to help adapt traditional ecological knowledge to innovative solutions, and to contribute to the adaptation of social groups that possess, maintain, and practice traditional ecological knowledge (Hungarian herders and livestock farmers) to today's challenges. In fact, we have previously described the adaptation process that pastoralism has undergone over hundreds or even thousands of years, but today it has become much more difficult in the drastically changing ecological and human environment of the last 150 years, in all its aspects. The next step in the evolution of Hungarian pastoralism can be interpreted both as a struggle for the survival of their own society and knowledge, and as a struggle to save our natural environment and biodiversity.

As a result of this approach, traditional knowledge and innovative practices are constantly being collected, which will be essential for the survival of Hungarian herding and the maintenance of pastures and livestock. At the same time, the practical reinterpretation and real use of this knowledge will not be realized in the present, but in the future. As the world of herders is shrinking in many ways (declining and degrading pastures; declining number of livestock; declining number of herders; cultural loss/cultural transformation; negative changes in employment and occupational-economic conditions), the maintenance of the current form of herding cannot be guaranteed. It is conceivable that, as in many other countries around the world, a shock effect will be needed in human society (and especially in Hungary!) for the role of pastoralism in food production and ecological processes to be highly valued. We have seen similar examples internationally for many years, in global scale. Hungarian pastoralism is an extremely important element of the culture of the Carpathian Basin. Although our goal is to continuously maintain the pastoral society, the social behavior that has developed over many centuries has unfortunately threatened the long-term survival of their communities in the 21st century. Considering the laws of evolution, it cannot be foreseen that the centuries-old cultural and social system of Hungarian pastoralism will disappear completely, or not. In this regard, our own research work must focus on preserving values and collecting the widest possible range of traditional ecological knowledge, data and technological skills. This will provide the basis for a partial re-learning of the science of herding in the future. Herders – and here it is worth highlighting certain herders who were born into the profession – are slowly recognizing the need to pass on their knowledge. Although this is a very slow process due to historical reasons and cultural difficulties, they have clearly begun to learn and practice accepting and teaching young herders who come from outside the profession. It is unlikely

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that they will develop their own advocacy group for a long time to come, but they have already expressed a desire for change.

Society, or parts of it, are capable of responding appropriately or inappropriately to ecological problems. However, we cannot leave these responses to random decision-making. Accordingly, comprehensive knowledge transfer and communication between sectors and social groups is necessary, from which innovative solutions can emerge. In practice, we cannot expect results based on the experiences and practices of the last century when it comes to preserving biodiversity. According to our scientific understanding, we have never occurred conditions of nowadays in the Carpathian Basin since human memory began. We must respond to environmental changes that we have never had to adapt to before. Accordingly, current and future practices affecting biological diversity and ecological processes must rely on a variety of methodologies: the traditional ecological knowledge of local communities, the experiences of other countries in similar circumstances and processes the international scientific solutions, and completely new innovations—and the most effective combinations of these all. Of course, the question for the future will be how this new knowledge and methodology will affect the cultural and social conditions of traditional communities, and what unexpected events may occur in terms of society and the ecological background.

In Hungary, extensive animal husbandry is being significantly reduced by intensive technologies and breeds, which often require less labor and, in some respects, less expertise. In addition, problems are already emerging in this sector due to a lack of reliable labor. Another negative aspect is that intensive livestock farming has become a form of agriculture that is unsustainable in the long term for humanity in today's drastically extreme and changing ecological conditions, causing enormous environmental stress and ecological damage. At the same time, animal products can be produced entirely through extensive grazing, which would be extremely beneficial for our natural environment and biodiversity. However, this requires special knowledge and special people. The special knowledge also requires new and special methods. This is, why we are trying to launch innovations from the bottom up in the interest of biodiversity: a school for herders in Hungary, the knowledge library about the traditional ecological knowledge of herders, and the advocacy of hungarian herders for the first time.

We must accept as a fundamental fact that the current structure of Hungary's political, regulatory, and economic infrastructure does not allow for anything other than bottom-up initiatives, and even then, many forms of such initiatives are made impossible by various interests. Therefore, we can only choose research and intervention methods that are fully understood and supported by local communities and are also useful for the entire pastoral community of the country. In this way, the pastoral community, which otherwise holds many different views, will be able to present a unified professional stance on certain issues within the policy and institutional frameworks. Although their voice does not yet carry much weight in the decision-making and regulatory environment, they can be expected to gradually become involved in lower and middle-level consultation processes. However, none of this can happen without research partnerships. At the same time, research results are less likely to be implemented in agriculture, so herders and researchers working with herders are trying to jointly enter the policy gap they are trying to create for themselves. If these efforts are successful, herders and their supporters will have a greater opportunity to influence processes that strongly serve the interests of biodiversity as well as their livelihoods.

5. Social-ecological system analysis

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5.1 SES dynamics, interactions, and relations

The most serious problem facing the national and international agricultural and nature conservation environment is that there is a desire to separate and treat differently the landscape and the people who live and work in it, and especially those who maintain it. However, with the gradual elimination of activities that maintain the landscape, the values and characteristics that need to be protected and preserved are disappearing at an increasingly rapid speed. In our case study, although most herders and farmers are unfamiliar with and do not refer to the concept of the SES system, they nevertheless seek solutions and formulate demands within this theoretical system.

In Hungary, decision-making has been moving away from the SES over the last two hundred years, and this trend is continuing under the current agricultural and nature conservation decision-making activities. In fact, they maintain a system based exclusively on financial and economic indicators, which does not even attempt to interpret the system created by the combination of landscape and people. This problem has several components: the flaws of international regulatory and support systems; corruption, bureaucracy, and cosmetic arrangements; and a complete lack of interest and, in many cases, incompetence. The basic principles of SES are best understood by those working at lower levels in nature conservation and agriculture on the one hand, and by local communities on the other; for natural reasons, they are the most sensitive audience in practice.

The direct drivers of biodiversity loss in the case study can be classified into several types. First, we could consider natural processes, but given the history of the Carpathian Basin, we cannot speak of natural processes in the past. The current situation has been shaped most significantly by almost a thousand years of extremely significant and, to this day, increasingly intense human landscape formation. In the case of the SES, the ideal vision for the future is to keep the landscape alive. If the landscape is not alive, it is impossible to live with it, nor is it possible to use its resources in a balanced way. So, we must start from the basic needs of the landscape: in terms of the regulatory background, water management and soil restoration are the first and most important issues! Once activities to restore the functioning of the landscape have been stepped up, the next step is to help the people who currently live in the landscape to acquire the traditional ecological knowledge and practices that do not fundamentally interfere with the functioning of the landscape yet provide resources and livelihoods for those who live there. We are attempting to collect a segment of this knowledge, the ecological and livestock-related knowledge of traditional herders and the innovative solutions based on this knowledge, within the framework of our case study, and then prepare it for later social use.

SES impact on different actor groups

In general, in European cultures - but also specifically in Hungarian regulatory and support practices - there is a general societal perception of the need to separate the functioning of nature from the human environment and its impacts. This situation, however, is almost incomprehensible in our time. A social-ecological approach does not currently exist in Hungary, but rather only through the work and research of a few individuals is attempting to draw attention to the role and importance of this way of thinking and value system. The most serious problem of the Hungarian and international agricultural and nature conservation environment is that they want to separate the landscape from the people who live, work and specifically maintain it. To take a concrete example, they want to maintain Hungary's protected grasslands of natural value - which are also cultivated landscapes - by making it impossible and excluding the human landscape-forming and landscape-maintaining activities that have been present there for hundreds of years, for example by severely restricting grazing. It is precisely the values and features that need to be

protected and maintained that are disappearing at an increasingly drastic rate as the activities that sustain the landscape are gradually being eliminated. In our case study, herders and some farmers, although mostly unaware of and not naming the concept of the SES system, are looking for solutions and formulating demands within this theoretical system. Some conservation professionals have encountered the concept itself and even understand and perceive its importance. Yet the implementation of the regulatory environment obliges them to do the exact opposite in the practice of their work. In most cases, the infrastructure and staff involved in decision making and implementation have little or no theoretical knowledge or understanding of its importance. Thus, in fact, there is no comprehensive link between SES and the participants in our case study, or in Hungarian society in general.

Decision-making processes and power relations between relevant actor groups

Several of the social and ecological actors identified in D2.5 (contextualization chapter 3) have decision-making power over the state of SES in our case study. As discussed earlier, we can distinguish several distinct segments in terms of the regulatory environment:

In Hungary, the Ministry of Agriculture is responsible for enforcing general international standards for agriculture and animal husbandry and for establishing and maintaining harmonization of national legislation. Although the activities of the Ministry of Agriculture do not cover the principles of the SES at all, its infrastructure is the most authoritative in matters concerning agriculture and nature protection. At the same time, there has been an extremely flawed decision-making process over the last two hundred years, which has tended to move away from the SES, and which has continued at an accelerated pace under the current Ministry of Agriculture. In fact, they maintain a system that thinks solely in terms of financial and economic indicators, which does not even intend to interpret the system of landscape and people. This problem is made up of several parts: failures in the international regulatory and support systems; corruption, bureaucracy and spectacular measures; a total lack of interest and, in many cases, incompetence.

The same can be said of national and EU nature conservation legislation. The regulatory and maintenance environment for nature conservation also falls under the Ministry of Agriculture. Within this institution, the Department of National Parks and Landscape Protection is responsible for the harmonization of nature conservation legislation. However, there is also a very strong dominance of agricultural approaches and interests in nature conservation issues and practices. The National Park Directorates are merely the managers of public assets (nature reserves and the movable and immovable property and livestock needed to carry out their functions), playing an executive role in the system. Thus, there is no substantive intermediate infrastructure formally able and capable of driving the practical implementation of the system towards SES principles. Although there are conservation rangers and other persons in the National Parks system who are very close to the SES approach, their powers of intervention are unfortunately very limited. As a result, they can only assist in the practical implementation of the SES principles in a semi-official or other way. This behavior can sometimes even threaten their jobs and positions, so relatively few of them resort to such methods.

Animal health and welfare organizations play a decision-making role in our case study. They only overlap with the SES principles to a very limited extent. Animal health standards are also closely linked to agricultural standards. On the other hand, the environmental impact of many of the active substances tested and successfully used in animal care, which are compulsory and used in animal health, is unknown or only partially known. In this respect, there is a serious lack of theoretical and practical information at the level of decision-makers, manufacturers and users. Accordingly, optimal implementation into legislation is typically lagging. Thus, even if one wants to implement SES principles in the field of animal health, one is unable to take the appropriate action in the absence of information. The former is based on the research evidence that only a few of the widely used products for the mandatory treatment of livestock against external and internal parasites have been tested in any meaningful way. However, they have been found to have

serious detrimental effects on insect fauna and, in turn, on grassland ecosystems when used inappropriately. In addition, only a minority of farmers are aware of this impact, while the regulations do not take it into account (there are no information or mandatory conditions of use to prevent negative effects).

The various breeders' organizations, which may set standards for indigenous and other livestock breeds in our country, may also play a decision-making role for herders. The scope of the activities of these organizations is, however, not linked to the SES principles, but only a very broad interpretation of them would allow some common ground to be found. They therefore have no role in this matter.

Types of knowledge informing decision-making and biodiversity framing

We have written about government involvement before. At present, biodiversity is not given any consideration, and in many cases is being deliberately and consciously destroyed. There is a growing number of cases where the public is trying to use its limited means to take action against damage to nature and the environment. This is not only a case of uncontrolled and excessive use/exploitation of natural and environmental resources and the suppression of basic citizens' rights, needs and interests. Such government actions and decisions lack any realistic professionalism and any justification compatible with the public interest. Unfortunately, over the last decade, corruption has become more frequent and more serious in matters that have a very serious impact on nature conservation and biodiversity. So unfortunately, we must count almost exclusively negative effects on governance processes. In this respect, it makes no difference what type of knowledge is relied upon in decision-making. Among the main actors in our case study, herders naturally represent local and traditional knowledge, as well as innovations partly based on traditional knowledge. Conservationists and researchers already rely heavily on science-based knowledge. At the same time, our own research team necessarily relies strongly on local traditional ecological knowledge in addition to scientific knowledge.

SES in general is of very little importance in Hungarian society; there is not much awareness of it. It should be added that there is a growing demand in society for SES principles and methods, but at the same time the country is facing much more serious political-socio-economic problems than it is able to address (or even be able to disseminate emerging needs and methods). It is a contradiction that the ecological problems caused and aggravated by inadequate policies are not being addressed in a way that society has the time and the means to address them properly, but that economic solutions are also being sought to address them. Of course, these methods delay and exacerbate the situation of ecosystems (including people).

The principles of SES are best understood by those working at lower levels in conservation and agriculture on the one hand, and by local communities, on the other, who are the most receptive audience in practice. This naturally follows from the fact that the living space, housing and work of these people are directly and strongly linked to, or even dependent on, socio-ecological-economic processes. This includes herders. It should be added, however, that they do not formulate the principles of SES consciously and precisely, but rather experience the necessary positive and negative processes, associated with it. The relationship of conservationists to the same issue is different, as they can often experience the same issues on a scientific basis, but also as members of a local community. However, experiencing the real-life situation in today's bureaucratic and regulated environment is not easy for any of them, as change would require conscious energy and financial investment from the lowest individual level to the top national levels, with more sacrifice for the long-term interests and benefits of communities and all citizens of the country. At the same time, it is a well-known process that people are typically unwilling to give up their comfort and are only forced to do so by necessity. So, the very timely and necessary solutions that the SES embraces are coming. The theories contained in SES are only secondarily followed by that part of society which is not directly connected (through housing, work, etc.) to the natural environment, the landscape and the communities living in it, but which nevertheless considers the problem important through media and

influencers or other influencing communications. Unfortunately, this section of human society follows the principles of SES mostly in theory but does not make serious commitments or even abandonments to achieve them.

Ecological functioning of the SES and direct drivers of biodiversity loss

The direct drivers of biodiversity loss in the case study can be of several types. First of all, we could think of natural processes, but given the history of the Carpathian Basin, we are talking about processes that have not been natural for a long time. The present situation has been shaped most significantly by almost a thousand years of very significant human landscape formation, which has been increasing until today.

The systematic regulation of rivers and drainage, starting in the mid-1800s, has now dried up the landscape to the point where there is hardly any water reserves left. Although there are scientifically and socially based proposals to properly manage the remaining water and reverse the process, no meaningful policy or decision is taken beyond the spectacular. Thus, the desertification of the country is taking place directly and immediately, and despite social pressure, neither the government nor the institutions responsible for water management are doing anything to counter it. As a result of the drought, the possibilities for agricultural production are becoming increasingly unpredictable and the weather more extreme. While it is possible to talk about climate change, the tasks and opportunities for humans to influence the weather and local climate are largely unrealized. So, it is not worth talking about climate change, but rather about human activities that change the climate, or the lack of them. The average annual temperature is increasing. As a result, woody vegetation is drying out, and grasslands are being eroded in the absence of rain or are boiled when rain falls. The regulatory environment does not adapt in any way to changing conditions, making it impossible for livestock farmers to adapt, causing financial and long-term damage to nature. The species composition of grasslands is changing very rapidly. Invasive and other harmful species that are of no use to herders are spreading through the grasslands, taking over very large areas every year. The natural and protected species diversity of grasslands is thus gradually being degraded. In addition, agricultural and nature conservation activities are strongly reinforcing this process through outdated grazing and harvesting standards. Soils are becoming more compacted, and their structure is deteriorating year by year. As a result, they are unable to absorb rainfall, which runs off and evaporates on the soil surface.

The grazing systems that maintain grasslands are disadvantaged by regulations and bureaucracy that are unable to adapt to change to such an extent that livestock keeping and the associated traditional ecological knowledge and innovations are threatened. So, the people who are disappearing from the degraded landscape are precisely those who have the potential and the ability to mitigate, halt and sometimes reverse the damaging processes. This dwindling section of society is increasingly disappearing, and the technological options created to replace them are in practice not, or only partially, able to fulfil their role. In the case of many technological advances, in the long term they are leading to the initiation or intensification of ecologically damaging processes. In fact, there are two fronts on which a major battle needs to be fought: the survival of the people who live in and maintain the landscape (and their traditional ecological knowledge and innovations), and the restoration of the elements necessary for the landscape to function properly. Unfortunately, the two are intimately linked: it would be pointless to keep herding communities and knowledge alive if there is no place to eventually herd in an extremely changing and degrading natural environment. However, it would be pointless (and impossible) to put in place processes to normalize the landscape if people who can maintain it professionally are no longer present in the landscape. Overall, the survival of Hungary's landscapes, its ecological stability, its cultural, intellectual and practical heritage, the genetic values of its livestock and the country's food and drinking water security are under threat. There is a clear downward trend in biodiversity, the speed of which is greatly increased by the destructive activities still being carried out by humans and the lack of corrective regulation.

Values underpinning decision-making processes

The values that are being created and developed in the context of the case study seek to influence policy and decision-making processes from several directions. The most basic and realistic instrument is to strengthen and increase the number of grassroots initiatives. Firstly, we need to strengthen local communities and public opinion to the extent that their presence becomes a factor for the executive and local decision-making bodies at the grassroots level. This can be followed by the development of an advocacy group that is capable and able to negotiate with middle-level and, progressively, top-level decision-maker institutions and individuals. In this process, we have made more significant progress in strengthening local communities. From here, work can continue to increase stakeholder engagement and communication. Policies are unlikely to change dramatically for the reasons already given and are unlikely to generate the minimum substantive response expected. Therefore, it is the decision-making bodies and institutions that are independent of policies and play an indirect role in the lives of livestock keepers and the state of biodiversity that should be the first to be put under more pressure to achieve the theoretical and practical goals set. Another possibility is to try to influence public opinion outside the industry, which can also exert pressure on decision-making and policy activities. Today, public pressure is increasingly being exerted to bring together large numbers of individuals by various means to curb decisions and implementation measures that are extremely damaging from an ecological point of view. A similar example is when citizens' initiatives and implementation processes are triggered by the failure to take the necessary decisions and measures. In conclusion, we must rely primarily on the role and power of society to shape opinion and intervene to achieve results.

Political, cultural and institutional power dynamics

The current political and institutional power relations have little regard for the alternative methods, knowledge and values offered by SES. Background information on this has been shared previously. Regarding the cultural context, there are formal and other socially based institutions and communities that offer opportunities to take into account SES principles in some degree and form. Although not yet widespread and not yet taking a very effective form, there are several social communities that are emerging with the intention of civil society coming together, most of which are trying to consider and implement SES values and scientific background, either explicitly or subconsciously.

Embedding the local SES in the high-impact sector

A fundamental circumstance is that policy conditions significantly ignore the problems related to SES principles and their possible solutions. Since the upper interest is not substantially related to the fulfilment of the SES principles, and social pressure is not sufficient to achieve changes, the various institutions, their norms and rules do not take them into account. Mostly, unconscious and neutral decision-making takes place in the direction of SES, which simply does not take these circumstances into account. In certain cases, we can also report on specific countermeasures when the basic principles and practical implementation possibilities of the SES are consciously destroyed in favor of political and national economic interests (typically also affected by corruption). In many cases, institutional systems appear to be neutral, taking no responsibility for planning and implementation, nor for the impacts that arise from their work. Typically, they try to assume a service provider and enforcer role and communicate about themselves, thereby avoiding responsibility. The professional opinions of individual employees of the institutions may of course differ from this, but in most cases, internal professional initiatives are quickly eliminated due to the force of higher-up instructions.

Economic structures' impact over the SES

It is difficult to generalize regarding market structures. Market conditions set at the national, government level do not explicitly take into account the principles of SES. We could rather say that among small and medium-sized entrepreneurs there are those who, considering the discussed aspects, enjoy increasing support from society, even in an otherwise inadequately designed support and financing system and in the face of gradually degrading ecological conditions. This social support can be observed most strongly among producers striving for short food chains, the number of which is gradually increasing in various agricultural sectors, including at the level of local small producers. Across Europe, and in Hungary in particular, it is typical that large producers and traders do not typically strive to establish short food chains. A very significant part of the economic goods produced in our country – and here we can specifically talk about agriculture, including live animals and animal products produced in animal husbandry – are not sold, processed and consumed locally. Moreover, there are the environmental and ecological conditions that, with rapid changes in recent years, are increasingly making certain types of production activities impossible. As an example within Hungary, the drying out of landscapes – it is a process practiced by humans until even this day – is causing serious emigration and demographic problems in several regions (the most serious situation is at the region of Kiskunság and Békés-county), as agriculture and the associated employment opportunities are becoming increasingly scarce, and there are no other livelihood opportunities that can absorb large numbers of people in these regions. So, it is not the principles of SES that are being enforced, but rather people are trying to escape from a landscape that is considered increasingly unlivable from economic, social, ecological and other perspectives. The developments built up by the national high management further worsen the situation in terms of the ecological environment, as they typically disregard the basic principles of the SES, which also concern ecological aspects, and establish environmentally destructive industrial facilities under the pretext of creating job opportunities. Returning to the example of drought, they are not trying to address the ecological problem that would best serve the principles of SES and the needs of society. Instead, they try to intervene using methods that are ineffective in the long term, and in some cases even harmful, for local society and nature, based on completely different principles.

Assessment of biodiversity challenge and related biodiversity trends in the high impact sector

Typically, the domestic institutional system cannot handle locally perceived and specifically defined biodiversity-related problems and challenges individually. The identified challenges and trends may be fully scientifically based or simply based on practical observations. Regardless, the compulsion to act is triggered when many similar reinforcements arrive over a sufficient period, and when associated with appropriate social pressure and narrative. So, the broader impact sector has a severely delayed reaction time. The appropriate level of key stimulus (e.g. the combined implementation of scientific and social positions and pressure) triggers communication that acknowledges the problems and initiates the planning of responses. At the same time, increasingly accelerating ecological processes may lead to increased erosion of biodiversity due to slow infrastructural reaction times.

Current enablers and barriers for transformative change

Although the situation is probably similar in many parts of the world, one of the most serious dangers in Hungary is the treatment of the landscape (and the entire ecosystem within it) and humans on separate theoretical and practical levels. One of the biggest inhibiting factors is that society, the relevant organizational structure, and the regulatory and support systems are all designed as if they were independent and determinable from their entire ecological and natural environment. The advantage lies in the social and scientific recognition that is now beginning to emerge extremely slowly: the separation of landscape and people is no longer possible in Europe. To mitigate and stop the increasing ecological damage to the natural environment, we need to think in a complex system, for

which there are (for now) some local initiatives. Other countries in Europe may be already ahead in this process in some respects. The increase in social needs experienced by the population in Hungary due to natural-ecological and related economic reasons (e.g. agriculture) may mean the appreciation of the basic principles of SES in the future, as well as the planning and application of practical options.

5.2 Vision: What alternative SES could be?

For SES, the ideal vision is to keep the landscape alive. If the landscape is not alive, it cannot be lived with, nor can its resources be used in ways that bring it into balance. We must start from the basic needs of the landscape: in terms of the regulatory framework, water management and soil restoration are the first and most important issues! We consider this fundamental because these factors provide the basic conditions for the survival of the landscape and thus for any socio-ecological process and environment that is integrated into the landscape. At the same time, the inertia and slowness of the regulatory environment no longer allow for the rapid handle and reversal of the damage caused by the increased pace of ecological problems and extreme climatic conditions. So, in addition to the siege of decision-making infrastructure and personnel, there is a parallel need for a major transformation of societal thinking and lifestyles, and the launch of active interventions, even to the point of civil disobedience. We highlight this example because the impact of the recent severe droughts, despite misleading government communication, has led to a situation where citizens directly and currently most affected by the drought (although in fact everyone is equally affected by water management issues, as water has now become a national treasure) have started to implement point-based local water containment attempts at their own expense under the legal category of civil disobedience. Thus, in some situations, social interests and professional arguments are beginning to override the outdated and, in some cases, unprofessional and inappropriate regulatory framework. Of course, this process should not be an end in itself but rather seen as a potential short-term tool to address the increasingly pressing issues of food security, drinking water security and ecology. In other words, society is already receiving the kind of inputs that are beginning to influence the way it organizes itself and its environment (both human and natural) towards SES principles. If we succeed in harnessing these social waves in the future, we may be able to achieve increasingly effective results in society and the landscape by informing the public at large and by using and disseminating the traditional ecological knowledge that has been gathered and disseminated so far.

Since activities to restore landscape function have already been stepped up, the next step is to help people living in the landscape now and potentially in the future to acquire the traditional ecological knowledge and practices that do not fundamentally disrupt the landscape but still create resources and livelihoods for those who live there. One segment of this knowledge, the ecological and livestock-related knowledge of traditional herders and innovative solutions to this knowledge, is what we are trying to gather in our case study and prepare for future social use. Although we are currently facing many barriers in this area, our collections could play a key role for the extensive livestock sector in the future. The big question is whether there will be policy changes that will facilitate this process. The most practical course of action in the present situation may be to seek to use these collections in a way that is not currently possible, as many cultural, regulatory and practical infrastructural circumstances prevent or severely limit the possibilities for their publication. Instead, we are preparing these materials for the future, when society and policymakers will, by necessity or otherwise, demand this type of knowledge. By that time, presumably the demand will have created the conditions for publishing the material in various forms.

There are, of course, much more obvious ways of transferring knowledge than the above method. Community building among people living in the landscape should be a cornerstone of SES. Hence the need to create communities not only to save and maintain the traditional ecological knowledge of herders, but also to understand and use it from the direction of society becomes essential. Our current work covers this in the sense that we have

successfully encouraged different groups (e.g. by gender, age, regions, types of livestock kept, etc.) within herders and herders' societies to engage in community building, networking and exchange of experiences. Of course, this process needs to continue for herders to form officially and professionally recognized communities and to inform and influence decision-making processes, regulatory environments and civil society opinion. In addition, this process should be extended in the future to those people who are not herders in terms of their occupation and culture, but who need or will need the knowledge and practical skills of herders to a greater or lesser extent to successfully coexist with the landscape. People in this category can include a wide range of people: people who are already living in the landscape; people who are moving back to the landscape and have the knowledge they need; people who are moving back to the landscape but do not have the knowledge they need; people who are moving back to the landscape but do not need the knowledge to survive there, but still need the support to build social communities. In addition, groups can be distinguished by occupation whose knowledge needed to live in and with the landscape is in some form or part complementary to that of herders. These may be small farmers, people who are trying to be partially or totally self-sufficient, people working in agriculture - who may have a professional and material interest in the knowledge linked to livestock -, organizers of any agricultural sector that uses livestock keeping and grazing as a complementary activity (the role of no-till should be highlighted here!!!), etc. The important point here is that it is not only the herders, i.e. those who are in some way entrusted with this profession and task by the community or who work in it in some other way (as employees of a farmer or as self-employed), who need the knowledge of the herders. Both researchers and the relevant practical sectors need to incorporate this kind of knowledge and practice into their own systems. This will also help to sustain herding and allow people and occupations from any part of the SES to see through to elements of the landscape that do not directly affect them but are essential to its functioning. The building of communities and the transfer of the knowledge needed to live in and with the landscape must therefore be extended at some point to all members of society who need it. Moreover, it is not only those individuals and groups who need it that should be given access to the necessary knowledge, but the general shaping of society's consciousness should increase the number of those who can play any role in building a society that functions in accordance with the SES principles. We need to continuously develop ethical, culturally appropriate, socially usable and inclusive ways of doing this for local stakeholders in the future.

The economic and market structures related to nature conservation need to be transformed. For the last two, it is essential that locally produced raw materials and products can be processed and sold locally. Obviously, the most optimal situation would be for the small communities that emerge to be able to meet their basic food needs from their own activities, but given the social structure of modern Europe, this is almost impossible to achieve without external inputs. The solution that comes closest to the most optimal objective should therefore be the first to be identified: local economy, but most on a regional or national scale at the largest. There are many resources and even services available from extensive livestock farming which are ignored or considered unnecessary by modern society, but which it is trying to obtain from other sources. To exploit these, major infrastructural improvements are needed, which cannot be achieved solely through local initiatives and funding. It is therefore worth adding this objective to the list as part of long-term strategies, in which national or even international assistance and experience should be sought. There is also the unanswered question of what standardized opportunities and positive or negative impacts emerging technological opportunities may have in the future.

It is necessary to take a different approach to understanding and assessing the challenges of biodiversity in different ways. The concepts of biodiversity and nature conservation are closely related, as has been the case up to now. However, in the changing ecological and climatic context of our times, we need to remain grounded in reality. Accordingly, we need to review what possibilities the changing or already changing landscapes and conditions offer for the future. Although, in the best case, we should return to the natural and ecological conditions that have been known for roughly 150-200 years, we must

nevertheless recognize the very low probability of this happening. There are many cases where changes that take place in too short a time and have too great an impact affect certain local, regional and national conditions to such an extent that it is physically impossible to restore the original conditions in the short term (e.g. the decline and even disappearance of certain indigenous species can unfortunately not be prevented, or even slowed down). This leads to a compelling need for adaptation on what the changed - and even partially restorable - landscape characteristics will allow in the short- and long-term future. It is possible that the expansion of certain cultivated and wild plant and animal species (even, in extreme cases, invasive species) may be so successful that it is either not possible or not really in the human interest to fight it. So, there may be a new level of adaptation where we seek to preserve and exploit the changed conditions (or some element of them) in the hope of long-term stability. While this will not change the basic mechanics and laws of how the landscape works, it may involve a significant reassessment of the elements of the landscape and some of the principles of SES.

It is expected that the highly extreme changes in the natural-ecological environment and climate, and the equally extreme changes in human society will pose challenges to professional and civil society organizations, communities and individuals working on SES objectives for which we do not have ready solutions and proposals today. At any time, processes may emerge, even as previously unknown factors, for which we do not have ready answers at local or global level. We should expect to be unprepared.

5.3 Discussion

A social-ecological approach does not currently exist in Hungary, but rather only through the work and research of a few individuals is attempting to draw attention to the role and importance of this way of thinking and value system. The most serious problem of the Hungarian and international agricultural and nature conservation environment is that they want to separate the landscape from the people who live, work and specifically maintain it. To take a concrete example, they want to maintain Hungary's protected grasslands of natural value - which are also cultivated landscapes - by making it impossible and excluding the human landscape-forming and landscape-maintaining activities that have been present there for hundreds of years, for example by severely restricting grazing. It is precisely the values and features that need to be protected and maintained that are disappearing at an increasingly drastic rate as the activities that sustain the landscape are gradually being eliminated. In general, we can say that there is no comprehensive link between SES and the participants in our case study, or in Hungarian society in general.

The implementation of the SES principles is also made more difficult in the Hungarian case study by the fact that natural and climatic changes, as well as drainage and river regulation, which have had an extremely negative and damaging impact on the landscape over the last 150 years, are making it increasingly difficult to carry out activities that sustain the landscape. These human activities and their effects manifest themselves in different ways and with varying intensity in different regions of the country. However, it can be said that climate change, and in particular man-made climate change at the local (e.g., national) level, has a uniformly negative impact on the development of our natural and agricultural environment. In this context, it is becoming increasingly difficult to maintain the activities, knowledge, and traditions of traditional communities linked to nature and agriculture. At the same time, it is becoming impossible to develop and sustain innovative socio-ecological processes and social environments that meet the expectations of our contemporary society. The outcome of this process cannot be predicted, as there are many sudden factors emerging in both the ecological sense and on the part of human society. At the same time, we can say with certainty that we are currently living in an era of significant ecological restructuring, where it is extremely difficult to develop appropriate long-term strategies. It is difficult to shape public opinion in the right direction because rapidly changing circumstances and new proposed solutions follow each other in quick succession, causing a great deal of misinformation in policymaking, public opinion, and traditional communities alike. Thus, the demand for SES has been growing steadily and

strongly in recent years, and we should not expect the development and implementation of uniform and strong SES principles in society in the coming years (in the Hungarian context). Of course, it is worthwhile and necessary to intensify efforts in this direction!

6. Locally tested interventions

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6.1 Evaluation of strategies in action

In our case study, we are working to maintain the biodiversity of grasslands, and other areas in the landscape, which are suitable for environmentally friendly form of livestock keeping (mainly herding) in the whole area of Hungary. Due to accelerating climate change, the natural environment changed dramatically. However, the outdated system of regulations and subsidies in nature conservation, agriculture and the general economic sector is causing increasing damage to the biodiversity of the areas we are examining. The competent decision-making sphere and the institutions entrusted with the implementation/enforcement of the regulations are doing nothing to monitor and follow the changes. The increasing drying of the landscape, the destruction of the condition of the soils, and the dramatic decrease in biodiversity no longer allow the continuous success of the agricultural technologies that have been widely used to date. Pastoralism, on the other hand, may be able to survive in these circumstances, given its methods, while also playing a role in maintaining biodiversity and reversing the current situation. Moreover, the traditional ecological knowledge of traditional herders can help to map and understand in detail the processes to which humanity must respond about nature and environmental issues. At the same time, the social background created by human society, as well as the nature conservation and agricultural regulatory environment makes it impossible for the herders lifestyle to continue. The situation threatens the loss of traditional ecological knowledge represented by pastoralists, which we absolutely need to preserve the biodiversity and health of grasslands.

We are working together with our main stakeholders, the Hungarian herders to develop the strategies presented in our case study. Although they are naturally our most prominent stakeholders in the majority of cases, numerous other actors are also involved in joint consultations with the herders and us, as well as in the development of national and regional strategies. We are working together with various researchers and research partner organizations about collecting and systematize traditional ecological knowledge, land use practices, water management methods, ecological impacts, etc. They have mainly a scientific role about data management and communication within society, and among herders. There are members of the nature conservation ranger service, other staff of National Park Directorates and other nature conservation experts working together with us and the herders. They have a strong, direct impact on pastoralism through the different type of knowledge about nature conservation grassland areas, climate change issues, and through conservation regulations to humans, livestock keeping and grassland management. They have a very important role in the life of pastoralists, but they can have quite different attitudes about herding (good or bad opinions about the herders knowledge and role in grassland management. The representatives of regulatory and animal husbandry-related infrastructure and institutions has also a very important role through requirements, bureaucracy and registration in animal husbandry, but they basically are not concerned especially about herders. We have to take into count animal health experts, as allies in the formation of hybrid animal healthcare knowledge in the future, and the preventers of dangerous livestock diseases that are emerging more and more frequently nowadays. The breeder organizations are also important to our work. The different institutions have a different role in the case study, because the herders are keeping different breeds in different numbers. Moreover, the role of those breeds are also important, which are not kept by herders, because they might have an influence to the economic background of livestock keeping. In this aspect, they have a very important, but partly indirect role in the life of herders. (1.;2.;7.)

The Hungarian case study is about the traditional ecological knowledge of Hungarian herders, which contributes both directly and indirectly to the maintenance of biodiversity in natural and semi-natural grassland areas. For historical and cultural reasons, the Hungarian herders are a marginalised social group, whose social presence, professional recognition and needs have not been properly addressed. Local, national and international

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regulations in the areas of land ownership, land use, animal husbandry standards and market outlets have created a strong vulnerability in the lives of herders, which they have never tried to change due to a lack of advocacy, and which has not been recognised by policy makers and society. We are trying to use a range of instruments to launch the professional and social innovations needed to save herders' knowledge, to preserve their way of life and to reverse marginalising decision-making.

Our central aim is to maintain the knowledge and society of herders who help to conserve and partially restore biodiversity. Accordingly, our first and most important strategy is to shape herders' societies from within so that they are willing and able to recognise and influence the processes that affect them in their ecological, social and regulatory environments. We do this by strengthening their societies, building relationships and social networks, and developing target groups (eg. the women herders, young herders, herder communities with specific needs in direct areas, connecting herders with same breeds of livestock, etc.) In accordance with these efforts, the informal network of contacts with a national coverage is constantly expanding. An excellent example of social transformation is the Women Herders Group, which has been set up to represent the interests, contacts and professional opinions of women working in pastoralism. The series of Forum of Hungarian Herders (2.;4.), which aims to bring together active herders with a nationwide coverage, was launched by our research group. The aim is to inform herders on a wide range of issues, to discuss their views and to set up their own strategies on professional and social issues that concern them, including occasional involvement of external partners - other stakeholders and decision-makers. The Forums also provide an opportunity for individual organisation, as we try to invite specific target groups by topic, age, etc. The members of these specific target groups can connect among themselves in professional or social meaning much more easily, so they can experiment and explore the opportunities created among them individually. This will hopefully lead to the formation of a self-organising group of young herders in the future. Seeing positive examples, herders in many regions will start to organise themselves effectively, strengthening the representation of the profession towards the civil and professional world. The herders' community is now beginning to open up to society and is increasingly actively seeking opportunities to build useful professional links and contacts at individual or community level.

The second step is to make the regulatory environment more professionally and economically acceptable, even beneficial for herders. This, of course, requires that decision-makers and individuals who are currently completely uninformed about the needs and importance of herders' expertise are given a thorough understanding of the current processes and situation affecting herders. The Forum of Hungarian Herders (2.;4.) provides an opportunity to invite and inform decision-makers and representatives of the bodies and institutions involved in decision-making on specific issues. In addition, we try to initiate face-to-face discussions in various other professional and social forums and conferences to bring the views of the profession and decision-makers closer together. For these occasions, we have initially invited herders to represent their professional interests and demonstrate their knowledge and its relevance, with our guidance and supportive presence. The method is proving to work, as more and more herders are being asked to participate in such events or to make a professional presentation. The general awareness and motivation of the decision-makers towards herders is still low and further long-term efforts will be needed in this respect.

A key task for the future is to inform society as widely as possible about the importance and value of the work of herders. In parallel with promoting change in the decision-making environment, it is also worthwhile to influence the immediate economic and occupational environment of herders. In addition, raising the awareness of the broader civilian community is equally important to ensure the supply of new generations of herders, as it would create the right regulatory and employment environment to attract new herders into the profession. The educational environment in Hungary currently

seems unsuitable for training herders, so this is likely to be a long-term process of planning and implementation. (2.;4.)

As the survival of herders' knowledge, jobs and farms are extremely fragile due to a number of negative factors –like ecological changes, the occupational environment, economical factors, regulation background in conservation and livestock keeping, global social disinterest, etc. –, it is in our vital interest to collect and document knowledge for future generations. We conclude that we must not only work for today. A collection of knowledge that archives both the traditional and innovative knowledge of herders can ensure the survival of the profession even if the current economic and societal environment does not allow for the straight lineage of the Hungarian herding profession. For this reason, a wide-ranging collection of details of the practical work of herders in relation to livestock and the natural environment is being carried out at national level. In this respect, it is entirely up to the herders themselves to share with us and to record and pass on to their descendants. (4)

Generally speaking, in the context of our case study, political impotence and disinterest is high at both national and EU level. The herders' problems are ultimately also the problems of humanity as a whole, since, for example, the processes of drought and desertification and semi-desertification are generating pressing issues for all in terms of drinking water supply and food security. This is likely to lead to the emergence of allies and stakeholders in the future that we did not expect in the past, but which we can nevertheless count on to represent common interests. The identification of partners is slow because we need to continuously map the interest groups that are immediately emerging to address the problems that are becoming more and more socially recognised. What seems encouraging is that a number of stakeholders representing other sectors and interests are seeking to bring solutions similar to our own research, with some overlap, into the public regulatory and implementation sphere.

In fact, our activity is trying to prepare for several different possibilities for the future. We seek to influence herding communities, society, the agricultural sector and the policy environment in ways that mitigate negative impacts on biodiversity. On the other hand, we will prepare as far as possible for the long-term problems that are bound to arise as biodiversity and climate change. In this way, a society undergoing radical change will have access to the knowledge that can help it survive in the face of adaptation challenges, regardless of our current achievements.

6.2 Enablers and disruptors

The basic problem of our case study is the disregard of the traditional ecological knowledge of local communities and the irresponsible and thoughtless destruction of biodiversity (in urban, rural and natural environments) at almost state level. The general trend across Europe is that the behavioural and spatial reorganisation of our society has distanced people very strongly from the knowledge of natural values and processes, and from the opportunities and needs to conserve and maintain ecosystem services essential for human life. Traditional or innovative local communities capable of restoring and maintaining biodiversity have become marginalised groups. There are no such local policies or initiatives that actively support the recognition of these local societies (such as Hungarian herders) and their traditional ecological knowledge. EU-level initiatives are typically unsuitable for specifically helping the marginalized society of Hungarian herders in this regard. The legal harmonization of Hungary in this regard has not occurred, and there is currently no political will to do so. In addition, governments do not attach importance to maintaining biodiversity or even ecosystem services and basic human needs. It has now reached the point where the country's food insecurity is looming, the problem of drinking water supply is becoming increasingly serious, and the rapid acceleration of human made 'desertification' through subsidised agriculture and other activities is increasing. About the identified structural constraints, land-based support schemes, the out of date conservation

regulatory frameworks and subsidies, and general land use subsidies have the most direct affect in the destruction of biodiversity in our country during use of the landscape.

It can be concluded that the traditional and innovative strategies of local communities are not taken into account by trends and decisions at regional, national and EU level. The regulatory system is extremely inflexible and slow, and is unable to absorb proposals and solutions from the local community level. It cannot of course support them for the same reason. The supporting system in agriculture and conservation is a very good example for these cases. The dates of grassland management regulations and subsidies in conservation areas urge that kind of land use, what can directly contribute to destroying grassland areas and damage soil conditions. Although local herders have many ideas and suggestions for reasonable changes in local or national level, these suggestions do not even reach the local decision-making levels. Inclusion in policies or international proposals is not provided in any form for local communities. In addition, it would be impossible to make meaningful interventions for biodiversity in the face of the complete contradictions in the support systems. The interests and trends of the economic sectors are not in line with local needs and public interests. In addition, the lack of public awareness would make certain necessary decisions unpopular and thus exclude them from the decision-making process.

Many international examples show that among the different agricultural sectors, pastoral grazing is the one that can adapt even in increasingly extreme weather conditions. However, they are also finding it difficult to adapt to trends in agriculture, forestry, water management or urbanisation at national and EU level and have become extremely vulnerable. Unfavourable land ownership restructuring, land conversion and land-based support schemes have opened up loopholes that have created conditions that have made the livelihoods of the large majority of herders impossible. Positive examples have been observed mostly only in personal reconciliations and local cases (eg. we know about some cases in the country, when local herders are allowed to use other farmers land out of agricultural plant cultivation season due to unique relationship with farmers), but the long-term positive effects and the survival of traditional communities are not really solved or generated by these initiatives. Herders and extensive livestock farmers could potentially implement different or identical approaches to biodiversity and food security. But they are not given the necessary territorial and regulatory opportunities to do so. As a result, their spot interventions generally fail to achieve the effects that researchers generally agree are attributed to herders' activities. Thus, the technological potential for ecological change is available, but the social, economic and regulatory environment largely prevents its realisation. Herders and other relevant stakeholders are unable to address these constraints with their influence and currently available power.

Local policies and strategies that need to be renewed are not constrained by the European directives in the sense that the Hungarian government does not currently pay attention to such issues, but rather approaches the issue in terms of economic funding opportunities. In fact, there is no real will at the top level of the country to address the issue in a meaningful way. Moreover, the decisions that are taken are typically not technically grounded. Further questions are raised by the fact that EU directives do not leave sufficient room for the maintenance of useful and workable local practices as a result of the implementation of funding schemes. Regulations that focus on environmental and nature conservation rather than exclusively economic (agricultural) ones may also contribute to biodiversity loss and the disappearance of local practices that can mitigate extreme climatic factors, due to dramatically changing climatic conditions. In summary, inflexibility at EU level and political and social indifference at national level are barriers to the implementation of beneficial local practices. At the same time, the economic and supportive context tends to neglect the use of scientifically sound methods that are in the interests of biodiversity. This is in large part due to a system and approach that is unable to respond to rapid change and that continues to perpetuate the practices of the last century as a tradition. The partial passivity of cultural and local communities thus repressed, combined with the predominant reliance on subsidy-based management represents a major threat to the future sustainability of the areas. The knowledge needed to do so are held by the marginalised groups they would otherwise support, will be lost in the near future. The reduction of

constraints is not strongly perceived, but the willingness of middle-level decision-makers and executives to compromise on some minor issues is a positive development.

The herders themselves have so far not formulated a public, unified opinion on the processes that affect them and society as a whole. Their attitudes are changing dramatically as we work, but they do not yet have the real power to bring about real change. The social partners are thus developing theoretical strategies to mitigate the disturbing factors, but they are still powerless to implement them and to transform the barriers. The problem is that they have no insight into the national and EU regulations and decision-making environment, next to its connectivity and infrastructure. They are therefore best placed to assist in the implementation and design of local practices, and in the collection of scientific and technical data and opinions. The former are important in the sense that the regulatory and support environment in which they operate is in need of change at all levels of decision making and implementation, and harmonisation is almost impossible to ensure in the short term. (2)

6.3 Failed and successful practices

The basic problem in Hungary is that biodiversity conservation as a fundamental issue is only stated and effectively considered in the context of nature conservation. Although some local communities, such as herders, have a special and basic interest, they do not frame the problem in this way. Moreover, due to the heavily agricultural sector dominated Hungarian nature conservation, a very significant proportion of farmers do not base their livelihoods on actual production activities, but on the subsidies provided by a dysfunctional system, while they are not really interested in positively influencing their environment (agricultural and natural). State nature protection in our country now plays more of an executive role and cannot intervene to resolve these financial and regulatory contradictions. Today, the changes in climatic conditions (especially drought and water supply problems) and the drastic loss of biodiversity are tangible to almost everyone, but there is no comprehensive movement for change at either social or political level. The problems have probably not yet reached the critical level where society needs to address these issues with discernment and compulsion. In fact, there are no political factors that actively support the goals and results of our case study, and the public sector is not helping biodiversity conservation in any way due to the failures of the system (regulations and subsidies) and the lack of interest (sometimes willful damage to nature) of the current government.

From a societal perspective, we expect to discover double effects. The civil society (traditionalists, festivals, folk art organisations, local communities, etc.), which respects the diversity of Hungarian culture, sees pastoralism as a unique curiosity. Consequently, sharing the experience gained in our case study with a specific layer of the civil society could be quite effective. On the other hand, these communities are not moved by the technical and technological issues of herding, nor by their social, economic and cultural problems. Most of them seek only to examine and visualise the herders' cultural heritage in the form of externalities (eg. traditional clothing, carvings, typical tools and other fancy equipments, songs and dances, etc.), in many cases in a way that is distinctly unethical towards them. So, in some respects, there is also a great receptivity to our own work on herders, but so far we have not found allies and stakeholders who can technically benefit herders. However, in the civil society sector, with the increasing climate and drought situation over the last few years, civil organisations have emerged that are completely unaware of the presence and needs of pastoralism, but which represent public interests that are closely linked to herders. One example is the issue of ecological water resupply, which is becoming an increasing problem for herders every minute. The sudden emergence of these civil organisations should be seen as a new potential ally, but we need to examine their precise background and intentions to see if cooperation is possible. Although the actual role of these opportunities is still unfolding, perhaps in the future, professional representatives of the civil society can be powerful allies in the technical promotion of herders' issues.

In terms of successful practices, the internal processes in the Hungarian herding community are worth mentioning. Thanks to the networking activities of our research group, increased communication between small and large communities of herders and the ever-increasing exchange of knowledge between groups and age groups have been initiated (1.;2.;3.;4.;7.). By knowledge, we do not only mean the methods for the maintenance and regeneration of biodiversity that are found in the practical work of herders. It can include the various ways of adapting to the diverse set of rules that human society has created today. The latter form of knowledge contributes indirectly to biodiversity conservation by facilitating the survival and retention in the profession of those communities and individuals most skilled in biodiversity conservation and regeneration, and thus their traditional biodiversity-related ecological knowledge. We cannot, of course, claim that this will stop biodiversity loss, it will simply enable us to professionally gather the methods and needs to advocate to decision-makers in the interests of biodiversity and herding communities. It is important to highlight the increasing trust-building between the herders' community and the representatives of the relevant disciplines and institutions (e.g. during the Forum of Hungarian Herders organised by our research group - (2.;4.)). This is clearly successful in the sense that the stakeholders and sometimes decision-makers in their negotiations with us treat the herders we bring into the negotiation process as partners in the negotiations. This has never been done before, so the herders themselves can start to build their own advocacy and representation.

Attempts over the last two decades to get real help from the top level decision and policy making community have proved to be unsuccessful or less effective. To this point no progress has been made. While many decision-makers and political leaders agree or even support our efforts in principle, no practical efforts have been made to provide substantive assistance. While it would be inappropriate to give up trying to move in this direction, we must acknowledge the lack of interest and infrastructural powerlessness at system level. For the time being, we do not have a concrete, developed method for breaking through these barriers, and we need to keep working on our approaches.

One of the shortcomings of our activities is the lack of communication channels that could inform the profession and the civil society on a very broad scale about the results and priorities of our research and the objectives and solutions we are seeking to achieve. The publication of technical material in scientific and agricultural journals is also of course a value and can be seen as an essential first step in informing the professional community. However, they have not been followed up by further progress in the field of communication. At the same time, the research community typically lacks the insight - and in many cases the skill and sensitivity - to use these media opportunities ethically and professionally to achieve their objectives. So, in fact, our own research team needs to develop its professional manifestations. In this respect, development together with herders cannot be considered the same as the research team's own state of being.

The lesson to be drawn from our achievements so far is that we should not continue to push the same methods and communication lines to achieve the same goals, solely because of the powerlessness and disinterest of the state and international governmental and infrastructural background. Change must not only be considered from the perspective of biodiversity and the stakeholders that sustain it - in our case the herders - but also the case study workers must make continuous adaptations between different static and highly variable environmental elements. Otherwise, the long-term objectives to be achieved could easily be stalled by a single inhibiting factor, which could be avoided in several places by innovative solutions. In this respect, the herding sector among the stakeholders of our case study provided us with a number of reinforcing feedbacks. Although no workshop has yet been held specifically on this topic, it will be necessary to hold one in the future.

Among the practices and specific interventions that support the conservation and restoration of biodiversity, we can highlight those that we have made possible for shepherds at an individual level, or in some cases regionally and nationally. We tried to promote the national or local legalization of useful practices, or we provided information to herders about the circumstances and effects of implementation that were invisible to them. The basis for this is therefore to ensure the flow of information among herders,

between herders, researchers and conservationists, and between competent decision-makers and local stakeholders. Concrete examples of successful practices include adjusting the timing of fox rabies immunization at the beginning of grazing seasons; ad hoc agreements on stubble grazing, which both improve the condition of agricultural land and protect grasslands; resolving individual conflicts between conservationists and herders regarding specific economic activities and conservation issues; etc. This mostly includes practices that herders are basically familiar with and perform (with or without permission). However, it is worth further refining these practices with knowledge from other fields, sciences and aspects. Moreover, it is very important to communicate them properly between the stakeholders involved, as the perceived conflicts of interest in the legal sense actually represent mutual benefits to the parties during practical implementation. For example, the practice of stubble grazing was active among Hungarian pastoralists until the second half of the last century. However, with the redrawing of property relations and agricultural regulations, the majority of herders and their livestock were forced to move to protected grasslands. When grazing stubble and fallow lands, livestock benefit both landowners and herders: the livestock can access an additional feed base, for which the herder does not have to pay any costs. Grazing removes weeds that farmers are required to remove with herbicides. The vegetation on the remaining (i.e. unrolled) stubble covers the soil, protecting it from further drying out. The trampling and droppings of livestock can improve the condition of the soils. In summary, we are talking about an ecologically and economically rewarding practice for everyone, which we must once again widely introduce in the country. The successes so far have only started with a compromise between a few shepherds and farmers, but we are launching further lobbying activities to legalize and financially support successful practices.

6.4 Co-learning

Our work with Hungarian herders began years before the BioTraCes project began. It is a difficult task to ethically and effectively approach a marginalized and traditionally closed community due to its social past. Gaining social trust was based on joint fieldwork and participatory action research over the long term. The most effective way to learn and exchange information emerged from this fieldwork was through this kind of physical cooperation. The herders understood the researchers' perspectives and goals, while revealing more and more information from their traditional ecological knowledge and social processes. Community-level knowledge exchange and co-learning developed from this, to which our personal networking activities within the BioTraCes project and the meetings and workshops we organized contributed greatly. As our research team conducts fieldwork with national coverage, herders from different backgrounds and regions have begun to connect more closely, both personally and professionally. A new network of relationships began to emerge, and an increased flow of knowledge began within the pastoralist society, as well as between the pastoralist society and stakeholders directly or indirectly involved in their work.

At the conference at Olaszfalu (19-20.05.2023), at the international meeting among herders and between herders and researchers working with pastoralists, the herders recognized and made aware that in many places in the world, there are separate interest groups, educational and training solutions and economic partners about herding. Through their example, it is worth examining Hungarian herders' society, then determining their goals and developing their community life and groups according to their own needs and culture. At the first Forum of Hungarian Herders held on September 27, 2023, the gathered pastors specifically consulted with decision-makers and representatives of the institutions affecting them regarding the current situation and needs of the pastoral community. The meeting had three main results: informing decision-makers about the situation of herders; the herders were able to see the opportunities and barriers provided by the state infrastructure; together with the herders, we were able to define long-term goals for the survival of the herding profession. The Second Forum of Hungarian Herders was organized on February 20, 2024. The event provided an opportunity for herders to discuss their own

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ideas in detail regarding the main issues affecting their own communities. Some plans were accepted, others were rejected on the spot, thus determining the further work of our research group. The First National Meeting of Hungarian Womenherders Group took place in March 2024. The meeting established the representation of a special group – women working in pastoralism. The members of the group could discuss their personal situations and ask each other for advice on their internal affairs. In 2024 and the second half of 2025, we participated in several professional conferences and consultations (organized by others) that provided information for our work together with herders on topics related to regenerative farming, grassland management, and water management. On the other hand, with these occasions herders and researchers had the opportunity to represent their own positions on issues affecting them.

The year 2025 was not at all favourable for mutual knowledge exchange and personal consultations with the participation of stakeholders from different areas. We had to postpone face-to-face meetings and group workshops due to the emergence of the foot-and-mouth disease virus, as the meetings we organized for livestock farmers would have created a potential risk of spreading the disease. Stricter animal health and livestock farm regulations, as well as research ethics required us to temporarily cancel or postpone the meetings, field visits, and trips abroad that we had organized. As a result, for a longer period of time, we were only able to hold consultations in a smaller circle, online, or in person (1-on-1 meetings) under secure conditions. This plays a role in that, herders are best at personal consultations among themselves in bigger numbers, if they need to coordinate their views on a national scale. At the same time, it is important to note that in the case of the Hungarian case study, mutual knowledge exchange and learning are the result of longer-term cooperation that goes beyond the time frame of the BioTraCes project (as we have already explained in several places). Therefore, the temporary suspension of personal consultations and the learning of conclusion did not cause as much of a problem in terms of the results of our case study as it would have if we had to produce our results within the specified deadlines during the four-year duration of the project.

Discussions about the indirect causes of biodiversity loss have been ongoing in recent years. The learning processes between research partners vary in terms of methods and intensity between different regions of the country. Our main research partners in this regard are participants from the research sector who share our interest in some form in grassland wildlife and biodiversity (e.g., experts in grassland entomology, forestry, ornithology, etc.), herders and livestock farmers themselves, as well as nature conservation experts, with particular emphasis on certain members of the ranger service working under the National Park Directorates. In addition, our work brings us into contact with numerous experts from the civil, public, and other sectors who could potentially be involved, and with whom the exchange of knowledge and joint position statements could provide extremely important additions to our own research group's work and thinking on the topic. (1.;2.;5.;6.)

As a result of the co-learning processes, we reached the following conclusions regarding biodiversity in our case study: Since different regions of Hungary have completely different characteristics (e.g., saline and sandy landscapes, forested areas, hills and mountains, floodplains, nature reserves and agricultural landscapes, centuries-old cultural landscapes, etc.), the various stages of biodiversity development are influenced by anthropomorphic and natural factors, and biodiversity processes are at different stages even in areas with different or identical characteristics within the same region. It is worth working with our stakeholders to assess and solve local, regional, and national problems at the same time. Our partners generally identify the extremely harmful water management practices of the last 150 years as the main cause of biodiversity loss, and in our opinion, the severe droughts that have developed as a result of bad water management practices over the last two decades in particular. The impact of droughts is significant in that our native natural environment is slowly becoming unable to regenerate. The environment has been able to absorb the effects of numerous processes causing biodiversity loss, most of which are man-made, for a very long time. However, with the onset of increasingly extreme droughts, our natural environment is unable to regenerate adequately. Opinions are divided on the vision

for the future and the processes that need to be implemented to secure it. From the perspective of farmers and the agricultural sector (including herders and livestock farmers), droughts threaten the existence of agricultural sectors. From a nature conservation perspective, alarm bells have been ringing for intervention, but despite this, there is a high degree of infrastructural inertia and institutional passivity. Most interventions are small-scale and ad hoc, serving mainly to influence public opinion. Research perspectives may vary depending on the areas and topics studied. Based on our own perspective, the droughts that have occurred over the past two decades and are intensifying year by year are part of a major transformation process. The legal and regulatory protection of native flora and fauna has not adapted to the current ecological and climatic conditions. A significant proportion of native grassland species are becoming less and less tolerant of severe droughts, including atmospheric drought, and we can therefore expect to see the decline and disappearance of many species in the near future. Despite previously effective landscape conservation activities, we will not be able to maintain the survival of these species at the local level in the absence of the conditions that are essential for them. The appearance and spread of invasive and non-native species is obviously not in the interests of nature conservation, nor is it an ecological goal. At the same time, a drastic decline in the species composition of grasslands and grassland-related biotic communities is to be expected, as well as a transformation parallel to this decline, possibly accompanied by the spread of non-native species. These species are generally undesirable from a nature conservation point of view, but – alongside local biotic communities that are unable to adapt to the changing conditions – we can and must find ways to use them successfully in the future. There are already numerous examples of this in Hungary. For example, grazing on invasive and non-native *Asclepias syriaca* in the Kiskunság region ensures the survival of flocks and their herders. Although livestock are generally unwilling to graze on this plant, it still serves as fodder for them in times of shortages. The foliage of *Robinia pseudoacacia* can also be used as feed for livestock, but its reputation and status are mixed: in the lowlands, these trees are drying up, and fewer and fewer tree species are able to withstand droughts. In the much rainier areas of the west part of Hungary (the part of Hungary west of the Danube), these tree is considered an invasive species that needs to be reduced, but it can also be a significant source of feed for livestock in some cases. The few examples listed above demonstrate that diverse and often extreme conditions can elicit diverse responses from farmers, researchers, and conservationists. Reconciling comparable problems and disseminating possible solutions requires continuous work. The meetings we organize (the international Conference at Olaszfalu, the first and second Forum of Hungarian Herders, and other occasions) and the events organized (sometimes spontaneously) among stakeholders provide a suitable environment for the co-learning processes, clarify the results of co-learning processes.

Numerous solutions have already been developed for certain biodiversity issues, which could bring about change across the country under the right circumstances and when applied appropriately. In disseminating these solutions, we not only engage in professional consultations and personal exchanges of experience but also strive to publicize the methods in ways agreed upon with our partners, e.g., by publishing articles in professional journals, giving presentations at conferences, and holding roundtable discussions, both in Hungary and abroad. However, most of these methods are successful when they can be implemented at the level of individual farms and individuals. We base the importance of the former statement on the fact that individual commitments to certain methods lead to changes in practice more quickly. The policy and regulatory environment, as well as the inertia of decision-making and infrastructure related to agriculture and nature conservation, the regulations which are subject to little change, do not allow for a rapid and effective response to rapidly changing ecological conditions. Of course, regardless of this, it is necessary to continue with the guiding professional activities in this field, but at the same time, it is not possible to rely solely on these in the future.

6.5 Testing of interventions

On-site testing of local interventions in the Hungarian case study is ongoing, but it is also encountering difficulties. We have already discussed the cultural composition and processes (and, in some cases, tensions) of the herders' society, as well as the differences in their natural and social environments. During our work, among other things we were working on the field of the herding methods of different regions, animal healthcare, grassland management strategies, water retention possibilities of different regions, the nature conservation procedures, cooperation, or even conflicts of the competent National Park Directorates, the difficulties of the bureaucracy related to livestock farming, the social and cultural barriers and opportunities, the necessary professional and social reactions in critical animal health situations, etc. Accordingly, beyond establishing ecological guidelines, it is not possible to generalize specific interventions among Hungarian herders and livestock farmers in order to maintain biodiversity. Every herder has his own innovative interventions on his own fields and socio-cultural sphere, to which we ourselves have tried to contribute to the best of our knowledge we have gathered and transferred. The social, economic, natural, and other conditions of the different regions are far from uniform, making it impossible to plan uniform interventions for all areas. The exchange of knowledge and experience is therefore justified, but the synthesis of knowledge and the development and implementation of intervention proposals require smaller-scale consultations. Accordingly, when discussing the results, special attention should be given to the different circumstances of the negotiating parties and to gathering information that is useful to them. Furthermore, we strongly urge that the knowledge of local communities be supplemented not only by national and international research, but also by the involvement of other local experts on the subject. For practical and cultural reasons, the development and testing of action plans should not be carried out exclusively in cooperation with experts who come from radically different parts of the country or who specialize in those areas. When establishing national principles, the situation is naturally reversed, as it may be worthwhile to involve as many experts as possible from as many regions as possible (local stakeholders with different knowledge; local and international researchers, etc.) in the consultations so that all potential circumstances can be taken into account in the decision-making process.

Action plans can be categorized according to their individual level or their community character. Developments that directly impact biodiversity at the local level are largely due to the personal exchange of knowledge between herders. Our primary social partners, herders and livestock farmers, are constantly working individually on their own interventions to improve their natural environment, economy, and social environment. We can help them in this process in two ways. On the one hand, we establish connections with their colleagues and other professionals, thus enabling the exchange of experiences and the resulting personal innovations. The other option is to create a community space (which can be physical, intellectual, or virtual) and community events where collective experience sharing can take place. Of course, these community events can be organized on an ad hoc or regular basis (an excellent example of this is the series of Forum of Hungarian Herders we organize - (2.;4.)). In this regard, it is a huge advantage that Hungarian pastoralists within their profession specifically like to meet personally and exchange stories and ideas. The events we coordinate or organize have expanded the topics they discuss among themselves. So they are starting to communicate more broadly and openly with different groups and members of their own community, and they are also willing to pass on different and deeper knowledge to each other in order to help their communities. The exchange of experiences between communities and sectors can on the one hand generate personal innovations, and on the other hand define the basic principles and necessary interventions that the research sphere needs to further develop, explore, propose, and communicate to the relevant policy-making and decision-making organizations and interest groups. Similar to the development of action plans, these interventions can be monitored on two levels. Individual interventions can be monitored through on-site inspections and consultations (about the grasslands, animals, and other parts of biodiversity at place). The experiences of personal innovations can go through great distances between regions by personal

communication of herders and through our intermediary role, and can reach different professional circles among livestock keepers, researchers and conservationists. Thus, the innovations generated by the initial small scale knowledge exchange return to the community and create new innovations through repeated knowledge exchange, starting a self-exciting process between the community and its individual members. This requires the personal experiences of herders and livestock owners, as well as the involvement of external parties with the necessary expertise (researchers, various experts), which is expected to be followed by the development of a new action plan. Community action plans can be monitored in several ways, depending on their nature. On the one hand, we can gather information on social processes by specifically seeking out community members, and we can also discuss results, mistakes, shortcomings, and proven or unsuitable methods during meetings. Measuring the results of the goals set in policy and decision-making processes is much simpler, as it is easy to track the start, halt, or completion of processes, which is communicated to our stakeholders through national and regional communication channels, and stakeholders directly feel the effects of decisions that affect them. It is definitely worthwhile to gather information about new decisions and changes as soon as possible, regardless of whether they were made on our own initiative or for reasons beyond our control.

Action plans can be classified into two types according to their nature: those implemented by stakeholders in the areas they manage, and those we wish to achieve at the local, national, and international levels in the policy, regulatory, and decision-making environment. Due to the large number of cases, we are unable to present the implementation of local practices in detail in this report. However, it can be stated with certainty that the professional exchanges and knowledge transfer (primarily related to livestock and land management) that arise through the network of relationships built up between stakeholders and various stakeholder groups often yield results in the everyday practical work of local farmers and herders. Of course, this applies to all groups of herders and livestock owners, regardless of region, age, origin, family background, and gender. These results are also discussed during formal and informal occasions organized during our work or related to our work as participants. Consultations with stakeholders other than practitioners are a much greater challenge. We have not yet found an effective method to break the policy deadlock in our work. In terms of the regulatory environment, policies, and economic background, we are unable to involve some of the stakeholders related to our case study in the consultations; at most, we can ask for their opinion on certain issues (e.g., commercial organizations involved in the trade of live animals from abroad). The lack of infrastructure is so severe that in many cases the requests we make and the bottom-up initiatives we launch get stuck at the lower and middle levels, so we can only maintain contact with regional representatives with limited authority. A further difficulty is that the herders and livestock farmers we represent do not have any significant connections in this area, so they can only provide effective assistance in planning initiatives (and of course, the practical interventions would fall to them at a later stage). They have no authority in the infrastructural launch and intellectual-regulatory implementation of interventions and can only rely on the authority of our own research group. Therefore, we can provide very few examples where the results of the procedures initiated could be evaluated. We discuss these on an individual level with certain directly affected herders, but they are always mentioned at community meetings, and we communicate our results in this area in professional journals for the purpose of providing general information. We are aware of most of the shortcomings arising from policy, decision-making, and infrastructure conditions, and we continuously list newly emerging needs in our individual work and during various meetings and consultations.

The involvement and participation of stakeholders in the processes we plan, and initiate creates an intellectual and knowledge system intersection that has never occurred before in the history of hungarian pastoralism. A new form of dialogue is emerging, as herders are increasingly willing to be involved in certain discussions that affect them personally or professionally. Although we still devote significant energy to supporting herders in this area, more and more organizations are paying attention to them in this regard. For example, they are invited to cultural events where they can present their knowledge and

culture according to their own needs and ethics. In an increasing number of cases, scientific and cultural materials created in their connection are published with their contribution and presence (e.g. scientific works, photo contests, film productions, ethnographic lectures, etc.). Our own efforts are most strongly trying to strengthen their professional presence in the issues of grassland management, landscape use, nature conservation and agricultural subsidies. Our research group is invited to numerous consultations and conferences, where we arrive representing the professional opinion of herders and, in most cases, together with herders in person. This raises the professional dialogue about pastoralism to a higher level. We also try to achieve results in decision-making with similar methods, but at the same time, our possibilities and actual influence on decision-making processes in this area are currently very limited. It is encouraging that the First Forum of Hungarian Herders, organized by us, has already provided an opportunity to bring the decision-making sphere closer to the practice and presence of herders.

All meetings we organize contributed to mutual learning and shared reflection among herders themselves, between herders and the research team, and between herders and other organisations, policy-makers, or groups of interest. The dialogues held at the location of the meetings can also have a significant impact on the thinking of Community-level changes and social perceptions of the pastoral communities, as the knowledge exchange influenced how herders researchers and other actors perceive biodiversity, land use, participation, and regeneration practices. Moreover, specific consultations have already taken place on some decision-making issues. These occasions provide opportunities for mutual learning not only on site. After each meeting, we collect both the personal and collective opinions of the participating parties, further helping the development and perfection of ideas. Regardless, unfortunately we cannot report on a larger decision-making process generated by our activities, what made a shift of formal or informal rules, institutional practices, or interactions with local or regional authorities. They were more about information exchange and knowledge co-production. Structural constraints are so strong in terms of policies and institutions (primarily agriculture and nature conservation), and institutional inertia and political disinterest are so great that the potential for future changes seems unpredictable.

6.6 Discussion

We are working together with our main stakeholders, the Hungarian herders to develop the strategies presented in our case study. Although they are naturally our most prominent stakeholders in the majority of cases, numerous other actors are also involved in joint consultations with the herders and us, as well as in the development of national and regional strategies. We are working together with various researchers and research partner organizations about collecting and systematize traditional ecological knowledge, land use practices, water management methods, ecological impacts, etc. They have mainly a scientific role about data management and communication within society, and among herders. There are members of the nature conservation ranger service, other staff of National Park Directorates and other nature conservation experts working together with us and the herders. They have a strong, direct impact on pastoralism through the different type of knowledge about nature conservation grassland areas, climate change issues, and through conservation regulations to humans, livestock keeping and grassland management. They have a very important role in the life of pastoralists, but they can have quite different attitudes about herding (good or bad opinions about the herders knowledge and role in grassland management. The representatives of regulatory and animal husbandry-related infrastructure and institutions has also a very important role through requirements, bureaucracy and registration in animal husbandry, but they basically are not concerned especially about herders. We have to take into count animal health experts, as allies in the formation of hybrid animal healthcare knowledge in the future, and the preventers of dangerous livestock diseases that are emerging more and more frequently nowadays. The breeder organizations are also important to our work. The different institutions have a different role in the case study, because the herders are keeping

different breeds in different numbers. Moreover, the role of those breeds are also important, which are not kept by herders, because they might have an influence to the economic background of livestock keeping. In this aspect, they have a very important, but partly indirect role in the life of herders. (1.;2.;7.)

Discussions about the indirect causes of biodiversity loss have been ongoing in recent years. The learning processes between research partners vary in terms of methods and intensity between different regions of the country. Our main research partners in this regard are participants from the research sector who share our interest in some form in grassland wildlife and biodiversity (e.g., experts in grassland entomology, forestry, ornithology, etc.), herders and livestock farmers themselves, as well as nature conservation experts, with particular emphasis on certain members of the ranger service working under the National Park Directorates. In addition, our work brings us into contact with numerous experts from the civil, public, and other sectors who could potentially be involved, and with whom the exchange of knowledge and joint position statements could provide extremely important additions to our own research group's work and thinking on the topic.

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On-site testing of local interventions in the Hungarian case study is ongoing, but it is also encountering difficulties. We have already discussed the cultural composition and processes (and, in some cases, tensions) of the herders' society, as well as the differences in their natural and social environments. Accordingly, beyond establishing ecological guidelines, it is not possible to generalize specific interventions among Hungarian herders and livestock farmers in order to maintain biodiversity. The social, economic, natural, and other conditions of the different regions are far from uniform, making it impossible to plan uniform interventions for all areas. Within pastoralist society, different groups (e.g. young and old herders, women working in pastoralism, etc.) are able to help mitigate biodiversity loss with different methods and effectiveness depending on the region and local customs. The exchange of knowledge and experience is therefore justified, but the synthesis of knowledge and the development and implementation of intervention proposals require smaller-scale consultations. Accordingly, when discussing the results, special attention should be given to the different circumstances of the negotiating parties and to gathering information that is useful to them. Furthermore, we strongly urge that the knowledge of local communities be supplemented not only by national and international research, but also by the involvement of other local experts on the subject. For practical and cultural reasons, the development and testing of action plans should not be carried out exclusively in cooperation with experts who come from radically different parts of the country or who specialize in those areas. When establishing national principles, the situation is naturally reversed, as it may be worthwhile to involve as many experts as possible from as many regions as possible (local stakeholders with different knowledge; local and international researchers, etc.) in the consultations so that all potential circumstances can be taken into account in the decision-making process.

The basic problem in Hungary is that biodiversity conservation as a fundamental issue is only stated and effectively considered in the context of nature conservation. Although some local communities, such as herders, have a vested interest, they do not frame the problem in this way. Moreover, due to the heavily agricultural sector dominated Hungarian nature conservation, a very significant proportion of farmers do not base their livelihoods on actual production activities, but on the subsidies provided by a dysfunctional system, while they are not really interested in positively influencing their environment (agricultural and natural). Public nature protection in our country now plays more of an executive role and cannot intervene to resolve these financial and regulatory contradictions. Today, the changes in climatic conditions (especially drought and water supply problems) and the drastic loss of biodiversity are tangible to almost everyone, but there is no comprehensive movement for change at either social or political level. The problems have probably not yet reached the critical level where society needs to address these issues with discernment and compulsion. In fact, there are no political factors that actively support the goals and results of our case study, and the public sector is not helping biodiversity conservation in any way due to the failures of the system (regulations and subsidies) and the lack of interest (sometimes willful damage to nature) of the current government.

One of our greatest challenges in our case study is the disregard of the traditional ecological knowledge of local communities and the irresponsible and thoughtless destruction of biodiversity (in urban, rural and natural environments) at almost state level. The general trend across Europe is that the behavioural and spatial reorganisation of our society has distanced people very strongly from the knowledge of natural values and processes, and from the opportunities and needs to conserve and maintain ecosystem services essential for human life. Traditional or innovative local communities capable of restoring and maintaining biodiversity have become marginalised groups. In addition, governments do not attach importance to maintaining biodiversity or even ecosystem services and basic human needs. It has now reached the point where the country's food insecurity is looming, the problem of drinking water supply is becoming increasingly serious, and the rapid acceleration of human made 'desertification' through subsidised agriculture and other activities is increasing.

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- (2.) First Forum of Hungarian Herders
- (3.) First National Meeting of Hungarian Womenherders Group
- (4.) Second Forum of Hungarian Herders
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Csányi Nikoletta: Time of women herders:

<https://www.youtube.com/watch?v=Ox1c2cJ3JDs>

Egy délután a legelőn Máté János gulyással (3 hour 38 min., with English subtitles):

<https://www.youtube.com/watch?v=rX-KyKxW9z0>

Egy élet kevés hozzá (pásztorok tudásátadása, A life is not enough, with English subtitles): <https://www.youtube.com/watch?v=QRpoC6KV2yk&t=22s>

Egy nap a legelőn Barta Sándor gulyással, kolompok között (2 hor 50 min., with English subtitles): <https://www.youtube.com/watch?v=gYjxj2ZU-VU>

IPBES Magyar pásztorok ökológiai tudása (17 min., with English subtitles):

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IPBES Magyar pásztorok ökológiai tudása (38 min., with English subtitles):

<https://www.youtube.com/watch?v=dj5iLAuWoJg&t=11s>

Kert-a-köbön: Pásztoros nap (no English version):

https://www.youtube.com/watch?v=D8SQYa0sW_0

Közös tudásalkotás természetvédő, botanikus és pásztor között. Gondolatok egy tátorjános és más, természetvédelmileg értékes felhagyott gyepterületek pásztoroló legeltetéssel történő kezeléséről és hasznosításáról egy mozaikos kultúrtájban (Rád és környéke, Cserhát) (44 min. with English subtitles):

<https://www.youtube.com/watch?v=qqR0PFLDpe0>

Pásztorok és természetvédők (no English version, Sáfián László juhász válaszol természetvédők kérdéseire, 2018. április 7.):

Első rész (a természet változása)

<https://www.youtube.com/watch?v=YYTndDaf5Uo&t=6s;>

Második rész (jószágglétszám, túllegeltetés): <https://www.youtube.com/watch?v=aLfR-QIzcK4;>

Harmadik rész (fák, bokrok szerepe, erdőlegeltetés):

<https://www.youtube.com/watch?v=Y-dECGjj0pA;>

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Ötödik rész (természetvédelem és legeltetés):

<https://www.youtube.com/watch?v=KGAnC0E26dc;>

Hatodik rész (kolompok, kutyák, család):

<https://www.youtube.com/watch?v=o8Gy9qHgJwk;>

Hetedik rész (a pásztortudás és jövője):

<https://www.youtube.com/watch?v=FOykjEplqS8&t=7s>

Pásztorok és villanypásztor (no English version, villanykerítés, sorozat):

Első rész (Kun Péter előadása): <https://www.youtube.com/watch?v=csZ-4KbV3-4;>

Második rész (Molnár Zsolt előadása):

<https://www.youtube.com/watch?v=1BA7gPu3XD0;>

Harmadik rész (Tihanyi Gábor előadása):

<https://www.youtube.com/watch?v=vKrDyBcdzd8&t=3s;>

Negyedik rész (pásztorok hozzászólásai):

<https://www.youtube.com/watch?v=gnXKZTokzXo&t=3s;>

Ötödik rész (előadások utáni vita):

<https://www.youtube.com/watch?v=zKSeFGDisUg&t=11s;>

Hatodik rész (pásztorok összegzése):

<https://www.youtube.com/watch?v=GNeDhfruUME&t=8s>

Pásztoroló legeltetés a jövőben: miért fontos, mit kell tennünk? Traditional herding for the future: transforming understandings and policies.

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Sáfiánné Ibolya (2023): The role of woman herders in livestock farming in the past and the present (with English subtitles). Agroecology Europe, Gyöngyös, 2023. november 16.: <https://www.youtube.com/watch?v=66FLjmkLEVo>

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D2.5, Portugal

December 2025

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Funded by
the European Union

Summary

The Mértola case study (Mértola Future Lab) explores how regenerative governance and community-led initiatives can offer transformative responses to desertification, climate change, and rural abandonment. The focus of the Mértola case study is to examine how regenerative practices can be activated through local food systems to enhance community resilience in a context shaped by ecological degradation, rural depopulation, and socio-economic marginalization.

Known for its rich historical heritage and striking semi-arid landscape, Mértola, a municipality in the Baixo Alentejo Region in Portugal, today faces major ecological and socio-economic challenges. These include population decline, aging demographics, limited economic opportunities, and increasing climate vulnerability. Yet, this apparent fragility has also opened space for experimentation with innovative, inclusive, and sustainable alternatives.

Mértola is one of the pilot sites of the BIOTraCes project, which investigates how biodiversity can be protected and regenerated through just and inclusive governance. In this context, the Mértola case highlights the value of a participatory approach to ecological transition. Mértola's case is particularly relevant because it links environmental regeneration with social justice by mobilizing local knowledge, fostering intergenerational dialogue, and promoting a diversity of actors and experiences. Similarly, this case allows us to reflect upon the relevance of intersectional lenses to go a step further in terms of environmental justice, with underrepresented groups taking benefit from environmental betterments and being less affected by an unequal environmental burden.

At the heart of this process is the Mértola Future Lab, a local strategy towards ecological transition that gathers a range of initiatives and projects to this end, as well as a diversified group of organisations committed to be part of a collectively designed strategy to face climate change in a semi-arid area. Mértola Future Lab addresses key regional concerns such as climate adaptation and biodiversity regeneration, while also tackling social and economic resilience. It is worth recalling that 47% of Mértola's surface is already affected by high rates of soil degradation (Roxo, Casimiro & Sousa, s/d), which points out not only the environmental problem but also the impacts on agricultural practices.

This local strategy co-designed and co-implemented by different local organisations and stakeholders - highly animated by the Mértola City Council - has managed to bring together public institutions like the Mértola City Council and the Santana de Cambas' Community Meeting House, educational institutions such as local schools, associations and NGOs such as the Guadiana Valley Business Association and the Agency for the local development in the Southwest Alentejo (ESDIME), and grassroots associations like Terra Sintrópica. Mértola City Council and Terra Sintrópica Association play a pivotal role in this BIOTraCes' case study as they are the societal partners in the case, welcoming the CES team and helping us understand the cross-case strategy in Mértola engaging a diversified set of organisations.

What makes the Mértola case unique is the networked approach to transformation. Terra Sintrópica and Mértola City Council do not act alone—it is part of a broad coalition that includes public authorities, NGOs, schools, vocational training centres, research institutes, and regional development agencies. Many of these partners are also involved in the Mértola Food Network, a participatory governance model that brings different actors together around the shared goal of food safety. This collaborative ethos ensures that regeneration is not treated as a technical fix, but as a deeply social and political process that requires engagement, negotiation, and redistribution of power and resources.

In terms of funding, the sustainability of these efforts relies on a mosaic of national and international sources, including foundations such as Stiftung Drittes Millennium and the Leopold Bachmann Stiftung, EU funds (notably from the ERDF via COMPETE 2020), and cross-border cooperation programs like POCTEP (Interreg Spain-Portugal). Programs like the Healthy Neighborhoods Programme also support specific projects that address social vulnerabilities through ecological action.

In sum, the Mértola case offers a vivid example of how small rural communities can become laboratories for regeneration and resilience. By placing community participation, environmental justice, and local sovereignty at the center of ecological transformation, Mértola challenges the dominant narrative that rural peripheries are doomed to decline. Instead, it invites us to see such territories as fertile grounds for reimagining the relationship between people, place, and biodiversity.

1. Case Study Introduction

1.1 Justification of the importance of the case study

Mértola, a municipality located in the semi-arid Baixo Alentejo region of southern Portugal, is the stage of a compelling case study due to its acute exposure to ecological degradation and socio-economic vulnerability. The territory faces a complex array of environmental challenges, including severe susceptibility to desertification, chronic water scarcity, soil erosion, and loss of fertility—problems that are aggravated by past and present land use practices, including intensive monocultures and unsustainable grazing patterns (Cortegano et al., 2021) also with heavy mining activity. These challenges are further compounded by the region's demographic decline, characterized by an aging and shrinking population and limited economic diversification (Agência Portuguesa do Ambiente, 2022; ICNF, 2022). This historical trajectory adds complexity to any attempt at ecological restoration, making Mértola a paradigmatic setting for experimenting with regenerative strategies that must engage with both past degradation and current socio-environmental pressures.

Mértola's vulnerabilities offer both a challenge and an opportunity: while its natural and social systems are under stress, the region has also become a fertile ground for innovative, community-based, and multi-level responses (Cortegano et al., 2021). These initiatives are taking place due to an integrated articulation between local governance and social and environment CSOs with particular emphasis to Terra Sintrópica Association (TSA), one of the societal partners of BiotraCes. This model of governance has been succeeding in scaling the level of experiencing of new techniques in agriculture and grazing.

TSA in cooperation with local authorities and other civil society actors aim to foster a transition grounded in syntropic agriculture, participatory governance, and inclusive food systems (Cortegano et al., 2021). These interventions challenge dominant paradigms by emphasizing soil regeneration, biodiversity enhancement, and intergenerational and intercultural inclusion, while also resisting the technocratic, top-down solutions often promoted in rural policy agendas.

The importance of the Mértola case lies in its potential to illuminate how local, situated responses can inform broader frameworks for climate adaptation, biodiversity regeneration, and just transitions in rural, semi-arid regions across Europe. It also provides a lens through which to examine the intertwining of ecological and social transformations, especially through participatory and more-than-human approaches that value traditional and community knowledge systems alongside scientific ones. The region's political ecology—marked by tensions between innovation and resistance, between sustainability discourse and conservative land imaginaries—makes it particularly rich for analyzing the socio-political dimensions of environmental change, including the institutional lock-ins, cultural conflicts, and power asymmetries that either hinder or enable transformative biodiversity practices.

In sum, Mértola offers not only a site of critical environmental urgency but also of possibilities. Its unique combination of ecological vulnerability, historical depth, and engaged community actors positions it as a strategic and fertile case for rethinking regeneration, co-governance, and resilience in the face of global ecological crises.

1.2 Explanation of the focus of the case study

The case explores how food systems are being reimagined not just as economic or productive sectors, but as dynamic ecologies of relationships between people, land, and institutions. Food becomes here both a material and symbolic entry point into broader processes of transformation. Practices such as community-supported agriculture, seed saving, training in syntropic and regenerative farming, local distribution networks, and regenerative economies are being tested and expanded as alternatives to extractive and top-down models of rural development.

These practices are embedded in strategies being co-developed and implemented by TSA, which plays a key role in facilitating participatory action research in the territory together with other CSOs and the local governance. The focus on the MFN allows the case to document and support how a shared vision of regeneration can materialize through food—by reconnecting people to land, revitalizing biodiversity, and creating new forms of care and mutuality.

By ecological degradation, rural depopulation, and socio-economic marginalisation. Central to this focus is the **Rede Alimentar de Mértola** (Mértola Food Network - MFN), an evolving discussion and decision-making group for collective experimentation that seeks to articulate agroecological practices, food sovereignty, and regeneration with inclusive governance.

Equally important is the role of **shared governance**, which is a cornerstone of the regenerative strategy. Shared governance is a key element in the Mértola Food Network but it might be said to go beyond that since it is related to other strategies designed outside the MFN. A wide range of actors—the **Municipality of Mértola, Terra Sintrópica (TSA), Mértola Future Lab, environmental and cultural associations, educational actors, local producers and informal initiatives**—are involved in co-defining and co-implementing the actions of the food network. This governance model does not simply aim at institutional coordination but seeks to **redistribute decision-making power**, integrate plural knowledges (scientific, traditional, experiential), and build long-term collaboration based on trust, transparency, and territorial commitment.

Through this lens, the case study does not frame resilience as passive adaptation to crises, but as a **transformative capacity** that emerges from social learning, cooperative action, and regenerative imaginaries rooted in place. The work around food systems in Mértola thus offers a valuable entry point to rethink sustainability transitions as grounded, participatory, and relational processes. It reveals how regenerative governance is not only about restoring ecosystems but also about **cultivating more just, inclusive and future-oriented relationships among humans and with the land**.

1.3 Research questions addressed by the case study

- How can regenerative practices—particularly those related to agroecology and local food systems—contribute to ecological restoration and biodiversity enhancement in a region marked by environmental degradation and climate vulnerability?
- How does co-governance foster community participation beyond established civil society organizations, and in what ways do local actors—such as farmers, institutions, and grassroots initiatives—collectively engage in building a place-based food system shaped by the socio-ecological specificities of the Mértola territory?
- To what extent does the Mértola Food Lab and its governance processes mitigate socio-environmental inequalities—such as those related to gender, age, migration, and access to land or knowledge—affecting the capacity of different community members to participate in and benefit from regenerative practices?
- What institutional and cultural lock-ins constrain regenerative transitions in Mértola, and to what extent do community-led practices—supported by local innovations, solidarity networks, and enabling policies—reconfigure territorial imaginaries, political agency, and everyday behaviours to foster transformative change?

1.4 Reading guide

This case study report is structured to provide a comprehensive and multi-layered analysis of the Mértola territory through the lens of regenerative biodiversity governance. It follows the template established in Deliverable D2.5 of the BIOTraCes project and integrates

findings from three deliverables: Transformative Biodiversity Innovations (Chapter 4 | D2.2), Social-Ecological Systems Analysis (Chapter 5 | D2.3), and locally tested interventions (Chapter 6 | D2.4).

The reader will first encounter an introduction to the case study (Section 1), including the justification for its selection, the research questions it addresses, and the conceptual and practical focus on regenerative food systems and shared governance.

Section 2 presents the methodological framework, detailing the participatory research designed with societal partners. It outlines how Participatory Action Research (PAR) was applied and how various methods—interviews, focus groups, workshops, and ethnographic observation—were combined to ensure a robust and situated analysis.

Section 3 offers an in-depth contextualization of Mértola as a social-ecological system (SES). It highlights the territory's demographic, ecological, political, and cultural specificities, emphasizing the diverse and sometimes conflicting worldviews that shape biodiversity governance in the region.

Sections 4, 5, and 6 are respectively focused on:

- Transformative Biodiversity Innovations (Section 4): including mechanisms of inclusion/exclusion, key niche innovators, and locally grounded innovations that challenge dominant paradigms.
- SES Analysis (Section 5): exploring the structural dynamics of the territory, power relations, knowledge systems, and values that shape biodiversity outcomes.
- Locally Tested Interventions (Section 6): reflecting on the implementation, testing, and evaluation of biodiversity strategies, highlighting both enabling factors and ongoing challenges.

Throughout the report, readers will find frequent references to field data (interviews, focus groups, workshops). These are essential to ground the analysis in lived experiences and on-the-ground dynamics.

This report is intended for a broad audience, including researchers, practitioners, policymakers, and community stakeholders interested in biodiversity regeneration, environmental justice, and inclusive governance. It offers both analytical insights and practical reflections that may inform policy design, grassroots strategies, and future research.

2. Research Methods and application of PAR

2.1 The role of social partner

In the Mértola case study, the involvement of our societal partners, **Terra Sintrópica Association (TSA)** and the **Mértola City Council (MCC)** have been central to all phases of the research process.

In terms of roles in the research process, they both actively contributed to the design and planning of the fieldwork. This included helping to map critical stakeholders and define the scope of the research and interventions, contributing to focus group scripts, and suggesting context-relevant questions that aligned with both the goals of the BIOTraCes project and the local community dynamics. Similarly, TSA and MCC played a key role in the organization of focus groups, assisted with the agenda-setting for interviews, and supported the mapping of critical stakeholders, ensuring a rich and diverse representation of voices across the territory.

Their involvement began in the early phases of the research, particularly during the first internal workshop (**IW**)¹⁴, where key concepts of the BIOTraCes project—such as transformative change—were collectively discussed with the societal partner. Methodological questions were also brought to the table, including criteria for the choice of data collection methods, facilitation strategies to stimulate participation, analysis techniques, and reporting formats. The workshop also served as a space to reflect on the ethical and practical dimensions of engaging with underrepresented groups in Mértola. The societal partners contributed with their own elaborated perspectives on participation, transformative change, and work, which significantly shaped the conceptual and methodological framing of the research.

This contribution also involved theoretical reflections upon key concepts in the project, such as transformative change and governance. In the first workshop (**IW**) organised online by the CES team with the TSA members, theoretical contributions were made regarding the concepts of participation, transformative change, work with marginalised groups, etc. We also discussed relevant criteria for data collection, analysis and report methods, considering the specificities of Mértola context. Furthermore, the workshop allowed for collective reflection on how to enter the territory respectfully, what constitutes adequate individual and collective consent, and how research methods could be aligned with local realities and values. These discussions evidenced a shared commitment to ensure inclusive participation from the outset and underscore the societal partner's active role in shaping the research architecture.

It is also worth mentioning how receptive TSA and MCC have been so far to the co-design and co-implementation of a work plan after the fieldwork stage. The initial draft of this action plan was based on contributions from the societal partners, who shared their diagnosis of the main gaps preventing the success of regenerative processes in Mértola. Their continued collaboration in the co-implementation of this plan reflects their ongoing engagement and ownership of the process.

As an organization already engaged in ecological and social regeneration and experienced in collaborative and transdisciplinary approaches, TSA demonstrated a high level of sensitivity to qualitative research methods, particularly group discussions, openness to the participation of the research team in their activities, demonstration and presentation of the study case to other researchers and so on. The Mértola City Council, in turn, facilitated access to key institutional stakeholders and contributed to the articulation of multi-actor focus groups, enabling a more integrated approach to understanding the governance dynamics in the region. The familiarity of both with research processes—stemming from

¹⁴ IW refers to the Internal CES workshop held in May 2024. The event identifier is IW_PT_05-24. See chapter 6 of this document for a list of events and identifiers.

their participation in other applied research projects—greatly facilitated the collaboration and contributed to a fluid and co-productive research environment.

Throughout the process, both societal partners have had an active role in supporting fieldwork logistics, facilitating interviews, co-hosting workshops, and ensuring alignment between research activities and local regenerative efforts. Their strategic and practical input has been essential not only in implementing the research but in co-shaping its direction and scope.

TSA's and MCC's deep-rooted connections in the community also enabled meaningful engagement with local actors, ranging from schools and farmers to older residents, to name but a few. Their presence and trust in the community helped build an open atmosphere for dialogue and participatory reflection during field activities.

2.2 Collaborative Research and Application of PAR

In the Mértola case study, we adopt a Participatory Action Research (PAR) approach grounded in the tradition of Orlando Fals Borda (Fals Borda & Rahman, 1991), while also incorporating insights from intersectional analysis and socioecological systems (SES) frameworks. This methodological integration has allowed us to address both the social and ecological complexities of regeneration processes in a semi-arid rural context.

The core principle guiding our research is shared decision-making, implemented in continuous collaboration with our societal partners—Terra Sintrópica Association (TSA) and the Municipality of Mértola (MCC). Together, we have co-designed the research process, developed tools and questions, and ensured that community perspectives inform the research at every step. This partnership has fostered mutual learning and reinforced the legitimacy and relevance of the data and interpretations generated.

While the project is firmly rooted in the PAR tradition, some flexibility and adaptations were required to respond to the context and needs of the societal partners:

- **Temporal Adjustments:** Due to the demanding schedules of our local partners, especially TSA, it was not always feasible to follow a strictly iterative and continuous PAR cycle. Instead, the research process has been shaped by phased engagement and bilateral negotiations, allowing for asynchronous collaboration where needed.
- **Integration of Additional Frameworks:** The complexity of ecological transition in Mértola led us to go beyond classic PAR by integrating multispecies perspectives and intersectionality to better capture the social-ecological entanglements at play.
- **Diffuse Co-creation:** Rather than limiting participatory research to predefined workshops, we embraced a diffuse model of co-creation across multiple events, informal gatherings, and joint reflections. This approach aligns with the everyday rhythms and emergent dynamics of the community, enabling more sustained and meaningful involvement.
- **Participatory Activities and Adapted Methodologies**

In alignment with PAR, we implemented a series of participatory methods and workshops, including:

- **Focus Groups:** Two focus groups, (**FG1 and FG2**) have been conducted as part of the intervention strategy. The first involved members of the *Mértola Food Network* (MFN), providing an opportunity for key actors — including civil society organizations, institutional representatives, and local producers — to collectively reflect on the achievements, limitations, and strategic direction of the food system transition in the region. The second focus group was held with community representatives from the seven parishes of the municipality, ensuring broader territorial inclusivity beyond the already organised actors. This second session focused on understanding the community's perceptions of biodiversity loss, as

well as of the weight of participation for its surpassing. This focus group also brought topics such as the adequacy of targeted communication and sensibilisation strategies, especially to youth, children, and the elderly, and other difficulties associated with geographic isolation such as transportation, distribution, and economic vulnerability.

- **In-depth Interviews:** in-depth interviews with 21 stakeholders were conducted with key institutional actors and grassroots representatives (key informants from TSA were interviewed more than once). These interviews aimed to uncover how diverse actors perceive and engage with the processes of regeneration, co-governance, and biodiversity restoration in the territory, while also mapping out mechanisms of inclusion and exclusion. Interviews were conducted with institutional representatives—including staff from the municipality, development agencies (e.g., ESDIME), environmental research centres (e.g., Estação Biológica de Mértola), civil society organisations, school representatives and others. These interviews shed light on the co-governance mechanisms at play, the challenges of securing sustainable funding, and the ongoing tensions between innovation and traditional land use models (e.g., montado conservation vs. intensive agriculture).
- **Workshops:** The set of workshops were planned as follows: a first workshop at May 2024 (IW) - with the aim of discussing key concepts for the project (eg. transformative change) as well as some preliminary ideas on methods and approaches to start the fieldwork; more specifically, with the aim of clarifying field strategy, reflecting on ethical considerations, and preparing for respectful engagement with members of TSA. The two focus groups aforementioned (**FG1** and **FG2**) were conducted in M25 and M30. Two other workshops are scheduled for December 2025: a Feedback Workshop (**FBW**), a moment of collaborative review and feedback with all participants, and a Cross-case co-learning workshop (**CoIW**), with the theme 'Participation and the youth's role in regenerative processes: opportunities and challenges.'
- **Multispecies Ethnography and Collective Diaries:** By including schoolchildren, as co-observers of interspecies interactions (plants, insects, soils) and the way these interactions bring to bear on collaboration instead of competition among species we foster a more inclusive understanding of what constitutes a regenerative territory. This could also give rise to a **nature diary** that maps more-than-human experiences and relations.
- **Participant Observation:** Conducted during key events such as Mértola's "Night at the Market," Food Network assemblies, and the launch of regeneration initiatives, this technique helped identify implicit tensions, alliances, and performative aspects of community engagement.

2.3 Triangulation

As initially outlined in Deliverable 2.1, the triangulation of methods includes **focus groups, in-depth interviews, and participant observation**.

Each method captures distinct yet complementary dimensions of the field:

- **Focus groups** allow for the identification of shared concerns, collective perspectives, enablers, potential solutions and relational dynamics among community actors. For instance, both focus groups with the Mértola Food Network and with the representatives of the community provided valuable insights into perceived bottlenecks in the regeneration process and highlighted opportunities for improving collaborative governance.
- **In-depth interviews** offer a deeper understanding of individual perspectives of key stakeholders and allow for a more nuanced exploration of positionalities, motivations, and constraints. These interviews were conducted with a diverse set of stakeholders, including local policymakers, municipal representatives, civil

society leaders, school staff, and community members with different roles in land and resource management.

- **Participant observation**, carried out during key events such as Food Network meetings, "Night at the Market" gatherings, and regeneration workshops, offered an immersive understanding of how actors interact with and engage in regenerative approaches and proximity agriculture perspectives during key community events.

By integrating these methods, we ensure **cross-verification** of information from different sources, validate emerging insights and reduce biases, ensuring our findings accurately reflect the complex realities of the field.

3. Case Study Contextualization

3.1 Multidimensional presentation

Mértola, a municipality in Portugal's Alentejo region, exemplifies the intricate interplay between historical legacy, socio-economic challenges, and ecological dynamics. This contextual analysis delves into Mértola's geographical, demographic, economic, political, and cultural facets, shedding light on the pressing issues of agricultural sustainability, food production, and demographic aging.

Mértola is located in southeastern Portugal, in the Baixo Alentejo subregion, and stands out for its Mediterranean semi-arid climate, low population density, and distinctive landscape composed of rolling hills, cork oak woodlands, river valleys, and arid plains. It is a municipality with biophysical and socioeconomic limitations classified under several indicators at the lower rates (García-Delgado et al., 2020; presentation video TSA). Among municipalities in the region, it is considered one of the most exposed regions to desertification in Europe and the impacts of climate change (Cortegano et al., 2021; round of interviews). The soil conditions throughout Mértola are generally poor, marked by low organic matter content, shallow horizons, and limited water retention capacity (Valente, 2009, quoted by Cortegano et al., 2021). These limitations have been further aggravated by long-standing anthropogenic pressures, such as overgrazing, inappropriate crop choices, and land-use policies. Notably, the mid-20th century "wheat campaign" launched during the Estado Novo dictatorship promoted extensive cereal cultivation across the Alentejo, branding the region as Portugal's breadbasket. This policy left a legacy of soil degradation and unsustainable agricultural practices that continue to shape the ecological challenges Mértola faces today.

The region sits at the intersection of several ecological zones, making it an important site for biodiversity — both for endemic Mediterranean species and for agroecological practices adapted to semi-arid conditions. Biodiversity challenges here are tightly linked to climate change, monoculture practices, water scarcity, and limited institutional capacity for environmental governance. The Guadiana River, one of the major watercourses of the Iberian Peninsula, runs through the region and has long shaped local livelihoods, ecosystems, and infrastructure.

Covering about 1,300 km², Mértola is among the largest yet least populated municipalities in Portugal (INE, 2022). This combination of vast territory and low population density has fostered the perception of a "territory of emptiness" (Corbin, 1995), where desertification, marginalization, and demographic aging intersect with limited economic diversification and ongoing land-use change. Annual precipitation is declining while temperatures rise, increasing the frequency of extreme events such as heatwaves and droughts (Graus et al., 2024).

Poor soil quality and harsh climatic conditions impose severe constraints on agriculture and other economic activities, reinforcing the municipality's economic fragility and accelerating outmigration and demographic decline.

Mértola is undergoing a significant demographic contraction. The most recent census reported fewer than 6,000 residents, with a population density of under-five inhabitants per square kilometer. The population is aging rapidly, with nearly half of all residents over the age of 60. Depopulation is particularly pronounced in remote villages and parishes, where abandoned homes and fallow land speak to a deeper pattern of rural retreat and socio-economic abandonment, which positions Mértola as "one of the most critical Portuguese municipalities in terms of depopulation and reduction of capacity to innovate" (Cortegano et al, 2021, p.5).

Migration patterns in the last two decades reflect both emigration and a modest influx of new residents. While many young people leave in search of education and employment in urban areas or abroad, the municipality has also welcomed newcomers—including international migrants and refugees, such as Afghan families supported by local

programs—as well as Portuguese citizens seeking alternative, sustainability-oriented lifestyles.

Economically, Mértola remains heavily reliant on its primary sectors—namely extensive livestock production, forestry, and hunting. However, these sectors are increasingly fragile, impacted by the effects of climate variability and largely sustained through European Union subsidies. Traditional agricultural systems, such as rainfed cereal farming and extensive livestock grazing, have sharply declined due to shifts in the rural economy, the collapse of smallholder farming, and continued population loss.

The current economic structure is marked by:

- A vulnerable primary sector, highly dependent on external subsidies and increasingly affected by extreme weather events;
- A limited industrial and service base, with the majority of services concentrated in the town of Mértola;
- A nascent but growing field of agroecology, regenerative pastures and regenerative tourism, largely driven by civil society initiatives and supported through European and national funding.

Whereas the youngsters continue to leave the territory, searching for better labour and educational opportunities, Mértola has also attracted a small but notable number of eco-migrants, researchers, and agroecological practitioners who view the region as fertile ground for experimentation and innovation in sustainable living.

Mértola's local body plays a central role in planning and facilitating territorial development. The current municipality has embraced ecological and participatory planning principles, aligning itself with broader European agendas on sustainability and climate adaptation.

Local governance is marked by a collaborative ethos, visible in initiatives like the Mértola Future Lab (MFL) — a territorial strategy where public authorities, associations, schools, and residents jointly explore responses to desertification and ecological degradation. This collective strategy embodies the principle of co-governance, where public and civil society actors work together to experiment with regenerative practices (Cortegano et al, 2021)

3.2 Key Actors and their Impact on Worldviews

Civil society groups like *Terra Sintrópica Association* (TSA), the *Mértola Future Lab* (MFL), and *ESDIME* play a central role in redefining the region not as a “territory of emptiness,” but as a living system full of regenerative potential. Meanwhile, conventional economic actors, which also play an essential role, such as montado estate owners and cereal farmers, often perceive nature in utilitarian terms—valuing biodiversity as a function of game species, pasture productivity, or hunting value. Emerging eco-entrepreneurs represent a small but growing group who view biodiversity as a resource for innovation in high-value agricultural products and tourism. These different framings directly impact land management practices, from grazing intensity to crop selection, with cascading effects on habitat health and species survival.

Beyond the human sphere, more-than-human actors—such as the Guadiana River, montado cork-oak forests, degraded soils, and species like the Iberian lynx—play critical roles in the region's ecological and symbolic life. Soils are seen by TSA as collaborative agents in regeneration, while conservationists position the lynx as an emblem of ecological integrity. Even invasive species, like acacias, are being re-evaluated by TSA as transitional agents that can build organic matter and prepare the ground for native forest restoration. The coexistence of these perspectives illustrates the complexity of local ecological narratives, where competing visions—extraction, conservation, and regeneration—collide and negotiate over what the future of Mértola should look like.

Implications for the socio-ecological system:

- *Power relations* – The municipality controls access to EU funds; landowners control 70 % of the territory; TSA gains soft power through its demonstration sites and narrative agility.
- *Knowledge pluralism* – Syntropic trials provide locally generated evidence that contests the dominance of hydraulic engineering solutions.
- *Transformative potential* – Where the three narratives find common ground (e.g., cork-oak restoration, local gastronomy), coalitions emerge that scale regenerative practices; where they diverge (e.g., big dams vs. soil water), stalemates persist.

3.3 Biodiversity loss factors

The biodiversity dynamics in Mértola must be understood within the frame of compounding pressures that range from ecological degradation to socio-economic marginalization and cultural tensions around land use and regeneration practices. Biodiversity in this semi-arid area of southeastern Portugal is under significant stress due to both direct drivers—such as land-use change, climate change, and water scarcity—and indirect drivers, including demographic shifts, economic dependency on unsustainable agriculture, institutional fragmentation, and cultural resistance to alternative imaginaries of land stewardship.

Current trends in biodiversity in Mértola show a steady loss of habitat complexity, reduced soil fertility, declining agrobiodiversity, and increasing desertification risk. These changes result from decades of monocultural land management, aging rural populations, and water overuse or misallocation. The territory's vulnerability is further exacerbated by climate change-induced extreme weather patterns, particularly droughts and heatwaves, which place additional strain on ecological systems and food production.

As highlighted in *Deliverable 1.7*, biodiversity change stems from an interaction of direct and indirect drivers. Direct drivers include changes in agriculture and forestry practices, pollution (particularly nutrient runoff and pesticide use), and resource overexploitation—especially in terms of water use and soil depletion. Indirect drivers are more complex and systemic, ranging from economic dependence on Common Agricultural Policy (CAP) subsidies to demographic aging and rural exodus, which limit human and institutional capacity for ecological transition.

In Mértola, food production and distribution constitute the central terrain of both biodiversity challenge and opportunity. Whereas practices rooted in rainfed cereal farming and extensive grazing constitute a pervasive challenge in a semi-arid area (Cortegano et al, 2021), necessitating urgent adaptation strategies, a coalition of local actors including associations like Terra Sintrópica, the Mértola Municipality, and the Mértola Food Network is giving rise to participatory strategies aimed at carbon-neutral food logistics, intergenerational knowledge exchange, and valuation of place-based agroecological systems.

However, these efforts unfold within a fragmented socio-cultural landscape. Different groups (e.g., school teachers, municipal technicians, elderly residents, agroecological entrepreneurs) often operate with contrasting definitions of key concepts like "biodiversity," "ecological restoration," and "regeneration." While children involved in school gardening projects may be introduced to syntropic agriculture, older residents may retain strong attachments to past practices and landscapes that were shaped during Portugal's mid-20th century cereal campaigns.

Discrepancies in cultural imaginaries and technical literacy regarding sustainable practices hinder the consolidation of biodiversity-friendly initiatives. As *Deliverable 1.7* emphasizes, cultural and knowledge-related indirect drivers, including mismatched values and lack of environmental awareness, can perpetuate biodiversity decline when they go unaddressed within governance and education structures.

In this context, biodiversity loss in Mértola must be understood not simply as a biological or ecological phenomenon but as a multi-layered socio-political and cultural process. The

key to reversing biodiversity decline lies in embracing and negotiating the heterogeneity of worldviews, knowledge systems, and territorial claims that exist among the area's diverse human and more-than-human actors. Subsequent subsections will explore in greater depth the specific cultural, political-institutional, and identity-related drivers of biodiversity change in the region.

3.4 Culture-based dynamics

Please describe how the diversity of values—including local beliefs, social attitudes, and hybrid forms of knowledge (such as expert, local, and traditional knowledge)—shapes relationships with biodiversity and the ownership of nature-based solutions within the community. What types of values (e.g., relational, instrumental, intrinsic, etc.) characterize the society-nature relations in the context of the case study? Do different actors hold divergent values? If so, do these values conflict with one another? How have human-nature relations transformed as a result of these changes?

In the Mértola case study, biodiversity governance and the implementation of nature-based solutions are deeply shaped by the coexistence—and sometimes conflict—of divergent value systems, imaginaries, and knowledge traditions. We could identify at this moment at least three dominant trends in value systems and social attitudes that influence how nature and biodiversity are perceived and managed in Mértola:

- A. **The Imaginary of the “Traditional Alentejo”.** A powerful and persistent imaginary frame the Alentejo region as a landscape of vast open plains whose agricultural vocation lies in extensive cereal production and livestock grazing. This vision is historically rooted in the Estado Novo’s “Wheat Campaign” and reinforced by decades of rural policy promoting monocultures and mechanized tillage. It aligns with instrumental values, where nature is seen primarily as a productive resource to be controlled and optimized. In this context, large-scale solutions—such as irrigation infrastructure, subsidies, or river transposition—are favoured, while small-scale or non-standard approaches (e.g., syntropic farming, holistic grazing) are often undervalued or misunderstood.
- B. **Economic Insecurity and Policy Lock-ins.** Tight profit margins and rising input costs create an environment of insecurity among small and medium farmers. This makes many landholders risk-averse, especially when regenerative approaches require upfront investment or shifts in familiar practices. Moreover, the structure of CAP subsidies has historically reinforced conventional methods, trapping farmers in cycles of soil depletion and chemical dependency. This dynamic reflects a tension between short-term instrumental rationality (economic survival) and the longer-term relational values promoted by regenerative actors, who advocate for multispecies cooperation and soil restoration.
- C. **Prevalent Practices vs. Ecological Imagination.** Standard farming practices in Mértola—such as soil inversion, burning plant residues, or chemical use—are embedded in deeply held ideas of “what works” and “what a productive field looks like.” These routines are not only technical but cultural, shaped by generational knowledge and social norms. Regenerative initiatives, such as those led by Terra Sintrópica, the Mértola City Council, and ESDIME, promote a shift toward relational and intrinsic values, where nature is not merely a resource but a living system to be co-created with. Yet fostering this ecological imagination requires not only demonstration and training but also narrative change and intergenerational dialogue.

These trends result in value pluralism, but also in tensions. For example:

- Municipal maintenance staff may mistake syntropic gardens for “weeds” to be cleaned.

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- Elderly residents may feel alienated by calls to replace familiar tree species with regenerative ones.
- Teachers, technicians, and youth educators may lack a shared vision of what biodiversity restoration looks like.

Despite these frictions, important transformations are underway:

- Regenerative initiatives have begun integrating elderly knowledge through therapeutic gardens and intergenerational education.
- Regenerative pasture experiments are slowly reshaping local subsidy criteria.
- School gardens are shifting perceptions among younger generations.
- The participatory governance of the Mértola Food Network offers a platform for dialogue, alignment, and contestation among actors with different values.

However, these efforts are resource-intensive and culturally sensitive. As noted by local actors, achieving a deep transformation in dominant mentalities across the broader Alentejo region would require a dedicated strategy but crucial in the long run.

3.5 Identity-based dynamics

While the Mértola case study is not structured around an explicit intersectional analysis, the current fieldwork reveals a set of identity-based dynamics that influence both the understanding of biodiversity challenges and the reception or uptake of nature-based solutions. These dynamics are visible across axes such as gender, age, class, and nationality, and have implications for participation, knowledge recognition, and ecological engagement.

Gender and Age

One of the most visible social patterns in Mértola is the intersection of gender and generational status, particularly in relation to knowledge about food, farming, and health. Elderly women, especially those working in kitchens of social economy organisations (e.g., community restaurants, school meal services), hold essential practical knowledge about local ingredients, seasonal cycles, and preparation techniques that support healthy and sustainable diets. Although often overlooked or considered “low-skilled” in broader contexts, these women play a pivotal cultural role in transmitting ecological knowledge to younger generations and could become key agents of change in local food systems. However, women’s roles in the local economy—particularly in food-related tasks—remain undervalued, and many of the women involved in these informal knowledge networks also face the double marginalisation of low education and advanced age. Engaging these women not just as “bearers of tradition,” but as critical voices in shaping regenerative practices, is a goal increasingly recognized by local actors like Terra Sintrópica and the Mértola Food Network.

Age and Authority

In Mértola, the elderly population is not only demographically dominant but also symbolically central. Their continuity in place and embedded experience in land use grant them a certain authority, yet their practices often reflect older, more extractive models of soil management (e.g., tilling, burning, monoculture). Local initiatives have responded to this with a strategy of gentle experimentation: instead of confronting elders with notions of error, regenerative associations invite them to test new ideas with their own hands and observations. This has created opportunities for slow but meaningful shifts in worldview, though changes are recognised as occurring on a generational timescale.

This age-based dynamic has been handled with sensitivity in Mértola. Elderly knowledge is validated even when it differs from scientific or syntropic models. In return, elders are increasingly involved in initiatives such as therapeutic gardens and intergenerational

learning events, ensuring they are not merely passive recipients of innovation but active participants in ecological imagination.

Nationality, Belonging, and Migration

Migration remains a delicate subject in Mértola, particularly as it relates to integration and perceptions of “the other.” The arrival of Afghan refugees and other migrants through projects like *Shelterland* reflects a new phase of rural diversity. Terra Sintrópica and its allies have taken care to connect migrants with local elders, creating opportunities for mutual learning and cultural exchange. Still, early indications suggest that some tensions persist, especially where older residents associate immigration with uncertainty or disruption to established norms.

Class-based dynamics are visible through differences in access to land, formal education, and institutional decision-making. Many regenerative actors (e.g., recent in-migrants or eco-entrepreneurs) enter the territory with higher levels of education and external funding, while long-term residents often rely on low-income farming, hunting, or service-sector work. This creates a latent asymmetry in who can adopt new techniques, apply for subsidies, or influence policy. At the same time, low schooling levels among older and working-class residents mean that official narratives around “biodiversity,” “carbon neutrality,” or “agroecology” may not resonate unless they are retranslated through everyday practices and culturally grounded knowledge systems. Local associations have recognized this and have gradually refined their communication, for example by using visual methods and practical demonstrations instead of technical jargon.

3.6 Political/Institutional Dynamics

While Mértola is increasingly recognised as a site of ecological experimentation and participatory governance, several political and institutional barriers continue to shape its biodiversity trajectory. In the broader Alentejo region, land management debates are often framed within traditional paradigms—such as irrigation expansion, river diversion, or fodder subsidies. These approaches reflect a longstanding orientation toward productivity and risk management, and they continue to dominate over emerging regenerative models such as holistic grazing or syntropic agroforestry. This pattern mirrors a wider institutional preference across Baixo Alentejo, where innovation is frequently constrained by legacy policies and sectoral routines.

At the operational level, funding mechanisms and administrative procedures pose additional limitations. Common Agricultural Policy (CAP) instruments and national subsidies remain largely aligned with conventional, high-input farming models, offering limited space for agro-ecological experimentation. Public procurement frameworks, governed by EU directives, further restrict institutional flexibility. Despite local initiatives to prioritise organic and locally produced food in public kitchens, procurement laws often require lowest-cost contracts, undermining sustainability goals. Meanwhile, institutional inertia persists within municipal structures, where long-standing professional routines and role expectations can inhibit the uptake of regenerative practices. These factors contribute to a broader lock-in effect, where systems default to established paths even when alternatives are locally known and available.

Nevertheless, counter-dynamics are visible. Co-governance arrangements—such as those fostered by the Mértola Food Network—demonstrate institutional capacity for collaborative, cross-sectoral decision-making. Actors like the Terra Sintrópica Association and ESDIME have contributed to reframing the territory’s ecological identity, moving from a narrative of desertification to one of regenerative possibility. These shifts are reinforced by flexible interpretations of national policy at the municipal level, and by emerging funding practices that increasingly value ecological regeneration. However, critical inclusion gaps remain. Roma communities and some immigrant groups continue to be peripheral to governance mechanisms, despite the acknowledged potential of their engagement for enhancing both

social equity and ecological resilience (Araújo and Brito, 2018). Addressing these gaps will require targeted strategies in areas such as housing, legal regularisation, and access to land, alongside continued investment in dialogue and trust-building across the territory.

4. Transformative Biodiversity Innovations

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4.1 Analysis of Inclusion/Exclusion Mechanisms

Exclusionary Practices

Although syntropic agriculture and regenerative practices are being tested in Mértola, much of Alentejo's agricultural paradigm remains rooted in conventional, large-scale farming models. These dominant models prioritize market logics, water-intensive methods, and standardized production (Nathan, 2023). Exclusion is also reinforced by subsidy structures and public procurement laws. CAP (Common Agricultural Policy) incentives in Portugal often prioritize conventional agriculture, limiting access to resources for small producers practicing regenerative methods. Additionally, EU procurement directives, which mandate selection based on lowest price, disadvantage local farmers and discourage biodiversity-oriented food systems.

Power asymmetries play a central role in marginalization. Perspectives aligned with industrial agriculture and centralized planning often dominate political discourse and policy implementation at a regional and national level. As a result, local producers and elderly residents with land-based knowledge are rarely consulted in broader territorial planning.

A cultural mismatch also sustains exclusion. Prevalent imaginaries of Alentejo — as a region of open plains, cereal crops, and hard manual labor — perpetuate resistance to alternative ecologies and regenerative farming. These imaginaries act as mental lock-ins that hinder change, casting new practices as incompatible with the region's perceived identity.

Inclusive Mechanisms

Despite these exclusionary tendencies, Mértola also demonstrates noteworthy inclusive mechanisms that contribute to a more just and effective biodiversity governance.

Mértola City Council has fostered a horizontal approach that brings together diverse actors—from school cooks and farmers to technicians—in shared decision-making spaces like the Mértola Food Network. This network provides a forum for co-creation and coordination across food production, procurement, and distribution, helping ensure that regenerative practices are locally grounded and collectively supported. Besides, Mértola, through its co-governance model, has stimulated different practices, more connected with biodiversity regeneration, in neighboring municipalities such as Alcoutim, Castro Verde, and Ourique. Partnerships in biodiversity regeneration projects have been particularly common. A good example is the partnership between the Mértola City Council, the Alcoutim City Council, TSA and the Forest Owners Association of Cumeadas do Baixo Guadiana for converting degraded forest ecosystems of monoculture of stone pine, eucalyptus and acacia in the semi-arid territories of Mértola and Alcoutim into native forest (Mértola, website, 2022).

The municipality of Mértola has shown openness to participatory governance beyond rhetoric. For example, despite restrictive procurement laws, it has implemented significant changes in collective catering systems in schools and care centers, prioritizing local and organic food. These changes, though technically complex and legally constrained, were made possible through collective coordination and trust between actors.

Central among these is the regenerative framework of syntropy, promoted by the Terra Sintropica Association (TSA). This philosophy underpins many of Mértola's participatory projects and has become a guiding principle in fostering inclusive biodiversity strategies, even when the name syntropy has not been evoked.

Several targeted initiatives have also promoted inclusion. The "Shelter Land" project, co-led by TSA and international partners, provides Afghan refugees with training in syntropic agriculture, integrating them into local regeneration efforts. This initiative not only

addresses environmental goals but also supports social inclusion and capacity-building for marginalized groups. Projects like “Grandmother’s Kitchen” and “There’s a Party in the Forest Garden” illustrate efforts to bridge generational divides and validate the knowledge of older residents. These initiatives recognize the role of elderly women in preserving healthy food practices and foster intergenerational exchange. The use of convivial tools such as music, painting, and storytelling helps make regenerative knowledge accessible and emotionally resonant, reinforcing a sense of ownership among participants.

Nonetheless, inclusion remains a dynamic and contested process. Differences persist between progressive and conservative factions in the municipality. While TSA and allied actors have created an “experimental space” of governance and imagination, a considerable part of the population remains uninformed or disconnected from these initiatives. This “two Mértolas” dynamic points to the need for improved communication and mobility support (e.g., transportation from remote parishes) to ensure broader participation.

4.2 Niche Innovators and Key players

Terra Sintrópica Association (TSA)

As a pioneering actor in regenerative agriculture, TSA is a key actor in Mértola’s transformative ecosystem. Their approach is rooted in syntropy—a concept that emphasizes mutualism and co-evolution between humans and non-humans—as the basis for biodiversity regeneration and socio-political renewal.

ESDIME (Agency for Local Development in the Southeast Alentejo)

ESDIME has consistently operated at the interface of development policy and ecological innovation. It has introduced techniques such as holistic grazing and keyline water retention design to the regional landscape, created local funding instruments to support small farmers in adopting biodiversity-friendly practices.

Mértola Biological Station (MBS)

MBS is both a scientific platform and a local innovation hub. It contributes to biodiversity research and promotes educational programs that link ecological theory with applied action. As a core partner in the “Mértola—Laboratory for the Future” initiative, EBM advances interdisciplinary approaches to address desertification, soil erosion, and climate adaptation.

Mértola Food Network (MFN)

MFN is a collaborative network composed of institutional and community members who share responsibilities in redesigning local food systems. It fosters horizontal governance structures, mutual accountability, and intergenerational learning. Through regular meetings and participatory forums, FMN exemplifies collective agency and shared vision in the context of biodiversity and food sovereignty.

Mértola Future Lab

A more recent yet increasingly influential player is the *Mértola Future Lab*, an innovation platform aimed at envisioning and co-producing long-term strategies for ecological transition. Coordinated in close synergy with MBS and animated by MCC and other local actors, the Future Lab functions as both a think tank and an experimental space, mobilizing young researchers, policymakers, and local stakeholders to reimagine land use, sustainability, and community futures.

The Influence of Niche Innovators and Key Players

The agency of these actors is increasingly recognized at both local and national levels. Some of them are internationally recognized - researchers and activists from different countries coming to Mértola to see what has been done in the territory for soil regeneration and biodiversity.

Their legitimacy stems not only from the visible outcomes of their projects — such as restored soils, educational gardens, or altered procurement models — but from their process-oriented approaches. These niche players promote co-design, long-term experimentation, and knowledge exchange, which are critical for systemic change.

- ✓ **TSA's syntropic training programs** have been challenging imaginaries of what agriculture can be in semi-arid regions.
- ✓ **ESDIME's food sovereignty agenda** has been introducing alternatives to the subsidy-dependent monoculture paradigm.
- ✓ **MBS' research networks** offer scientific validation and technical tools that support policy experimentation.
- ✓ **MFN's collective decisions** have changed public procurement routines, prioritizing local and healthy food over industrial products.
- ✓ **The Future Lab's strategic foresight** brings long-term thinking into local planning and helps bridge generational divides in imagining biodiversity futures.

The Centre for Social Studies (CES) is a recognized research institution committed to democratizing knowledge and revitalizing human rights through approaches that are democratic, participatory, and decolonial. With a strong impact in the social sciences and humanities, CES has engaged with several of these innovators through meetings, interviews and participant observation, and will co-host public events throughout 2025-26. CES was also invited to attend MFN meetings and conducted a focus group with its members. This session helped the network identify key communication gaps — particularly with youth and elders — and collaboratively develop an action plan aimed at supporting biodiversity regeneration and transforming food systems.

CES also established ties with the Future Lab, TSA and MCC to explore participatory methods and examine the role of imagination and narrative in biodiversity restoration. Ongoing conversations aim to develop future-oriented workshops with rural youth and community leaders.

It is important to emphasize that these key players are highly developed in both their intervention and research strategies. As such, CES does not assume a central or leading role in driving innovation within the field. On the contrary, we position ourselves as a supportive and respectful partner, acknowledging the deep expertise and strategic clarity already present among the local actors.

How Innovators Engage with the Community

Each of these niche players maintains strong connections to the community:

- ✓ TSA works directly with elders, refugees, and school children.
- ✓ ESDIME facilitates farmer-to-farmer knowledge exchange.
- ✓ MBS and the Future Lab engage students and researchers in applied ecological research and scenario planning.
- ✓ FMN connects institutional kitchens to small-scale producers and families

4.3 Scalable Bottom-Up Innovations for Transformative Change

A. Identification of Existing Innovations

In Mértola, innovations related to biodiversity are deeply tied to regenerative agriculture, participatory governance, and local food systems. These innovations differ markedly from conventional top-down or business-as-usual policies by rooting their transformative potential in collaborative learning, knowledge co-production, and experimentation. Three core innovations stand out:

A.1 Syntropic Agriculture and Terra Sintropica Association (TSA)

TSA plays a leading role in implementing syntropic agriculture in the region.

The Shelter Land Project exemplifies the potential for both biodiversity restoration and social inclusion. Hosting Afghan refugees and training them in syntropic practices, the project promotes intercultural learning, local knowledge exchange, and the integration of marginalized groups into regeneration efforts.

A.2 Mértola Biological Station (MBS)

MBS, part of the broader strategy "Mértola: Laboratory for the Future," represents institutional innovation. It combines research, vocational training, and service provision (e.g., soil analysis, game management plans) in a context where ecological transition is a survival strategy. MBS challenges the perception of Mértola as a place with no future by attracting researchers and providing youth with new vocational pathways linked to biodiversity and agroecology.

A.3 Food System Innovations: The Mértola Food Network (MFN)

The MFN is a group where local producers, public officials, cooks, technicians, and social organizations jointly develop strategies to enhance local food systems. Its initiatives include transforming school menus, supporting proximity agriculture, and integrating biodiversity concerns into collective catering.

B. Transformative Potential and Equitable Access

These innovations propose system-level shifts in the way land, food, and knowledge are managed. Their "nature positive" orientation is evident in the promotion of soil regeneration, agro-biodiversity, sustainable diets, and equitable inclusion. However, equitable access remains a challenge, particularly for isolated communities, low-income residents, and elderly populations. Residents in remote villages still face structural barriers such as lack of transportation and local markets. Similarly, the Roma community remains underrepresented in regeneration initiatives. Addressing these inequalities is essential to scaling the innovations inclusively.

C. Integration of Cultural and Epistemic Diversity

A notable feature of Mértola's approach is the integration of cultural and epistemic diversity. TSA's methods include participatory and experiential activities like the Therapeutic Garden Project, which combines art, memory, and ecological care with older residents. These initiatives foster new narratives and imaginaries about the territory, bridging the gap between scientific and traditional ecological knowledge.

The regeneration discourse in Mértola avoids technocratic imposition. Instead, it recognises the agency of local actors, particularly the elderly, whose knowledge is considered vital to the success of land-use changes. Syntropic agriculture, in this context, is not just a technique but a method of social inclusion and mutual recognition.

D. Social Networks and Key Stakeholders

The strength of the innovations relies on a dense and responsive social network involving:

- TSA and its core team
- MBS researchers and staff
- Mértola City Council (especially the Vice-President)
- ESDIME (development agency)
- Local producers and cooperatives
- Educators, school cooks, and healthcare workers
- Community members, including children and the elderly

E. Diachronic Analysis: From Initiation to Effects

E.1 Prior to the emergence of regenerative practices, Mértola's socio-ecological system was characterized by soil degradation, emigration, and dependency on EU subsidies tied to conventional agricultural practices. Public procurement followed price-based criteria, sidelining local producers.

E.2 Today, the impact of these innovations is visible in various dimensions:

- ✓ School and community catering include local and organic produce.
- ✓ New vocational pathways in agroecology and wildlife management are emerging.
- ✓ Youth are slowly being re-engaged with rural futures.
- ✓ Dialogue on water retention, dryland farming, and regenerative pastures is gaining ground.

4.4 Initial Mapping of Interventions

The regeneration strategy underway in Mértola aims to go beyond conventional biodiversity protection by grounding actions in community participation, ecological experimentation, and regenerative economics. However, a central challenge persists how to make these practices visible and accessible to the municipality's 106 dispersed populations, many of whom remain unaware or disconnected from the regeneration underway.

CES, in collaboration with Terra Sintrópica (TSA) and the Mértola City Council (MCC), carried out a second round of focus groups (FG2_PT_02-25, see Deliverable 2.4). designed to deepen understanding of local perceptions, and more importantly, to engage residents ensuring that all seven parishes were represented, and that citizens from various social positions—not only institutional actors—were heard.

A key strategy involves transforming participation from passive consultation to active learning. For instance, at the end of the focus groups, participants were offered organic baskets produced by TSA. This was more than a symbolic gesture, but a pedagogical act: a way to materialize what regeneration means—tangible, edible, rooted in the territory. Through taste, people learn what is being grown regeneratively and how it impacts soil, health, and autonomy.

The strategy proposed in the action plan will include community communication proposals, participatory tools that include a children's diary project documenting biodiversity, a "Nursery of Experiences" featuring workshops on traditional knowledge and memory-based planting, and economic regeneration activities like discussions on community redistribution and local entrepreneurship.

To monitor progress, metrics include participation diversity, engagement with communication tools, and feedback on inclusion and relevance. The initiative challenges top-down conservation by rooting biodiversity protection in everyday life and by co-designing solutions with the community. Lessons learned emphasize the need for inclusive language, culturally resonant methods, and infrastructure that supports care and mobility—key considerations for future interventions under Task 2.4.

4.5 Discussion

The Mértola case offers a distinctive lens through which to reflect on the complexities of implementing transformative change via biodiversity-focused bottom-up interventions. It encapsulates both the promises and the limitations inherent in efforts to foster ecological restoration in regions marked by desertification, depopulation, and entrenched economic and cultural practices. The findings from the various sections—especially the analysis of niche innovators, scalable innovations, and participatory gaps—reveal that while progress is evident, the broader structural conditions demand both respecting community rhythms and critical scrutiny from researchers and institutional actors alike.

One of the critical contributions of this case lies in challenging the traditional hierarchy of expertise in sustainability transitions. As noted in earlier sections, organizations such as Terra Sintropica (TSA), ESDIME, and the Mértola Biological Station (MBS) do not operate as satellites of research or university-led design; they are fully fledged nodes of innovation in themselves. In this context, CES situates itself as an interlocutor, someone that brings in reflexivity, supports critical dialogue, and engages in co-learning, rather than leading or imposing interventions.

This epistemic posture not only fosters trust but aligns with the very principle of regenerative governance—transcending extractive forms of knowledge production to embrace collaborative, situated, and plural epistemologies. In this sense, the discussion reaffirms that innovation in Mértola is about creating cultural and emotional infrastructure for people to imagine different futures.

The co-governance structures observed in Mértola—particularly the functioning of the Food Mértola Network and the participatory ethos behind MBS and TSA—provide fertile ground for rethinking how collective responsibility can be enacted. These networks, while still navigating tensions related to power asymmetries, funding competition, and differing ecological visions, demonstrate an impressive capacity to hold diversity and disagreement without paralysis.

Yet, as the focus group feedback and action plan reflections suggest, this co-governance model remains somewhat more prevalent to “institutionalised” stakeholders. Ordinary citizens from the 106 dispersed populations in Mértola’s territory continue to face barriers to meaningful engagement, be it due to isolation, lack of information, or structural socioeconomic constraints.

The implications are clear: interventions must go beyond organizational partnerships and reach deeply into the socio-spatial fabric of the region. This involves acknowledging the multiplicity of knowledge and lived experiences that are often overlooked when participatory processes privilege the most visible or already-organised actors.

A salient thread across the entire process is the evolving understanding of participation—not merely as attendance at meetings or approval of plans, but as the capacity to shape the terms of engagement.

In this sense, the goal is not to mobilize people for “our” sustainability agendas, but to identify points of resonance with their lived realities and help unlock their capacity for autonomous action.

Several actors—particularly MBS and TSA—are actively working to counteract the prevalent narrative that positions Mértola as a land of no future. Through education, youth engagement, and hosting international researchers and refugees, they are crafting new imaginaries of possibility grounded in the soil, biodiversity, and intercultural cohabitation.

While the innovations in Mértola are impressive in scope and ambition, the discussion also highlights key equity gaps that require ongoing attention. The underrepresentation of the Roma community, the misrecognition of women's role in the community's resilience and knowledge, the challenges faced by isolated elderly populations, and the limitations posed

by inadequate transportation infrastructure all point to a need for more inclusive frameworks.

These are not minor obstacles. They speak to the layered inequalities that can undermine otherwise well-designed ecological strategies.

5. Socio-Ecological System Analysis

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5.1 SES dynamics, interactions, and relations

SES impact on different actor groups

The Mértola case study reveals a social-ecological system (SES) shaped by a web of interactions between human and more-than-human actors, structured by desertification, depopulation, water scarcity, and emerging regenerative initiatives. These actors do not operate in isolation; their roles, vulnerabilities, and transformative potential are deeply interconnected with territorial imaginaries, institutional capacities, cultural values, and ecological processes. Below we present key actor groups and their positioning within the SES.

1. Elderly rural residents and low-income populations

These groups are among the most directly affected by SES degradation. Living in isolated villages, often with poor mobility, they face direct impacts from soil infertility, declining water availability, and loss of traditional farming systems. Their lives are also affected by weak access to health services and pensions, especially for older women. Despite these constraints, they are vital holders of local knowledge—especially regarding subsistence agriculture, wild plants, and seasonal patterns.

However, this knowledge has long been undervalued and marginalized in formal land management or policy design. Lock-ins include inadequate mobility infrastructure, lack of targeted communication strategies, and insufficient institutional mechanisms to integrate their knowledge. Nonetheless, initiatives such as the Grandmother's Kitchen and Therapeutic Gardens (by TSA) are starting to reposition their agency within regenerative strategies.

2. Women in social economy organizations and food provisioning

Elderly women from the community in general and the ones who are working at schools and nursery homes (e.g. cooks) hold crucial know-how on healthy, seasonal, and biodiversity-friendly food practices. Yet, their role is largely invisible in biodiversity policy discussions. While these women are essential to the local food system, they face social and economic lock-ins—including gendered undervaluation of labor and limited decision-making power. The participatory food governance strategy of the Mértola Food Network (MFN) is gradually elevating these contributions by revaluing cooking as a practice of care, transmission, and ecological learning.

3. Young people and children youth

Youth is impacted by declining educational and employment prospects, often migrating away and weakening the generational continuity necessary for territorial resilience. There is also a fragile connection between young people and environmental awareness. They are insufficiently reached by biodiversity-related communication or vocational strategies. While initiatives such as the Mértola Biological Station and ALSUD provide training in agroecology, game management and biodiversity management, these efforts are still too limited to counter the dominant perception of Mértola as a “place without a future.” Dependencies include a lack of career pathways, mobility options, and place-based innovation ecosystems.

4. Regenerative actors and agroecological entrepreneurs, including newcomers with environmental backgrounds, agroecological entrepreneurs, or project-based professionals, are both contributors to and shaped by the SES. They are less directly affected by socio-ecological degradation (often arriving with financial and educational resources) but are impacted by bureaucratic hurdles, cultural resistance to change, and the difficulty of scaling innovations in a structurally fragile economy. They depend on external funding and may lack long-term embeddedness, raising concerns about the sustainability of their

contributions if the local social fabric is not strengthened. Their innovations often contrast with prevailing economic structures, generating both inspiration and tension.

5. Civil Society Organisations (CSOs) and Societal Partners

Civil society organizations (CSOs) such as Terra Sintrópica (TSA), ESDIME, ALSUD, and Empresários do Baixo Guadiana (Association of the Guadiana Valley's undertakings) play a central role in shaping the SES through innovative actions like the Mértola Food Network, the Mértola Future Lab, and training programs in regenerative agriculture and biodiversity-related vocations. These organizations are often at the forefront of proposing and implementing nature-positive solutions—such as syntropic agriculture, regenerative pastures, and alternative food systems—that directly challenge business-as-usual approaches in the region. They are empowered by access to EU and national funding, policy advocacy tools, and recognition in regional and international forums.

However, their capacity to operate and innovate is also constrained by several structural limitations. These include the reduced administrative and financial autonomy of the municipality, fragmented institutional landscapes, and the high dependence on project-based funding. Additionally, despite their prominence, CSOs tend to be concentrated in the village of Mértola, while many of the municipality's 106 dispersed localities remain physically and socially distant from these hubs of innovation. This spatial concentration can hinder the broader social embedding of the regenerative agenda and limit the reach of their initiatives.

The effectiveness of CSOs is further tied to their ability to work in concert with other actors. These organizations thrive when they form synergistic relationships not only with the Mértola City Council (MCC) but also with each other, creating an ecosystem of cooperation that enhances legitimacy, resource-sharing, and collective impact. At the same time, their initiatives are dependent on gaining validation from local communities—something that is not automatic. Community trust must be built and maintained, especially when these organizations are perceived as external or disconnected from daily rural realities. These dynamics underscore the importance of inclusive engagement strategies that go beyond organized civil society to reach individual citizens and informal networks.

6. Mértola City Council (MCC)

The Mértola City Council (MCC) is a pivotal institutional actor within the SES, actively supporting and co-developing biodiversity-oriented strategies such as the Mértola Future Lab (focused on ecological transition and adaptation to climate change), the Mértola Food Network (a grassroots initiative that gathers different organizations and individuals to co-implement a locally-based food system for Mértola), the Grandma's kitchen (a project that fosters intergenerational co-learning and exchange, and stimulate parents to prepare healthy, territorially-based recipes for children for changing eating habits). A core strength of MCC lies in its commitment to participatory governance model, exemplified by its role in co-organizing the Mértola Food Network and its integration with civil society actors like TSA, ESDIME, and ALSUD.

However, MCC's role in fostering transformation is constrained by the structural limitations of municipal autonomy. The implementation of its regenerative agenda often collides with national and EU regulatory frameworks, especially in areas such as public procurement, where the law mandates prioritization of lowest-price contracts—frequently in conflict with goals of biodiversity, locality, and sustainability. Overcoming these constraints requires political coordination and policy alignment that go beyond Mértola's borders.

In this sense, the viability and legitimacy of MCC's innovations are being reinforced as Mértola increasingly inspires and engages other municipalities in the Baixo Alentejo region. While not a prerequisite for its strategies, this expanding network amplifies the impact and reach of Mértola's pioneering regenerative efforts. By building broader alliances, Mértola can further amplify its influence and strengthen advocacy for regional-scale changes to policy and governance. The Food Basin initiative exemplifies this potential: while Mértola's internal successes already drive significant change, connecting with neighboring municipalities through shared food sovereignty and regenerative agriculture strategies

offers an opportunity to expand and deepen the impact of its pioneering work. Inter-municipal collaboration is not only instrumental for scaling impact but also vital for demonstrating that localized innovations are not isolated experiments, but models with relevance for broader territorial regeneration.

Furthermore, MCC's engagement in horizontal governance structures—such as the governance pact underpinning the Mértola Food Network—reinforces its role not as a top-down authority but as a facilitator of collective transformation. Its relationship with CSOs is marked by complementarity: the municipality offers institutional infrastructure and political leverage, while CSOs contribute technical innovation, social trust, and community embeddedness. For governance to function as a tool of regeneration, this alignment must be nurtured and expanded—both within Mértola and across the wider territory.

7. Roma communities and migrants

Initiatives like the Shelter Land Project led by Terra Sintrópica (TSA) mark an important shift in the way marginalized groups are considered in regenerative processes. By offering housing and training in syntropic agriculture to refugees, TSA has helped reframe these populations as contributors to territorial regeneration. This approach encourages the integration of migrants and promotes mutual learning between newcomers and local residents.

While TSA has played a crucial role in fostering inclusive practices in Mértola, particularly through initiatives such as ShelterLand, a broader institutional commitment is required to transform these into sustained governance mechanisms. The question of migrant inclusion is particularly relevant given the demographic composition of the Baixo Alentejo, where migrant labor has become increasingly significant in agriculture and local economies over the last decade. Migrants, including seasonal workers and newly settled families, often face barriers to participating in territorial planning and decision-making processes, despite their growing role in the region's socio-economic fabric. Similarly, Roma communities—historically present in the Baixo Alentejo—remain structurally marginalized in governance spaces (EAPN Portugal, 2021). Without a more systematic approach to integrating these groups into co-governance structures, their knowledge, cultural practices, and potential contributions to social-ecological regeneration risk remaining under-recognized and underutilized.

Despite this, there remain important dependencies. These communities rely on recognition from local authorities and CSOs to be included in regenerative strategies. Their integration also depends on ongoing support from intermediary organizations such as TSA, which facilitate access to resources, legitimacy, and networks.

8. More-than-human actors — In Mértola's SES, more-than-human actors—such as degraded soils, invasive acacia trees, the Guadiana River, cork-oak forests, steppe birds of the montado, and keystone species like the Iberian lynx—are active forces that shape ecological conditions and human livelihoods. Soil infertility limits agricultural viability and community self-sufficiency, while species such as the lynx and steppe birds act as indicators of ecological balance and restoration potential.

These non-human elements are not merely impacted by human decisions—they are entangled in them. The Iberian lynx, for instance, depends on controlled hunting areas and species management, reflecting a shift in how traditional practices like hunting are being reimagined. Similarly, steppe birds and montado ecosystems require recognition and protection to ensure their survival, especially amid changing land use pressures.

Terra Sintrópica (TSA)'s syntropic agriculture approach stands out by explicitly valuing these cooperative relationships. Practices such as those in Malhadinha Vegetable Garden illustrate how soil regeneration is intertwined with biodiversity restoration. Syntropy encourages direct cooperation between human and more-than-human actors, moving beyond extractive models toward reciprocal regeneration.

Decision-making processes and power relations between relevant actor groups

Decision-making in Mértola's SES is shaped by a **hybrid structure of formal authority and experimental co-governance**, where power circulates unevenly among public institutions, civil society organizations, landowners, and ecological actors. This configuration reflects both **long-standing institutional hierarchies** and **emerging participatory models** that seek to address biodiversity loss through regenerative practices and horizontal governance.

Formal Decision-Making Actors and Institutional Power

At the institutional level, the Mértola City Council (MCC) has been a key driver of the territory's regenerative agenda. It has strategically positioned Mértola as a "living laboratory" for biodiversity regeneration and climate adaptation, particularly through its active role in the Mértola Future Lab and the Mértola Food Network (MFN). One of the most significant steps has been in public procurement: although national legislation and EU guidelines limit the ability to favor local or organic suppliers, the Council has worked within these frameworks to adjust its purchasing policies. By interpreting the rules of Directive 2014/24/EU on cost-based tendering in a flexible way, it has been able to prioritize small-scale procurement that guarantees the inclusion of local suppliers in public catering. This has enabled part of the municipality's collective catering services—such as school and eldercare canteens—to be supplied with local, organic food while remaining compliant with procurement regulations.

Public procurement decisions—especially those tied to collective catering—are being made collectively in spaces like the MFN, where institutional actors co-deliberate with civil society representatives and local producers. The stimulation of local organic production for collective catering is done in a concerted and planned manner. This includes: (1) a prior verification of local producers' supply agendas, ensuring they are not negatively affected in fulfilling pre-existing distribution commitments; (2) a progressive shift in school menus, discussed and planned with nutritionists, so that soups and salads can increasingly be composed of organic products; and (3) gradual adjustments in the primary supplier framework, involving the replacement of certain vegetables and legumes—traditionally purchased in large volumes from distant suppliers (e.g., potatoes)—with feasible and healthy local alternatives.

The MCC's leadership, particularly through its Vice-President, has also shown political will to distribute power through participatory structures and host municipal meetings in peripheral parishes to reduce territorial exclusion.

Co-Governance and Participatory Spaces

Civil society organizations - especially the Terra Sintrópica Association (TSA), ESDIME, Santana de Cambas' Community Meeting House, and the ALSUD vocational school - have played a transformative role in shaping the governance of the SES - although this set of organisations has mobilized resources and efforts towards a regenerative agenda in the territory, it is worth emphasizing the particular relevance of TSA's contribution regarding community participation, experimentation and change of mentality. The association has led experimentation in syntropic agriculture, promoted forest gardens in schools, and strengthened participatory ecological education, thereby contributing to progressively reshaping both material land-use decisions and ecological imaginaries.

Decision-making within the **MFN** exemplifies this participatory ethos. Cooks, producers, public officials, and technicians come together to make joint decisions on school menus, procurement strategies, and education programs. These decisions are rooted in collective discussions and shared responsibilities, not formal delegation.

The Agroecology and Regeneration Center for the Semi-Arid (CARES) and the Mértola Biological Station (EBM) also contribute to decision-making by generating context-sensitive

data and supporting regenerative policies. While not decision-making bodies in themselves, their technical input and visibility lend credibility to alternative land-use models.

Power dynamics

The Mértola City Council (MCC) holds a relatively central — yet balanced — position within the governance landscape. On one hand, it has successfully projected a public commitment to territorial regeneration; on the other, it has fostered a collaborative inter-institutional climate that has positively influenced the coordination of strategies and decision-making. Nonetheless, certain asymmetries persist. Some organizations and individuals may feel underrepresented in co-governance processes, as the regenerative approach has not achieved unanimous support. Moreover, there is a notable emphasis on the participation of organized civil society—such as social economy entities, development agencies, and cooperatives, while the direct involvement of ordinary citizens remains limited. The community tends to be perceived through the lens of its representative organizations. As a result, groups that form part of Mértola’s contemporary social fabric—such as Roma communities and migrants—often remain excluded from meaningful participation and decision-making.

Power Imbalances and Exclusion

Despite progress, not all actors enjoy equal say in the SES. Landowners and economic elites, although often disconnected from co-governance networks like the MFN, continue to exert strong influence over land-use outcomes through their control of territory and adherence to conventional agricultural practices. These are frequently reinforced by Common Agricultural Policy (CAP) subsidies that favor high-input, non-regenerative models. Many of these actors resist change due to perceived economic risks, slim profit margins, and skepticism toward agroecological approaches. However, a subset of landowners, particularly those with greater financial stability—have begun experimenting with regenerative farming and pastures and game management techniques. This shift has been supported by ESDIME, which has played a key role in fostering and financing these experiments through technical guidance, training, and access to tailored funding instruments. By enabling trial-and-error learning and buffering early-stage losses, ESDIME has created enabling conditions for landowners to test more sustainable models, helping to bridge the gap between economic pragmatism and ecological innovation.

Conversely, ordinary citizens from remote villages, young people, vulnerable groups and marginalized people remain largely peripheral to decision-making. The geographic dispersion of Mértola (106 villages across seven parishes), along with infrastructural limitations and lack of targeted inclusion strategies, reproduces territorial and social disconnection. Focus groups and interviews revealed a split between the “networked Mértola” (engaged in Future Lab and MFN) and the “excluded Mértola” (disconnected to a certain extent from institutional and ecological innovations). However, it cannot be denied that there is a true effort from MCC to integrate the villages by, for example, promoting municipal meetings in all seven parishes than only in the City Council headquarter in Mertola.

Youth voices are notably absent, although the interest of both public administration and an active group of civil society organizations in addressing this gap is clearly visible. The mainstream school system remains only partially engaged in fostering future-oriented ecological leadership. From a more proactive perspective, however, there have been concrete efforts to create regenerative career paths - such as the ALSUD vocational courses on wildlife and environmental management - indicating that a broader youth engagement strategy is still under development. Additionally, a work plan co-designed with the societal partners includes a scheduled workshop for December 2025 (See chapter 6) aimed at exchanging strategic insights with other initiatives—such as those developed in Brazil for

living with the semi-arid climate—that have successfully connected youth participation with environmental regeneration.

Knowledge and Discursive Power

Different forms of knowledge play varied roles in decision-making. Scientific, institutional, and technocratic knowledge continue to dominate procurement and planning decisions. However, local and experiential knowledge—especially that held by elderly women, cooks, and small-scale farmers—is gradually gaining recognition. Initiatives such as “Grandmother’s Kitchen” and “Therapeutic Gardens” were explicitly designed to value these non-expert contributions as essential to biodiversity regeneration, emphasizing intergenerational transmission, sensory experience, and embodied care practices. Although both projects have ended due to lack of funding, they remain on hold, with the intention to resume once new financial support becomes available. Their temporary suspension highlights the vulnerability of inclusive, bottom-up initiatives to institutional funding cycles, despite their proven social and ecological relevance.

Nevertheless, epistemic power remains uneven. Actors with academic training, project management experience, or external networks are more likely to influence the SES. Those without digital literacy, schooling, or social visibility need active inclusive practices to be included in strategic planning.

Efforts to pluralize knowledge—such as school-based forest gardens and intergenerational learning initiatives—stand out in the Portuguese context for their meaningful attempts to engage non-experts, like school cooks and grandmothers, in regenerative practices. While still developing and occasionally limited by resources, these initiatives represent significant steps toward inclusive and community-rooted biodiversity strategies.

More-than-Human Actors in Decision-Making

While non-human and more-than-human actors (soils, the river, steppe birds and other threatened species) are not “deciders”, they increasingly co-shape decisions indirectly. For instance:

Soil (in)fertility and desertification risks point out the relevance of adopting syntropic systems, grounded on the regeneration through the use.

The presence of invasive species has reframed land management debates.

The Guadiana River plays a practical role in shaping irrigation and conservation narratives. It is the primary source of surface water in a semi-arid territory, directly conditioning agricultural strategies, water allocation, and biodiversity corridors. Its fluctuating levels and ecological status act as indicators of climate stress and management effectiveness (Gualda et al., 2014).

The Iberian Lynx, the world’s most threatened feline, led to the improvement of wildlife management strategies in Mértola, allowing the municipality to become the first place where the lynx was reintroduced in Portugal.

The roller (*Coracias garrulus*), one of 17 ground-nesting bird species in Portugal critically threatened by land-use change, has contributed to a better understanding of farming practices in Mértola, as it serves as a bio indicator of agricultural activity.

Types of knowledge informing decision-making and biodiversity framing

In Mértola, multiple types of knowledge—scientific, institutional, experiential, traditional—interact in the governance of biodiversity. However, these forms of knowledge are not equally recognized or embedded in decision-making. Instead, they reflect ongoing

negotiations over legitimacy, visibility, and influence in shaping both strategies and imaginaries of ecological regeneration.

Dominant Biodiversity Framings: Institutional and Scientific Knowledge

The dominant framings of biodiversity in Mértola's governance spaces still rely heavily on science-based and institutional knowledge systems, especially in formal planning and funding mechanisms. Although this science-based knowledge has provided empirical evidence of critical scenarios and thus grounded important decisions for biodiversity regeneration, it is also worth recalling the prevalence of technical discourse over the tacit knowledge of communities. For instance:

The Mértola Biological Station (MBS) contributes to empirical research and technical assessments that support the case for regenerative interventions, especially around desertification, soil health, and land use transformation.

Biodiversity loss is often discussed in terms of degraded soils, species disappearance, and water scarcity, all of which are typically diagnosed using ecological monitoring tools, geospatial data, or environmental assessments.

Funding mechanisms—such as those influenced by ESDIME's evolving criteria for regenerative pastures—draw on technical indicators to validate investment in biodiversity-positive practices like holistic grazing or syntropic design.

These forms of knowledge offer strategic leverage in aligning local practices with regional, national, and EU biodiversity agendas. Yet, they also risk marginalizing more embodied or situated knowledge systems if not intentionally integrated into governance spaces.

Local and Traditional Knowledge: Slowly Gaining Influence

Local knowledge — particularly held by elderly farmers, community cooks, and non-institutional actors — was undervalued in governance in the past but has gained recognition through specific initiatives:

- The **Grandmothers' Kitchen Project** (Cozinha d'Avó) frames elderly women's food knowledge not just as culinary heritage but as environment-related knowledge, tied to seasonality, seed use, and ecosystem resilience.
- The **Therapeutic Garden Project**, designed by TSA to involve the community in regenerative practices, also served to validate the older persons' soil wisdom.
- The **traditional food preparation** and low-input farming methods play a key role as many of the recipes depend on locally sourced, seasonal ingredients, which historically came from low-input, diversified farming systems. This type of cooking implicitly supports short food cycles, local seed use, and biodiversity in production.
- Despite their relevance, these forms of knowledge remain largely contextual and project-dependent, rarely codified into policy frameworks or public procurement decisions unless they are championed by organised civil society groups like Terra Sintrópica (TSA).

Regenerative Education

A third form of knowledge production is emerging through educational initiatives aimed at cultivating ecological awareness among school children:

Forest gardens and school-based syntropic agriculture projects are reshaping how ecological processes and human-nature relationships are understood by the younger generation.

These projects promote multispecies literacy, relational values, and embodied learning. Though still modest in reach, they represent a strategic investment in cultural shifts that will likely influence future governance orientations.

However, these initiatives are not yet integrated into mainstream education policy or municipal curricula, and therefore their systemic impact remains limited unless institutionalized.

Transversal and Relational Knowledge

A key innovation in the Mértola case is the development of transversal or hybrid knowledge practices, particularly through the Mértola Food Network and other alternative spaces that foster social cohesion and dialogue on the necessary dietary transition:

Meetings, workshops, and experimental spaces like PREC (a self-managed restaurant) and Night at the Market foster dialogical knowledge creation, where scientific, traditional, and experiential insights converge.

In these spaces, biodiversity is not only understood as a measurable condition (e.g., species richness) but as a relational, cultural, and ethical condition tied to memory, identity, and territorial belonging.

These hybrid formats act as knowledge bridges, helping to pluralize both the definition of the problem and the range of possible solutions. They also facilitate inclusive governance, even if informally.

Governance Implications and Knowledge Asymmetries

Despite these innovations, asymmetries in knowledge recognition persist. The governance of biodiversity remains tilted toward actors and practices aligned with institutional logic, formal education, and technoscientific validation. Community-based knowledge is more likely to be mobilized in participatory projects or symbolic initiatives, but less so in infrastructural planning, funding allocation, or legislative decisions.

Tensions also persist in how different knowledge forms are translated across governance layers. For example, while local regenerative practices may align with EU discourses on agroecology and nature-based solutions, their translation into CAP funding mechanisms often fails due to bureaucratic and technical filters that prioritize quantifiable outputs.

Ecological functioning of the SES and direct drivers of biodiversity loss

The SES in Mértola operates within the constraints of a semi-arid Mediterranean ecosystem undergoing accelerated climate stress. In recent decades, the region has faced not just traditionally low annual rainfall, but a marked and ongoing decline in precipitation levels, combined with rising temperatures and prolonged drought periods (APA, 2022; 2023). These changes are already altering hydrological cycles and severely impacting soil health, plant productivity, and water availability. Ecological processes are therefore shaped by this increasing climatic aridity, interacting with historical land use patterns — such as intensive monocultures, overgrazing, and river management — that have long prioritized short-term productivity over long-term resilience. Together, these drivers form a structural backdrop of vulnerability, where biodiversity loss is exacerbated by both environmental degradation and limited adaptive capacity at multiple levels of governance.

From an ecological perspective, the system is defined by chronic vulnerability to desertification, water scarcity, and soil erosion, alongside decreasing habitat diversity and degraded agrobiodiversity. The region's natural resilience has been significantly weakened by human interventions over decades, making the functioning of the SES highly sensitive to small ecological and management changes.

According to climate scenarios RPC 8.5 (considered a severe scenario by the IPCC - Intergovernmental Panel on Climate Change), Mértola will face, in projections for 2040, 2070 and 2100, a combination of a significant reduction in average annual precipitation (404 mm in 2040 and 288 mm in 2100) with an increase in average maximum temperature (36.3°C in 2040 and 39.5°C in 2100). This combination of extremely high temperatures with low average precipitation means that many plant species in the region - including those that are currently seen in the montado, such as holm oak and cork oak - will exceed their tolerance range and will not be able to survive. According to the Mértola Climate Change Adaptation Plan (APA, 2017) "in the RCP 8.5 scenario, there is practically no natural regeneration of holm oak in the future except on the shady slopes to the NNW (north-northwest), which indicates that it is in these locations that trees should be left to regenerate or be planted". This shows that, in addition to direct drivers, it is important to take into account indirect drivers that may influence the struggle against desertification, such as the institutional perspective on the reforestation model to be implemented in the following years and the prevalent imagery on what a productive montado could be.

These climate projections underscore how climate drivers intersect with ecological and governance dynamics in Mértola. The anticipated shifts in precipitation, temperature, and species tolerance reveal not only the biophysical pressures shaping the territory but also the need to reconsider institutional and cultural models of land use and regeneration. Against this backdrop, understanding the ecological processes that underpin the socio-ecological system (SES) becomes essential to anticipate pathways for adaptation and transformation. The following section systematizes the key ecological processes currently structuring the Mértola SES, highlighting how soil, water, vegetation, species interactions, and agrobiodiversity are entangled with both direct and indirect drivers of change.

Ecological Processes in the Mértola SES

Soil degradation is one of the central ecological processes shaping the SES. Poor soil structure, low organic matter content, and long-term erosion—exacerbated by mechanized tillage and intensive grazing—have reduced the capacity of local ecosystems to regenerate autonomously. Soil fertility, water retention, and biological activity are all critically impaired in many parts of the territory.

Water cycles are increasingly disrupted. With declining rainfall and rising evapotranspiration, the region suffers from persistent drought stress. Institutional responses to this issue (e.g., small-scale irrigation systems, or lobbying for river transpositions) often replicate infrastructure-heavy approaches, whereas local actors such as Terra Sintrópica propose nature-based solutions such as successional agroforestry systems as more viable long-term alternatives.

Vegetation and land cover dynamics are central to how the SES regenerates or declines. The abandonment of traditional polycultures, coupled with the dominance of monocultures and extensive pastures, has led to a loss of landscape.

Heterogeneity. The presence of invasive species (e.g., acacias) further shifts plant communities and threatens native biodiversity—although TSA's syntropic practices reframe some of these invasives as transitional agents that help rebuild soil organic matter.

Species interactions are influenced by fragmented habitats and declining ecosystem services. Keystone species like the Iberian lynx are emblematic of both ecological vulnerability and conservation potential. While their presence signals partial recovery in protected areas, functional biodiversity in everyday landscapes—such as pollinators, soil biota, and native seed varieties—remains under threat.

Agrobiodiversity is a critical indicator of SES health. It is directly affected by market pressures, subsidy regimes, and loss of traditional seed systems. Regenerative actors are trying to reverse this through agroecological experimentation and seed-saving practices, but they operate within an overall system that still incentivizes chemical inputs, monocultures, and standardized production models.

Direct Drivers of Biodiversity Loss in Mértola

The direct drivers of biodiversity loss in the Mértola SES include:

- **Land-use change and simplification of landscapes**, especially the replacement of diverse agro-silvo-pastoral systems with cereal monocultures or extensive pastures for cattle breeding. This reduces habitat complexity and ecological niches for wildlife and beneficial insects. Mértola has invested, however, on a different approach to deal with extensive pastures, bringing the concept of regenerative pastures to the scene. Through rotating grazing and innovative forms of soil mobilization, the following results have been detected: enhanced soil health, nutritious fodder and improved water infiltration, to name but a few.
- **Soil tillage and erosion**, associated with both historical and current agricultural practices, degrade soil structure, eliminate microbial life, and reduce nutrient cycling, all of which are essential for sustaining plant and animal biodiversity.
- **Overgrazing and stocking density** in certain parts of the montado system, which prevents forest regeneration and depletes ground cover, accelerating erosion and compaction.
- **Invasive species**, particularly acacia and eucalyptus, which outcompete native flora and alter fire regimes, hydrology, river and soil conditions. While some regenerative practices attempt to work with these species during transition phases, their unchecked spread remains problematic in unmanaged areas.

Values underpinning decision-making processes

The Mértola SES is deeply influenced by competing and overlapping systems of values that shape how nature, biodiversity, land, and food are governed. While recent participatory processes and regenerative projects have helped to foreground relational and intrinsic values in Mértola, much of the governance landscape in national and regional terms remains informed by older, instrumental and productivist paradigms.

However, recent developments in co-governance—particularly through initiatives like the Mértola Food Network and the Mértola Future Lab—are gradually shifting this landscape in Mértola and neighboring municipalities. These processes have fostered greater visibility for relational and intrinsic values, such as care for the land, intergenerational knowledge, and more-than-human cooperation. Co-governance has thus begun to embed new forms of valuation into local policymaking, enabling a more collective, situated, and regenerative perspective on the management of socio-ecological resources. While tensions remain, these participatory dynamics are contributing to a cultural and institutional reconfiguration of how decisions are made and whose values are legitimized.

Instrumental Values in Conventional Policy and Practice

In many public policies and dominant economic sectors (agriculture, forestry, hunting), nature continues to be viewed through an instrumental lens—as a resource to be managed for productivity, extraction, or economic gain. This is especially visible in:

The implementation of Common Agricultural Policy (CAP) subsidies, which prioritize land area, productivity, and market output over ecological diversity or community well-being. The CAP is the European Union's main agricultural policy framework, designed to support farmers, promote rural development, and ensure food security across member states. CAP subsidies are financial aids provided to farmers through two main channels: Direct Payments and Rural Development Funds.

Conventional land-use models that favor extensive grazing or monocultures, guided by values of efficiency, output, and short-term profit rather than regeneration or biodiversity care.

Regional planning frameworks that focus on infrastructure-based responses to climate stress (e.g., dam construction, river transposition), which treat ecological systems as engineering challenges rather than complex relational environments.

These values shape not only public spending but also administrative *modus operandi*: procurement routines, project funding criteria, and landscape classification systems reflect and reproduce instrumental logics.

Relational and Intrinsic Values in Regenerative Governance

In contrast, civil society actors and several institutional partners—including the Mértola City Council—have increasingly introduced relational values into governance processes. These emphasize connection, interdependence, responsibility, and care between people, places, and ecosystems.

Examples include:

- The Mértola Food Network (MFN) integrates values of proximity, collaboration, and ecological justice into its collective decisions about procurement, menu design, and agroecological training. Food is not treated solely as a commodity but as a relational good that ties health, land, and community together.
- The syntropic agriculture promoted by Terra Sintrópica is explicitly guided by values of cooperation across species, mutualism, and soil ethics. Nature is not something to manage but to regenerate in dialogue.
- The Grandmothers' Kitchen (led by the Santana de Cambas' Community House) and Therapeutic Gardens (led by the Terra Sintrópica Association) promote intergenerational respect, food sovereignty, and memory-based ecological learning, thereby incorporating emotional, cultural, and ethical values into decision-making.
- In these initiatives, decision-making is shaped by care-based ethics, multi-species awareness, and the recognition of local knowledge as a form of ecological intelligence.

Plural Value Systems in Conflict and Negotiation

A defining feature of the Mértola SES is the coexistence—and often tension—between plural value systems. While participatory processes have succeeded in pluralizing who participates and what knowledge counts, deep structural and cultural lock-ins still limit the full expression of relational or intrinsic values in mainstream policy:

Procurement policies often still prioritize cost over ecological or cultural value.

Funding mechanisms, even when oriented toward sustainability, tend to measure outputs rather than qualitative transformations in land relationships.

Local actors who hold instrumental values (e.g., older farmers, large landowners) tend to see new approaches as threatening or impractical, especially if they challenge inherited landscapes or routines.

In this context, policy and decision-making processes are often sites of value negotiation, where regenerative actors must translate their relational values into formats recognizable by bureaucracies and policy frameworks.

Values as Drivers of Innovation and Resistance

The transformative potential of Mértola's governance practices lies precisely in this value contestation and experimentation. Many of the region's most promising interventions succeed not by replacing dominant values outright, but by:

- Creating hybrid value spaces (e.g., school menus that are both cost-sensitive and biodiversity-aware).
- Engaging communities emotionally and culturally, so that ecological values resonate with lived experience.
- Performing values publicly—through events like Night at the Market or educational installations—to build broader affective commitment to regeneration.

At the same time, failure to sufficiently engage with the dominant values of certain actors—especially those who perceive loss or risk in transition—can limit uptake or cause resistance, as seen in persistent skepticism toward syntropic farming or soil-based methods among traditional farmers.

Political, cultural and institutional power dynamics

The governance of the Mértola SES is deeply shaped by overlapping political, cultural, and institutional power dynamics that affect whose knowledge, which values, and what narratives are legitimized, resourced, and scaled. These power dynamics operate both vertically (e.g., between national and local levels) and horizontally (e.g., among local actors), reinforcing or challenging the dominant socio-ecological order.

i) Political Power Dynamics

Political dynamics in Mértola are marked by an openness to experimentation yet constrained by multi-scalar dependencies and structural limitations. On the one hand, the Mértola City Council (MCC) plays a progressive role in embracing regeneration-oriented narratives, supporting projects and initiatives like the Mértola Future Lab, the Mértola Food Network, and the Forest Gardens at Schools.

However, this local-level political will is limited by national and EU-level policy frameworks, such as public procurement laws and the CAP subsidy structure, which are built around cost-efficiency and productivity, rather than ecological or relational criteria. This reinforces instrumental logics and makes it difficult to institutionalize alternative values and knowledge systems.

Moreover, political visibility and legitimacy are unevenly distributed across the SES. Actors embedded in structured networks—such as Terra Sintrópica (which, despite its grassroots origins, has gained organizational capacity), ESDIME, or other local initiatives—often have more access to funding and opportunities for policy dialogue. This positioning does not imply distance from community dynamics, as these actors frequently operate in close cooperation with residents and smaller initiatives. Notwithstanding this proximity, the very presence of certain groups—such as Roma families, migrants, or elderly residents in isolated parishes—remain underrepresented in formal spaces of decision-making. Their lived experiences and knowledge systems, while rich and significant for territorial regeneration, are rarely translated into policy, highlighting the need for more inclusive governance mechanisms that can bridge different forms of social organization and representation.

Political alignment or friction between levels of governance also affects how biodiversity narratives unfold. For instance, local calls for agroecological procurement may be slowed or diluted by regional education authorities or EU auditing mechanisms, creating a tension between political aspiration and bureaucratic realism.

ii) Cultural Power Dynamics

Cultural dynamics shape both resistance and resonance in the governance of biodiversity. Baixo Alentejo carries a strong cultural memory of large estates (latifúndios), agricultural hardship, and hierarchical labor relations. This historical backdrop contributes to:

- The persistence of productivist narratives, where ecological regeneration is sometimes perceived as utopian or impractical.

- A gendered division of knowledge, in which women's roles in food systems and ecological stewardship (e.g., as cooks, caregivers, gardeners) are culturally undervalued and politically invisible.
- A split between local and newcomer actors, where newcomers with ecological literacy are sometimes seen as culturally disconnected or imposing external models.

Despite this, regenerative actors are strategically using culture as an entry point for transformation:

- Initiatives like the Grandmothers' Kitchen, forest gardens, and participatory festivals are reframing cultural memory as ecological knowledge.
- Food becomes a cultural-political tool, where cooking, eating, and storytelling recover marginalized values and make biodiversity regeneration emotionally and socially relatable.
- Still, cultural resistance remains a soft power barrier that often leads to subtle exclusion or lack of uptake—especially when new practices are perceived as culturally alien or economically risky.

iii) Institutional Power Dynamics

Institutionally, certain actors—such as the Mértola City Council (MCC), regional agencies, and organizations like ESDIME or the Mértola Biological Station (EBM)—hold greater strategic capacity within the local SES. Their relative access to technical staff, policy instruments, and their fluency in bureaucratic and funding procedures position them to align more easily with national and EU policy frameworks. While they may not directly control large financial resources, these actors have the ability to mobilize funding, structure project proposals, and influence the regional development agenda.

This privileged position is partly due to the institutional architecture itself: funding calls, reporting formats, and mechanisms of public visibility tend to favor those who can translate their work into the dominant language of quantitative indicators, administrative accountability, and measurable impact. As a result, grassroots groups, informal initiatives, and knowledge holders with less experience in institutional engagement often face barriers to recognition and support.

However, what distinguishes the Mértola context is the effort made by these more institutionally embedded actors to create bridges between regenerative practices, local knowledge, and institutional logic. Rather than merely reproducing hierarchical structures, actors such as TSA, ESDIME, and MCC are actively experimenting with ways to render regenerative and community-led practices legible to funding bodies and public authorities. This includes adapting reporting tools, framing policy dialogue in inclusive terms, and facilitating participatory arenas such as the Mértola Food Network (MFN), where multiple knowledge forms can co-exist.

Observed institutional tendencies:

- Some organizations might still privilege quantitative indicators (e.g., number of beneficiaries, cost-efficiency, land productivity) compared to qualitative, process-based, or relational metrics. This emphasis varies by actor:
 - Municipal initiatives and local networks in Mértola have shown openness to integrating lived and intergenerational knowledge.
 - National and regional funding frameworks often privilege standardized and measurable outputs.
- There is a tension between the weight given to **scientific and administrative expertise** and the recognition of embodied, community-based, and intergenerational knowledge.
- The persistence of **linear project logic**—with fixed timelines, predefined deliverables, and KPIs—can clash with the adaptive and iterative nature of regenerative processes.

These tendencies shape how biodiversity and regeneration are framed: often in terms of compliance, mitigation, and measurable risk reduction, rather than through the lenses of care, multispecies cohabitation, or social justice. Nonetheless, the ongoing commitment by key institutional actors in Mértola to integrate diverse epistemologies into governance structures remains a significant step towards fostering a more inclusive and effective socio-ecological transition.

Embedding the local SES in the high-impact sector

One of the most influential mechanisms is the Common Agricultural Policy (CAP), which defines the financial and normative landscape for agricultural development across the European Union. Under the Strategic Plan of CAP for Portugal 2023–2027 (PEPAC), subsidies are allocated through the European Agricultural Guarantee Fund (EAGF) and the European Agricultural Fund for Rural Development (EAFRD). CAP includes direct income support measures—such as basic payments, eco-schemes, and climate/environment/welfare payments—which are mandatory for member states. However, in practice, these funding mechanisms tend to benefit larger, conventional operations that can meet the bureaucratic requirements and scale thresholds often embedded in funding calls ([Lampkin, N. et al. 2020](#)). Regenerative actors in Mértola—typically operating on smaller scales and with diverse crop/livestock systems—face difficulties accessing such support, resulting in a structural lock-in that slows the transition toward agroecology and biodiversity-friendly models.

National procurement laws and EU directives—particularly the Directive 2014/24/EU—emphasize cost-efficiency as a primary criterion in public tenders. This focus often undermines efforts to institutionalize short-chain food systems and support local, organic production ([FAO et al, 2021](#)) while it does not support the cost for agroecological transition. In practice, cost considerations tend to outweigh social and environmental objectives, making it difficult for small-scale, agroecological producers to compete in large-scale procurement processes. While initiatives such as Mértola’s local food procurement offer promising alternatives, they remain structurally fragile, relying heavily on political will and local coordination rather than robust legal or institutional support.

At a discursive level, the overarching biodiversity narrative promoted by EU and national institutions is still dominated by technocratic and mitigation-focused paradigms especially through the term ecosystem services. Biodiversity is often discussed in terms of carbon capture, emissions control, habitat preservation, and climate risk reduction. These framings rarely acknowledge the value of community-rooted regenerative practices or more-than-human relations that are foundational to Mértola’s approach. This discursive gap reduces the visibility of initiatives like syntropic farming or intergenerational learning projects, which are essential to building resilience in the local SES.

There are, however, emerging opportunities for greater attunement between local experimentation and EU policy orientations ([UN, 2021](#)). The EU Farm to Fork Strategy, part of the European Green Deal, offers rhetorical and policy openings for the promotion of local, healthy, and environmentally friendly food systems. However, the implementation of this strategy at the national level—particularly through procurement frameworks, subsidy allocation, and food regulatory standards—often falls short. Ongoing critiques regarding the weak integration between the EU Green Deal and the Common Agricultural Policy (CAP) further underscore the risks of fragmentation and highlight potential shortcomings in realizing transformative goals within the Farm to Fork strategy ([Guyomard et al, 2020](#)). In this context, local governance in Mértola plays a dual role: navigating institutional constraints while seeking to realign national and EU frameworks with the regenerative practices being tested on the ground. The success of this alignment may determine the medium- and long-term viability of biodiversity restoration as both a socioecological and economic strategy.

Economic structures’ impact over the SES

Mértola’s socio-ecological system (SES) continues to be shaped by extractive and productivist economic logics driven by external forces. The dominant economic activities—extensive agriculture, livestock grazing, and game hunting—reflect a dependence on mainstream land-use models that are not necessarily aligned with long-term sustainability or high economic return. These sectors are highly dependent on subsidies, and decisions on how funding is organized and distributed lie primarily at the EU and national levels. As a result, local governance has very limited influence in steering economic incentives toward regenerative or locally appropriate practices.

Market structures in the region further reinforce these constraints. Centralized food distribution networks and the dominance of large suppliers marginalize small-scale producers, who struggle to access markets or achieve economic viability. For example, wild game is a traditional activity in the region, but the absence of a certified slaughterhouse makes it impossible to process locally and capture added value (Câmara Municipal de Mértola, 2024). Consequently, processing and profits are redirected to neighboring Spain, weakening the local economy’s capacity to retain and reinvest benefits from its natural resources.

Economic barriers, including lack of infrastructure—such as transportation networks connecting remote villages—exacerbate exclusion and limit the potential for inclusive and resilient local food economies. Financially, regenerative approaches require significant upfront investment and do not promise immediate returns. This economic model can be particularly challenging for smallholders or families experiencing economic vulnerability. Although some landowners with greater financial resilience have started experimenting with regenerative practices (e.g., regenerative farming or game management), often with the support of organizations like ESDIME, these remain isolated efforts – although they play an important role in experimenting and portraying results. The broader economic system does not currently incentivize such transitions on a scale.

Assessment of biodiversity challenge and related biodiversity trends in the high impact sector

In Mértola, biodiversity assessment is deeply grounded in scientific fieldwork, focusing on species-level monitoring, soil and vegetation analysis, and agroecological experimentation. The Mértola Biological Station (EBM) plays a pivotal role in this. However, these assessments are not always scaled up or systematically integrated into broader regional/national biodiversity indicators or land-use frameworks.

Table 3 - Local identification of challenges: methods and types of data

Type of Method	Example in Mértola	Data Type
Ecological Monitoring	Iberian lynx and steppe bird population studies	Species count, distribution data
Soil Quality Assessments	Soil health measurements in agroecological zones like Horta da Malhadinha	Soil carbon, nutrient content, erosion risk
Vegetation Surveys	Vegetation cover and species richness documentation in regeneration areas	Vegetation indices, species diversity
Experimental Agroecological Projects	Terra Sintrópica's syntropic agriculture trials	Productivity, resilience, microclimate data

Climate Adaptation Modelling	Climate Change Adaptation Plan for Mértola (Vizinho et al., 2016)	Scenario modelling, temperature and precipitation

Despite these rich data sources, their integration into policy, land-use planning, and sectoral adaptation remains limited.

Current enablers and barriers for transformative change

The Social-Ecological System (SES) in Mértola operates as both an enabler and a constraint for transformative innovation. On one hand, Mértola has become a living lab for regenerative practices, enabled by strong local actors, participatory governance, and ecological experimentation. On the other hand, entrenched economic models, institutional lock-ins, and cultural inertia pose significant constraints on the pace and depth of transformative change.

Table 4 - Enabling Elements (Opportunities and Leverages)

Category	Enabling Element/Key actor	Mechanism/Impact
Scientific Knowledge	Participatory action research/ Mértola Biological Station (EBM), TSA.	Generates data and evidence for biodiversity decline and restorative practices
Experimentation Space	Syntropic agriculture, regenerative pastures/ Malhadinha Vegetable Garden.	Testbed for agroecological methods and soil regeneration in semi-arid conditions
Co-Governance	Mértola Food Network, Mértola Future Lab.	Shared decision-making, policy alignment, community integration
Societal Engagement	Involvement of youth, elderly, refugees /Shelter Land project - TSA	Builds intergenerational & intercultural solidarity
Narrative Innovation	Reframing Mértola as a "territory of regeneration".	Shifts perception from rural abandonment to a model of resilience
Regional Influence	Projects scaled to neighbouring municipalities (e.g., Alcútem, Ourique).	Fosters regional replication and policy impact
Education & Culture	Creative workshops (music, storytelling) / School Forest gardens, Therapeutic garden - TSA.	Builds cultural and emotional infrastructure for transition
Policy Adaptation	Flexibility in local procurement for sustainable food	Local laws adapted to encourage biodiversity-friendly practices despite EU constraints

Table 5 - Constraining elements (barriers and lock-ins)

Category	Constraining Element/Key Actor	Impact
Economic Lock-ins	cattle breeding remains prevalent as economic activity; lack of local meat processing; CAP dependence.	Limits innovation in production and market diversification
Technocratic Constraints	EU procurement laws (e.g., lowest price criteria).	Undermines local food systems and regenerative procurement
Institutional Inertia	Resistance to change in maintenance services (gardening), conservative land imaginaries	Slows implementation of innovative land-use strategies
Cultural Imaginaries	Traditional views of Alentejo as mono-productive & extractive (e.g., cereal plains, mechanisation)	Conflicts with regenerative goals and biodiversity restoration
Social Fragmentation	Disconnection between “two Mértolas” — engaged actors vs. distant residents	Excludes large population sectors from innovation processes
Market Structures	National and European policies favour cheap food over local sustainability	Erodes food sovereignty and economic resilience
Knowledge Gaps	Low technical literacy in rural areas; lack of biodiversity awareness	Undermines understanding and engagement with restoration practices
Imagination Barriers	Limited envisioning of alternative futures by parts of the population	Restricts possibility of reconfiguring relationships to land and nature

The Mértola SES reveals a contradictory dynamic between enabling and constraining trends:

- Capacity is high in the experimental/activist sector (TSA, EBM, ESDIME), which operates with strong knowledge, regional alliances, and a vision for regenerative transition.
- Constraint arises when these innovations must scale, embed into formal governance, or influence dominant economic logic (such as livestock and hunting-centred economies that remain decoupled from biodiversity goals).

Notably, participatory strategies are highly effective where they occur but are not yet fully democratised across all territorial actors. The success lies in Mértola's ability to mobilise local knowledge and shared governance as a counterweight to external and institutional rigidities.

- The SES enables transformation through integration of knowledge, experimentation, and relational governance.
- It constrains transformation through economic dependency, policy incoherence, and imagination traps.

5.2 Vision: What alternative SES could be?

A transformative vision for Mértola's social-ecological system (SES) emerges from the everyday practices, knowledge systems, and affective ties that already exist among certain community members—particularly those most closely connected to food production, caregiving, land stewardship, and social reproduction. These marginalized perspectives offer a powerful counterpoint to dominant, extractivist logics. Rather than framing biodiversity as a technical or regulatory challenge, they embody a deeply relational understanding of human-nature entanglement—one that emphasizes mutual care, cooperation, and embeddedness.

In this alternative imaginary, land is not a backdrop for economic activity but a living system with which to co-evolve. Nature-positivity is not confined to conservation targets or reforestation quotas but unfolds through everyday practices like regenerative farming, seed saving, composting, and intergenerational knowledge exchange. In this vision, "regeneration" does not imply a return to a pristine past nor the linear application of technoscientific fixes, but rather a political, ethical, and ecological commitment to co-producing livable futures through situated, collective experimentation.

Institutionally, this vision calls for a reconfiguration of decision-making processes, moving beyond technocratic and indicator-driven governance. Co-governance spaces like the Mértola Food Network (MFN) represent steps in this direction but could be further expanded to meaningfully include Roma families, immigrants, and other community members currently underrepresented. A future-oriented SES in Mértola would redistribute not only material resources but epistemic authority, validating plural forms of knowledge and experience (scientific, traditional, emotional, embodied) in shaping strategies for biodiversity. Mértola has been taking steps in this direction.

Economically, the vision entails a gradual reorientation from externally dependent, subsidy-driven models to circular, locally rooted, solidarity-based economies. This includes the creation of community-supported agriculture models, regenerative cooperatives, and mutual aid initiatives that tie economic viability to ecological care and social justice. Markets would be shaped not only by price but by values—such as health, reciprocity, biodiversity, and territorial belonging.

This future is not utopian; it is emerging incrementally in Mértola through the actions of regenerative farmers, school cooks, elderly women sharing recipes, and organizations. To thrive, this vision requires ongoing support—legal, institutional, financial, and cultural—to challenge dominant systems and cultivate the conditions for more just and regenerative human-nature relations.

5.3 Discussion

The socio-ecological system (SES) of Mértola offers a compelling and complex portrait of how marginal rural territories navigate, resist, and reimagine biodiversity governance under conditions of environmental fragility, institutional constraint, and political underrepresentation. The SES analysis reveals not only the ecological degradation and demographic decline facing the municipality, but also the emergence of transformative practices that embed regeneration in everyday life, collective governance, and multispecies care.

One of the central messages emerging from this analysis is that the Mértola SES is structured by overlapping layers of environmental degradation and institutional lock-ins, but also animated by a diversity of social actors and ecological relations that challenge dominant paradigms. In particular, the SES shows how regenerative governance does not emerge from the simple implementation of best practices or policy tools. Instead, it is a dynamic relational process involving plural knowledge systems, deeply situated cultural imaginaries, and contested power relations.

From an ecological perspective, the Mértola territory faces severe constraints: climate-induced aridity, depleted soils, biodiversity loss, and water scarcity threaten both agricultural viability and ecological stability. However, these environmental pressures have been catalyzed by actors such as Terra Sintrópica (TSA), the Mértola Biological Station (MBS), and the Mértola City Council (MCC). These actors are not simply service providers or technical implementers—they are narrative-makers, policy-shapers, and guardians of a broader vision of regeneration grounded in relational values and social justice.

The SES analysis reveals that while formal governance institutions—especially the MCC—are essential enablers of systemic experimentation, transformative change in Mértola depends on co-governance spaces that blur the line between state and civil society. The Mértola Food Network (MFN), for example, embodies this hybrid logic. It allows for shared decision-making on procurement, education, and land use, while also acting as a site where food becomes a material and symbolic entry point for rethinking human-nature relations.

However, the democratization of governance is still ongoing. Despite the participatory ethos of many initiatives, significant segments of the population might remain underrepresented in SES decision-making.

The more-than-human dimension of the SES is also critical. In Mértola, biodiversity is not just an abstract indicator or technocratic goal; it is a co-produced condition emerging from the interactions between humans, animals, soils, seeds, and ecosystems. Practices such as syntropic agriculture—promoted by TSA—demonstrate how regeneration can be understood as a process of multispecies cooperation and ecological healing. This perspective challenges conventional conservation models that isolate biodiversity as something to be preserved rather than relationally restored.

Crucially, values play a decisive role in shaping both problems and solutions in the Mértola SES. Whereas national and EU frameworks continue to prioritize instrumental values—efficiency, productivity, and cost-effectiveness—the regeneration movement in Mértola draws on relational and intrinsic values, such as care, reciprocity, and more-than-human flourishing. This value divergence is not only philosophical; it has concrete institutional effects, particularly when EU procurement laws or CAP subsidies undercut local efforts to build ecologically and socially just food systems.

Power asymmetries remain a major obstacle to deeper transformation. Landowners, technocrats, and bureaucratic norms often hold disproportionate influence over how biodiversity is defined and governed. Meanwhile, the experiential and place-based knowledge of cooks, farmers, elders, and community caregivers is still too often treated as dreamy, utopical or ancient. Initiatives like the “Grandmothers’ Kitchen” or the “Therapeutic Gardens” have begun to reverse this trend, but institutional recognition of these knowledges remains fragile and often project-dependent.

Nonetheless, the Mértola SES has demonstrated an impressive capacity for experimentation and learning. The region is not only developing new ecological practices—it is also generating new imaginaries. The reframing of Mértola as a “territory of regeneration”, rather than one of desertification and decline, is a political and cultural achievement with implications for other semi-arid territories in Europe. It demonstrates that regeneration is not merely a technical task—it is a process of cultural, affective, and political reassembly.

What becomes clear in the Mértola SES is that transformation must be both material and symbolic. Soil restoration must be accompanied by narrative shifts; biodiversity metrics must be complemented by cultural indicators; co-governance must mean more than institutional partnership—it must entail epistemic justice and shared authorship of the future.

The enabling factors for transformation identified in this SES include a strong and coherent network of civil society organizations, a politically supportive municipality, experimental governance spaces like MFN, and a local narrative of regeneration that is emotionally resonant and strategically aligned with broader sustainability agendas. Conversely, constraining elements include rigid procurement frameworks, a limited inclusive territorial

mobility and communication, persistent knowledge hierarchies, and socio-economic barriers associated with prevailing structures and economic decision criteria within the agricultural sector.

In sum, the Mértola SES reveals a promising ecology of transformation. It is a laboratory that offers insights into how regeneration can take root in the margins of Europe. By centering care, cooperation, and pluralism—among humans and across species—Mértola invites us to imagine socio-ecological systems not as problems to be solved, but as relations to be renewed.

6. Locally Tested Interventions

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6.1 Evaluation of strategies in action

Strategies in action

Mértola is a rural municipality in the Baixo Alentejo region of southern Portugal, known for its semi-arid landscapes, rich cultural heritage, and low population density. It faces some of the most acute ecological and socio-economic pressures in the country: high susceptibility to desertification, chronic water scarcity, severe soil degradation, and the compounded impacts of decades of intensive monoculture, unsustainable grazing, and past mining activities. These environmental stresses compound demographic decline, an aging population, and limited economic diversification - conditions that make the territory both vulnerable and, paradoxically, fertile ground for pioneering approaches to regeneration and resilience.

In Mértola, the evaluation of biodiversity regeneration strategies reveals a layered and dynamic landscape of experimentation, shaped by a strong commitment to co-governance, ecological learning, and systemic transformation. A set of organisations has contributed to building an atmosphere of co-governance, consolidating a concerted action towards a regenerative process, with particular attention to the establishment of a locally-grown healthy food system.

Within this context, Mértola's societal partners in BIOTraCes - Terra Sintrópica Association (TSA) and the Mértola City Council (MCC) - have actively integrated and nurtured a governance model that is rooted in collaboration across a wide spectrum of actors. This includes local government, development agencies, educational institutions, grassroots associations, producers, local development associations, and community spaces. One of the key arenas where this articulation happens is the Mértola Food Network (MFN), a participatory governance platform that brings together diverse stakeholders around the shared goal of building a sustainable and inclusive local food system. The MFN functions both as a space for experimentation - such as testing local distribution schemes - and as a forum for shared decision-making that brings together scientific, traditional, and experiential knowledge.

This articulation goes beyond the MFN itself, linking to a broader constellation of projects aimed at climate adaptation, biodiversity regeneration, and social resilience that play a pivotal role within the Mértola Future Lab - a community strategy for territorial innovation linked to ecological transition. Whereas educational initiatives foster food sovereignty and ecological literacy into schools, regenerative grazing and syntropic agriculture projects seek to restore degraded soils. At the same time, intermunicipal collaborations are advancing the creation of a cross-border "food basin," designed to secure healthy and accessible food for regional residents. Funding for these initiatives comes from a diverse mix of local, national, and international sources, including EU structural funds, cross-border cooperation programmes, and philanthropic foundations.

In the context of Deliverable 2.4, the Mértola case provided an opportunity to test how these interconnected strategies perform when examined through the lens of regenerative governance. The focus was on assessing their capacity to address persistent lock-ins - such as geographic isolation, policy and procurement barriers, and the underrepresentation of certain social groups - while advancing the goals of ecological restoration, food sovereignty, and social cohesion.

To understand how strategies for biodiversity regeneration are unfolding in Mértola, it is essential to first map the network of actors, initiatives, and governance structures that give shape to the territory's regenerative efforts. What follows is not an exhaustive list of all organisations working in Mértola, but rather a focused introduction to the actors, platforms, and projects that are central to the agroecological transition explored in the BIOTraCes case study. These actors have played a pivotal role in experimenting with and operationalising regenerative governance and will be referenced throughout this

deliverable as we analyse the strategies tested in the field. Rather than presenting them through isolated descriptions, we introduce each actor and initiative in context, highlighting their interconnections, areas of influence, and contributions to systemic change in the territory.

Key Organisations, networks and projects

a) Terra Sintrópica Association (TSA). Leads territorial experimentation in regenerative agriculture and food systems, catalysing new imaginaries of rural sustainability and interspecies cooperation. Together with Mértola City Council, TSA constitutes a central societal partner in BIOTraCes. Its projects promote agroecological literacy and strengthen social cohesion across the territory. Examples include **Forest Gardens at Schools**, which engage children in cultivating vegetable gardens, exploring interspecies collaboration, and enjoying the harvest - either at school or at home - and the **Shelter Land Programme**, which welcomes Afghan refugees for training in syntropic agriculture. Developed in partnership with Permaculture for Refugees, the High Commission for Migration (ACM), and Mértola City Council, this programme fosters agency and integration through regenerative work. At the heart of TSA's efforts is the **Centre of Agroecology and Regeneration for the Semi-Arid Region (CARES)**, based at the Malhadinha Vegetable Garden, a site for experimentation and demonstration in agroforestry and the principle of "regeneration through use." Its **Therapeutic Garden Project - "There is a Party in the Forest Garden"** exemplifies how conviviality and memory-sharing can foster community resilience, well-being, and new imaginaries of soil care, particularly among the elderly.

b) The Agroecology and Regeneration Center for the Semi-Arid (CARES). Constitutes one of the central strategies of the Terra Sintrópica Association and grounds on practical experimentation to inspire broader participation in regenerative practices. This includes engaging farmers in syntropic agriculture as a method not only for restoring degraded soils but for shifting paradigms - from competitive to cooperative inter- and intra-species relations. These techniques, rooted in the syntropic philosophy promoted by the Terra Sintrópica Association (TSA), are presented as viable alternatives to extractive agricultural models historically dominant in the region.

c) Mértola City Council (MCC). Acts as an institutional facilitator within the co-governance ecosystem, supporting coordination among actors without assuming a dominant role, and creating space for experimentation, dialogue, and power-sharing.

d) Mertola Future Lab (MFL). Has emerged as a local and collective strategy for ecological transition, climate adaptation, and the fight against desertification. It brings together diverse organisations with the multiple aims of regenerating soil and ecosystems, building a healthy and local food system, valuing local knowledge in shaping a transition strategy, and positioning Mértola as a site of experimentation for regenerative practices.

e) Mértola Biological Station (MBS). Provides practical services - including keyline plow access, game censuses, management plans, and soil analyses - while investing in innovative research perspectives. Its transformative potential lies in countering perceptions of the region as a "landscape with no future," attracting international research interest, and reshaping long-term imaginaries of adaptation and sustainability.

f) Mértola Food Network (MFN). Serves as a space for planning and implementing changes focused on building a local food system in Mértola and initiating a regional Food Basin. The MFN is one of the key initiatives developed under the broader umbrella of the Mértola Future Lab, embodying its vision of regenerative territorial governance through food systems transformation. One of the main initiatives of MFN is **The Night at the Market**, an innovative community event hosted in Mértola's municipal markets, designed to foster social connection and promote sustainable practices. The event brings residents together around themed cooking sessions where food is shared alongside knowledge and experience. Each edition highlights a different theme and invites a special guest, creating space for informal learning, peer exchange, and the collective development of new ideas.

By combining conviviality with meaningful discussion, the initiative strengthens community engagement, nurtures trust and empowers participants to take part in shaping local responses to climate change, desertification, and food sustainability. Another noteworthy initiative is **Fresh on Wheels (Frescos sobre Rodas)**, a decarbonised delivery service for fresh products sold at the Mértola Municipal Market. Operating only in the town of Mértola, this project promotes low-emission logistics, electric mobility, and short supply chains, while reducing plastic packaging and raising awareness about sustainable food consumption. Developed as part of the MFN strategy and supported by the Environmental Fund, it involves the Mértola City Council, Terra Sintrópica Association, local producers, and the Guadiana Valley Business Association (AEVG).

g) Agency for Local Development in the Southwest Alentejo (ESDIME). Stimulates territorial development by supporting social economy initiatives, entrepreneurship, and community projects. ESDIME has played a pivotal role in fostering new farming practices and techniques in the Baixo Alentejo region. Some examples of innovative and ground-breaking projects are **Regenerative Pastures** and **TerrAlimenta (Land feeds)**. While the first one stimulates techniques of regenerative agriculture such as holistic grazing and use of key-line design, also creating funding for regenerative approaches, TerrAlimenta (Transition for a local food system) set the foundations for a regional Food Basin. This Food Basin has started through changes in collective catering canteens.

h) ALSUD – Vocational Training School. Offers a **Technical Course in Game and Wildlife Management** (*Curso Técnico de Gestão Cinagética*), which equips young people with specialised skills in sustainable land use, biodiversity monitoring, and ecological stewardship. The course includes training in the management of **red-legged partridge and other steppe birds**, directly addressing the ecological characteristics of the Baixo Alentejo region (ALSUD, 2021). Additionally, ALSUD hosts a Senior University (*Universidade Sénior*), promoting intergenerational learning and the inclusion of older adults in discussions on regeneration, land care, and rural resilience. Through these two educational arms, ALSUD fosters knowledge exchange between generations and strengthens local engagement in biodiversity protection.

i) Community House of Santana de Cambas. Anchors social and cultural engagement in a geographically isolated parish, contributing to decentralising participation and linking regeneration initiatives with the most remote communities. One of its most emblematic initiatives is **the Grandma's Kitchen (Cozinha d'Avó)**, a community-led project that reinterprets traditional Alentejo recipes using seasonal, organic, and locally grown ingredients, while promoting sustainable water use and agroecological practices. Jointly led by the Parish Council of Santana de Cambas, the Community House, and the Mértola City Council, the project fosters intergenerational co-learning by involving elderly women and children in educational activities that encourage healthy eating habits, food autonomy, and the preservation of cultural heritage. Through workshops like the **Cooking Academy**, families are engaged in adopting better food practices, especially in children's school meals. Funded by the EU's Operational Programme for Social Innovation and Employment (POISE) between June 2020 and December 2021, and implemented by the *Casa do Povo de Santana de Cambas*, *Cozinha d'Avó* illustrates how food can become a strategic entry point for social innovation, sustainability, and regeneration.

In the field of agriculture, several concrete interventions have been developed in Mértola to support the transition toward agroecology and biodiversity regeneration. These initiatives not only focus on technical practices like soil restoration and sustainable grazing, but also on reshaping collective food systems and embedding regenerative principles. Below are some of the **key practices and approaches currently shaping the agricultural landscape in the territory**.

Key practices in Mértola

a) Syntropic agriculture. It has been introduced as a key regenerative strategy for soil restoration and the conversion of degraded lands, based on cooperative intra- and inter-species dynamics, promoted by the Terra Sintrópica Association (TSA).

b) Education for regeneration from childhood. Regenerative pedagogy is being implemented in local schools through forest gardens and participatory ecological learning - helping to foster multispecies awareness and new relationships with the land.

c) Transformation of collective food systems. Through coordinated work on procurement processes, menu planning, and food preparation in public canteens, the Mértola Food Network (MFN) has supported a progressive shift toward including more local and organic food in schools and eldercare centres. This has involved strategically adapting purchasing practices - for instance, issuing tenders for smaller lots - to better match local supply capacities, and create room for qualitative criteria beyond price alone, while remaining fully compliant with European public procurement directives. These efforts have contributed to shaping purchasing decisions and strengthening a culture of food that values proximity, seasonality, and sustainability.

d) Food Basin for the Baixo Alentejo Region. Regional efforts are underway to structure supply chains and local markets around agroecological production.

e) Regenerative pastures and agroecological practices. ESDIME (Agency for the local development of Southwest Alentejo) has actively encouraged the adoption of regenerative techniques - such as holistic grazing and keyline design - through projects and partnerships that promote learning and experimentation. While its overall funding framework has not fundamentally changed, there is a growing effort to integrate regeneration criteria into its support schemes and to inspire local actors to adopt soil-restoring and climate-resilient practices. The regeneration agenda in Mértola is sustained by evolving governance practices that aim to redistribute power, foster cross-sectoral collaboration, and introduce greater institutional flexibility.

f) Co-governance model. Through partnerships between Mértola City Council (MCC), Terra Sintrópica Association and other actors, a horizontal governance culture has emerged. The Mértola Food Network (MFN) exemplifies this model, bringing together producers, cooks, technicians, and political representatives to deliberate collectively on food systems, land use, and regenerative strategies.

g) Transformative funding logic. Regional actors such as ESDIME have begun to experiment with ways of embedding regeneration principles into their support activities. While this does not yet amount to a systemic change in funding logic, these efforts demonstrate a willingness to test and promote approaches that link development funding more closely with biodiversity regeneration and soil restoration.

Transformative potential of the strategies

The strategies currently being tested in Mértola aim to promote structural and discursive shifts in how biodiversity, food systems, and land use are imagined, governed, and practiced.

At the structural level, they seek to move beyond the usual fragmentation of governance, toward a more horizontal and participatory model of decision-making that brings together public authorities, civil society, producers, and local institutions. The co-governance structure of the Mértola Food Network is a clear example of this, fostering spaces where regenerative practices and food system transitions are collectively discussed and implemented. Its transformative potential lies in enabling coordinated action that can address multiple, interconnected barriers to regeneration more effectively.

However, the transformative potential goes beyond the co-governance itself, manifesting in the very capacity for concerted action that it enables, allowing for the simultaneous transformation of multiple dimensions that constitute persistent lock-ins. When actors act in coordination across different fronts - policy, funding, knowledge systems, and everyday

practices - the chances of unlocking structural constraints and advancing biodiversity regeneration become significantly greater.

Another key structural shift is the growing institutional adaptability emerging at the municipal level. Local actors are demonstrating how public food systems can be oriented toward biodiversity goals - remaining fully within the legal frameworks while revising entrenched bureaucratic routines and streamlining procedures, thereby creating space for innovation.

At the discursive level, the interventions in Mértola are actively contributing to a reframing of agricultural and ecological imaginaries. Moving away from the dominant vision of the Alentejo as a monocultural breadbasket destined for intensive, extractive production, local actors are promoting new narratives of the territory as a mosaic of regenerative systems - dynamic, multispecies, and community-embedded. This symbolic shift is reinforced through education, public events such as "Night at the Market," and initiatives like "Grandma's kitchen" (see section 2.1.2 Strategies in Action), which revalue traditional knowledge and cultural practices linked to biodiversity.

By combining practical interventions with new governance models and cultural reframing, the strategies underway in Mértola offer the potential to challenge entrenched paradigms and to foster a more **inclusive, adaptive, and regenerative approach to biodiversity governance** in the region.

Responses to indirect drivers of biodiversity loss

The strategies underway in Mértola explicitly engage with several indirect drivers of biodiversity loss, particularly those related to **demographic decline, economic dependency, social isolation, political inertia**, and **cultural undervaluation of local knowledge**. The region's long-standing trends of aging population, depopulation of rural parishes, and limited economic diversification have created structural vulnerabilities that exacerbate both environmental degradation and the loss of community resilience.

In terms of addressing these indirect drivers, the strategies in Mértola directly tackle socio-economic and cultural conditions that typically hinder transformation. Initiatives such as the Shelter Land project (see section 2.1.2 Strategies in Action), which combines refugee integration with syntropic training, and Grandma's Kitchen (Cozinha d'Avó, description in section 2.1.2 Strategies in Action), which valorizes the culinary knowledge of elderly women, are examples of how regeneration is framed not only as an ecological need but as a social and cultural opportunity. These practices engage with drivers such as generational isolation, limited access to land, and undervaluation of local knowledge systems.

Educational initiatives - including forest garden projects (see section 2.1.2 Strategies in Action) - directly respond to the erosion of place-based ecological knowledge among younger generations. By fostering ecological literacy and multispecies awareness from an early age, these efforts seek to counteract the disconnection between youth and land, which is a key driver of biodiversity loss in depopulating rural contexts.

At the governance level, the emerging co-governance model within the Mértola Food Network addresses political inertia by promoting shared responsibility and horizontal participation, moving beyond hierarchical or sectoral decision-making that has historically failed to halt ecological degradation.

Nonetheless, challenges remain: geographic isolation, unequal access to transportation and information, and entrenched patterns of marginalisation continue to limit the participation of certain groups, especially in the most remote parishes. These constraints were clearly highlighted in focus group discussions and interviews with local actors. While practical measures such as mobile council meetings offer initial steps towards reducing these barriers, sustained efforts will be needed to ensure that biodiversity regeneration strategies truly reach and engage the most vulnerable and isolated populations in Mértola.

Scalability and replicability

The capacity to scale and replicate the strategies underway in Mértola is already visible in several dimensions. The Mértola Future Lab has established itself as a regional reference point, attracting researchers, practitioners, and public officials from other municipalities who are interested in learning from its regenerative approaches and developing partnerships. Within this broader strategy, the Agroecology and Regeneration Center for the Semi-Arid (CARES, see section 2.1.2 Strategies in Action) has further amplified the reach of local experimentation. Beyond testing soil regeneration techniques, CARES hosts guided visits, short-term trainings and volunteer programmes, welcoming participants from Portugal and abroad. These activities not only disseminate agroecological knowledge and practices but also create a living laboratory that allows diverse publics to engage with regeneration in concrete, hands-on ways. In this sense, CARES plays a pivotal role in transforming Mértola's local innovations into experiences that can be replicated and adapted in other contexts.

At the institutional level, the policy adaptability and the strategy towards a local food system led by Mértola City Council is now serving as an inspiration for neighbouring municipalities. Several municipalities in the Baixo Alentejo region have shown interest in adopting approaches to prioritise local, organic, and seasonal products. This influence is not prescriptive but rather emerges from Mértola's practical experience in aligning procurement procedures with regenerative goals, demonstrating that creative, context-sensitive solutions can inspire others while working within the current legal framework. Yet the experience also shows that without adjustments to procurement legislation and to EU Directive 2014/24/EU, the potential for truly scalable change will remain constrained, as the existing framework does not adequately value or prioritise local production.

At the same time, ESDIME has been taking steps to integrate regenerative principles into its support initiatives, encouraging interest in regenerative pastures and agroecological systems across the region. In parallel, the ongoing work to build a regional Food Basin holds strong potential for scaling, as it promotes inter-municipal cooperation and strengthens agroecological supply chains that extend beyond Mértola. Still, partners recognise that for these innovations to be fully institutionalised and replicated at scale, further steps are needed to broaden participation and to secure more stable and long-term policy commitments.

Strategic framing and symbolic dimensions

The strategies underway in Mértola are not limited to technical solutions or policy adjustments - they also actively engage with the symbolic and cultural dimensions of biodiversity regeneration. One of the most important shifts is the reframing of agricultural imagination: local actors, especially Terra Sintrópica Association, are working to replace the image of Alentejo as a monocultural breadbasket with new narratives of the territory as a mosaic of regenerative systems, based on cooperation between species, healthy soils, and community well-being.

This symbolic shift is supported by multiple initiatives: events such as "Night at the Market" create public spaces for dialogue on healthy food, biodiversity, and regeneration, while the Cozinha d'Avó project revalorizes traditional culinary knowledge, linking food practices with biodiversity and cultural identity. The work of **PREC - Ongoing Regenerative Process (Processo Regenerativo em Curso)**, a self-managed space created by Terra Sintrópica that serves healthy, local, seasonal, and regenerative meals in Mértola, further contributes to transforming local food culture. More than just a kitchen, PREC acts as a living laboratory for food sovereignty, ecological transition, and community engagement. By focusing on the consumption side of the food system – connecting production to the plate – it offers everyday experiences that link dietary habits with ecological awareness and demonstrate that regeneration is not only about how food is produced but also about how it is prepared, shared, and valued.

At the governance level, the very structure of the Mértola Food Network (MFN) - based on co-responsibility, collective decision-making, and multi-actor participation - models an alternative form of public action that counters top-down and technocratic governance. Through these cultural and institutional framings, the strategies in Mértola help reshape how biodiversity, land, and regeneration are valued - not only by policymakers but also by the broader community.

Taken together, all these initiatives show that Mértola's regenerative strategies are not confined to production but extend to everyday consumption practices, linking the field to the plate. This broader perspective reinforces the view of regeneration as a whole food system approach — one that integrates ecological, cultural, and social dimensions and makes biodiversity part of daily life.

6.2 Enablers and disruptors

Enablers

Among the most important enablers of biodiversity regeneration in Mértola is the positioning of the municipality as a “living laboratory” for sustainability - a political and symbolic choice actively promoted by the City Council together with a plethora of organisations. This positioning has helped attract resources, networks, and visibility at both national and international levels.

A strong participatory governance culture is another major enabler. One of the defining features of the Mértola case is its embedded **culture of co-governance**, which extends beyond formal participation mechanisms to foster deep-rooted collaboration among local institutions, producers, educators, associations, and researchers. Rather than centering on isolated platforms, this governance culture supports long-term relationships and trust-building processes that enable diverse actors to align around shared ecological goals. This collaborative ethos has provided fertile ground for experimentation and innovation, particularly in projects like **Regenerative Pastures**, led by ESDIME, which has stimulated the adoption of holistic grazing and keyline design techniques by local producers.

While the overall funding logic has not fundamentally changed, this initiative represents a significant step toward embedding regeneration criteria in local development strategies. Similarly, the **Mértola Biological Station (MBS)** plays a key role in transforming local imaginaries. Through practical services such as soil analysis, game census, and research in wild biodiversity, MBS challenges the perception of Mértola as a territory without prospects, positioning it instead as a knowledge hub for future-facing land stewardship. These efforts illustrate how the governance landscape in Mértola is not only about institutional flexibility, but about sustained co-responsibility and the gradual redefinition of what regeneration means in a semi-arid rural context.

Institutional adaptability and public procurement innovation. Institutional adaptability has proved pivotal - not only in legal terms, but also in the way procurement processes were used as a lever for change. Evidence from the TerrAlimenta project, one of the projects led and recently concluded by ESDIME, shows that local authorities worked with producers, nutritionists, and canteen staff to map production capacity, analyse food consumption data from public schools, and align menus with seasonal availability ([Monteiro & CIMBAL, 2024](#)). In Mértola specifically, the MFN served as an important arena for these discussions, bringing together organisations and municipal representatives to deliberate on how to progressively increase the share of local and organic products in public canteens.

The baseline data for the Baixo Alentejo Region - where Mértola is located - revealed the scale of the challenge: only 3.8% of the monthly volume of vegetables and 3.6% of fruit consumed in public canteens came from local production, with the remaining volume supplied by distributors, most of them within the Baixo Alentejo. This diagnosis suggests that building a regional Food Basin is a natural next step, as it would allow these existing supply chains to be reorganised around agroecological production and scaled up through inter-municipal cooperation.

These findings informed a process of progressive menu reformulation and the issuing of smaller tenders, enabling the application of qualitative criteria - such as proximity and organic production - while remaining fully compliant with EU procurement directives. In Mértola, the participatory process strengthened trust among stakeholders and encouraged local producers to adjust their calendars to supply schools and social institutions as regular clients.

Visibility and external recognition. The Mértola Biological Station (MBS) contributes by attracting academic and public attention to Mértola's regenerative work, positioning it as a reference at national and international levels.

Funding innovation, regenerative criteria and community of practice. Funding innovation, driven by ESDIME, has been another important enabler of change. Programmes such as Regenerative Pastures (Pastagens Regenerativas) have piloted approaches to holistic grazing and syntropic practices, providing technical support to encourage experimentation among farmers (Cortegano & Encarnação, 2024). While these initiatives do not yet represent a complete transformation of funding logic, they demonstrate a clear movement towards integrating regeneration criteria into territorial development support. The experience has also highlighted the importance of linking financial incentives with capacity-building, so that producers can adopt regenerative techniques with lower risk and greater continuity. Building on this, a Community of Practice on Regenerative Agriculture was created, bringing together farmers, researchers and practitioners in a structured process of exchange. The group combined participatory workshops with study visits to farms in Portugal and Spain where regenerative techniques such as holistic grazing and keyline design were already in place, offering concrete examples of their potential. These visits were complemented by theoretical and practical training sessions on topics ranging from rotational grazing to *montado* regeneration and direct marketing of pasture-raised meat, further strengthening collective learning and confidence in applying regenerative methods (Cortegano & Encarnação, 2024).

Networks of mutual learning. Within the Mértola Food Network and through cross-case inspiration with other municipalities - they support the spread of innovative approaches. The **Food Basin** initiative is fostering regional scaling, while practices piloted in Mértola are already inspiring similar efforts in neighbouring municipalities.

Taken together, these enablers - participatory culture, institutional flexibility, leadership commitment, visibility, funding innovation, and networked learning - provide a fertile ground for scaling and replicating biodiversity regeneration efforts across Mértola and the wider Baixo Alentejo region.

Disruptors

Several structural, political, ecological, and cultural factors continue to hinder biodiversity regeneration in Mértola, even in the presence of strong enablers.

First, ecological vulnerability remains a persistent background condition. The territory faces high exposure to desertification, water scarcity, soil degradation, and declining fertility - much of it inherited from decades of intensive land use. These pressures are compounded by prevailing imaginaries of land and water management held by many actors in dominant economic sectors. Traditional views continue to privilege extensive livestock farming, "LEGO-style" landscape interventions (rigidly fragmented and engineered responses), and the conventional *montado* system as ideal land uses. In this view, solutions often focus on large-scale infrastructure such as dams or river transpositions, rather than regenerative strategies like forest succession or water retention through syntropic agriculture. As noted in interviews, these imaginaries can act as significant cultural lock-ins, shaping local expectations and limiting the perceived legitimacy of agroecological experimentation.

Economic lock-ins reinforce these imaginaries. Many farmers operate with very narrow profit margins and remain trapped in a **subsidy-dependent cycle** tied to CAP mechanisms that usually reward conventional, high-input systems. This amplifies risk aversion toward

agroecological innovation. As a result, regenerative strategies like syntropic agriculture are still perceived as uncertain by many producers.

Institutional inertia also persists. Long-standing administrative routines - for example, in municipal maintenance - often ignore or resist regenerative practices (e.g., regenerative planting, soil care), requiring ongoing efforts to shift institutional culture and knowledge.

Geographical isolation further limits change. The **highly dispersed rural geography** of Mértola - with 106 villages spread across the seven parishes of Alcaria Ruiva, Corte do Pinto, Espírito Santo, Mértola (town), Santana de Cambas, São João dos Caldeireiros, and the Union of Parishes of São Pedro de Sólis, São Sebastião dos Carros and São Miguel do Pinheiro - makes communication, transport, and participation difficult, especially for marginalised groups. As focus groups have shown, this territorial disconnection results in “two Mértolas”: one, more networked and engaged in regenerative initiatives, and a second, composed of more isolated communities that remain peripheral to these processes.

Culturally, a **dominant political imagination** in the Alentejo region still favours infrastructure-heavy, productivist approaches over biodiversity-centred, regenerative models. Without adequate policy shifts, this mindset risks slowing the institutional embedding of regenerative innovation.

In response, actors in the territory are actively working to **mitigate these disruptors** through multiple strategies. The **Mértola Food Network** seeks to build an alternative **ecological imagination** - fostering social learning through projects like the **Therapeutic Gardens, Grandmothers’ Kitchen, Shelter Land, and Forest Gardens** in schools. These initiatives engage citizens in hands-on regenerative practices and help transform perceptions of land, food, and community (see section 2.1.2 for a description of the initiatives).

At the policy level, the Food Network and Future Lab are committed to long-term dialogue with institutional actors, aiming to shift local and regional funding logics and planning priorities toward agroecology and regeneration.

Finally, participatory efforts by the Municipality - such as rotating council meetings to outlying parishes - aim to address geographical isolation by fostering **greater inclusion** in decision-making.

Policy Attunement and mismatch

Mértola’s local biodiversity agenda encounters both alignment and tension within national and EU policy frameworks. While national and EU policies increasingly highlight biodiversity regeneration and agroecological transitions, their implementation frameworks often remain misaligned with the realities of rural territories like Mértola. Although recent CAP reforms introduced tools such as eco-schemes and rural development measures, in practice, structural incentives continue to favour large-scale conventional agriculture. This limits access to support for small-scale regenerative farmers and community-led initiatives. Rather than focusing solely on legal constraints, local actors have responded by exploring creative pathways to align available instruments with local priorities - experimenting with targeted procurement adjustments and fostering new partnerships. Yet, a broader transformation of policy cultures and funding logics is needed to fully accommodate regenerative approaches that are place-based, socially inclusive, and ecologically ambitious. The experience in Mértola reveals that adaptability alone is not enough: enabling real alignment requires sustained support for experimentation, recognition of diverse value systems, and space for local governance actors to shape implementation on their own terms. Below are some examples.

CAP

The structure of the Common Agricultural Policy (CAP) (2023–27) has introduced important environmental measures - such as mandatory eco-schemes, which allocate at least 25%

of direct payments to sustainable practices, and the Rural Development pillar ([FEADER](#)) dedicated to climate and biodiversity goals ([food.ec.europa.eu](#), [agriculture.ec.europa.eu](#)). However, as implemented in practice, the Portuguese CAP Strategic Plan favors larger landowners and conventional models, rendering it difficult for small-scale regenerative farmers to access consistent support. The result is a subsidy system that remains misaligned with Mértola's regenerative objectives, leading many farmers to remain locked into high-input systems.

National subsidy frameworks

National subsidy frameworks such as the **Programme of Support and Incentives for Agriculture** may technically support sustainable practices, but in reality often maintain a resource-intensive logic, highlighting a misalignment between policy and implementation ([Viegas, Wolf, Cordovil, 2023](#); [OECD, 2023](#)).

Farm to Fork Strategy

The European Green Deal's Farm to Fork strategy encourages sustainable food systems - reducing pesticide use, supporting organic farming, and promoting local agri-food networks ([European Commission, 2023 May](#)). This aligns conceptually with Mértola's efforts to build a local food basin. Yet, progress remains uneven due to delays in legislation and resistance from entrenched interests.

Public Procurement Policy

EU Directive [2014/24/EU](#) (European Union, 2014) requires procurement based on cost and non-discrimination, which often creates a bottleneck for sourcing local, organic produce. In Mértola, local actors addressed this constraint by developing a participatory procurement model involving TSA, MCC, and others to restructure school and eldercare menus. By working within the existing legal framework — for instance, by opting for smaller lot sizes and aligning supply with seasonal availability — they created space for local producers to participate. This grassroots adaptation, now being considered in neighbouring municipalities, illustrates how local practice can innovate within restrictive procurement norms.

Policy Alignment Opportunities

Portugal's CAP Strategic Plan must include a minimum share for eco-schemes (~25% of direct payments) and strong rural development funding (~35%) ([agriculture.ec.europa.eu](#)). These open pathways for Mértola actors to secure structural support for regenerative agriculture. The Farm to Fork strategy additionally supports local food initiatives - creating a favorable policy narrative for Mértola's food basin.

The prevalent imagery

Major economic sectors in the Baixo Alentejo region – agriculture, livestock, hunting and tourism – tend to hold conservative positions on the solutions proposed for addressing local challenges in the territory, such as desertification, water shortage, rising temperatures, depopulation, natural resource degradation, soil erosion, and fertility loss. For example, discussions on water management not rarely focus on river transportation, desalination, and small-scale irrigation systems, as well as subsidies and market-driven approaches on cattle stocking density, etc. This, therefore, leads to a considerable mismatch between major economic actors' interests and Mertola's agenda for biodiversity regeneration.

6.3 Failed and successful practices

Successful practices

A co-governance approach. One of the clearest successes in Mértola has been the establishment of a co-governance approach that integrates diverse local actors in the design and implementation of biodiversity regeneration strategies. Through the Mértola Food Network and the Future Lab, Mértola City Council, Terra Sintrópica Association and other stakeholders have created spaces for collaborative decision-making that go beyond isolated projects. This participatory structure has been effective in mitigating some local power imbalances and fostering transparency, contributing to a greater sense of shared ownership over biodiversity initiatives. The success of this model can be attributed to strong leadership from the Municipality, the trust-based relationships cultivated among actors, and the stability of the initiatives such as MFN and Mértola Future Lab, which provide continuity beyond individual projects.

Planting seeds for future youth opportunities. Initiatives on the ground are creating conditions that may, over time, generate new opportunities. Visible pathways for engagement with biodiversity and land regeneration are being created. The Mértola Biological Station (MBS) promotes research opportunities and innovation in biodiversity-related fields, helping to position the territory as a dynamic and forward-looking space and offering continuity for young researchers who might otherwise need to leave. ALSUD's training programmes in agroecology and game management provide vocational routes at an age when many young people consider leaving the region. These programmes help counteract the perception of Mértola as a place of limited prospects and have started to spark new forms of youth engagement. These initiatives may not yet yield immediate outcomes, but they represent important steps towards building synergies between education, employment and land stewardship, laying the groundwork for future youth opportunities linked to the territory's ecological vocation.

Strengthening social cohesion through regeneration. An essential dimension of Mértola's approach is its investment in strategies that connect ecological goals with social cohesion. Public events such as "*Night at the Market*" offer inclusive spaces where food, culture, and biodiversity regeneration are brought together in everyday life, reinforcing a sense of community in a geographically dispersed municipality. Similarly, initiatives like PREC and Grandma's Kitchen promote positive framings of the territory as a regenerative space - strengthening cultural identification with biodiversity goals. The strength of these practices lies in their ability to combine symbolic and tangible experiences, amplifying awareness while fostering a stronger collective identification with regeneration — a necessary condition for broader adherence and mindset change.

Failed Practices

Absence of ordinary citizens and underrepresented groups in participation processes. The participatory process promoted through the co-governance approach animated by the public body in Mértola is still limited to some pivotal organizations in the village and municipality. As a result, broader segments of the community - particularly ordinary citizens in more remote areas - remain underrepresented in the governance spaces, and their potential contributions to shaping local mindsets and values around biodiversity regeneration are not yet fully realised. Residing minorities should be better included in Mértola's strategies for biodiversity regeneration. Minorities are not ignored by Mértola's case, although some underrepresented groups such as Roma people and immigrants could strongly benefit from their insertion and participation in regenerative strategies in the territory.

Youth sensibilisation is missing. Youngsters are leaving Mértola as soon as they can as they are taught to consider the village and the municipality as places with no credible future. The strategies for enhancing the visibility of opportunities available in the municipality of Mértola needs targeted communication and further efforts to delineate

promising ideas engaging youth. At present, Mértola lacks a structured strategy for youth sensibilization and talent retention. A significant number of young people perceive the municipality as offering limited prospects for the future. This perception, while not universally shared, might be reinforced by certain local actors, including educators within the public school system. However, some promising avenues are beginning to take shape. ALSUD's vocational training programmes - particularly in agroecology and game management - are generating interest among younger generations and helping to reframe local rural professions as viable and meaningful career paths. Additionally, the Mértola Biological Station (MBS) holds potential to become a future hub for youth employment in biodiversity and regeneration, offering concrete prospects for those seeking locally rooted professional engagement. Importantly, the complementary action plan developed by CES includes a specific focus on youth engagement and participation, recognising it as a key dimension of any long-term regenerative strategy in the territory.

Critical Gaps and Missed Opportunities

A persistent gap is the **uneven participation across the municipality's dispersed geography**. Despite efforts to rotate meetings to rural parishes and initiatives like "Night at the Market" to both promote social cohesion and enhance food literacy, there is still a clear divide between the central network of engaged actors in the town and the more peripheral, isolated communities. The highly dispersed nature of Mértola - with 106 villages spread across the seven parishes of Alcaria Ruiva, Corte do Pinto, Espírito Santo, Mértola (town), Santana de Cambas, São João dos Caldeireiros, and the Union of Parishes of São Pedro de Sólis, São Sebastião dos Carros and São Miguel do Pinheiro - continues to produce **territorial disconnection**. Without more systematic approaches to outreach and participation, regeneration efforts risk deepening this divide rather than overcoming it.

Another important gap is the **lack of sustained youth engagement**. While individual programmes (such as the technical course in wildlife management promoted by ALSUD) are beginning to create pathways, there is still no coherent, municipality-wide strategy to involve young people in biodiversity regeneration - either through education, governance, or employment opportunities. Without such a strategy, the risks of **youth out-migration** and **future disengagement** remain high.

Minority inclusion also remains underdeveloped. Groups such as **Roma people and migrants** are underrepresented in the Food Network and in regenerative practices more broadly. Their potential contributions - in terms of cultural knowledge, social perspectives, and alternative practices - are not yet fully integrated. This reflects both structural inequalities and a lack of targeted strategies for meaningful engagement.

Finally, there is an opportunity to strengthen **external communication** and storytelling around biodiversity regeneration - particularly to counter dominant narratives of productivity and infrastructural "solutions" that still shape much of the regional political imagination. While successful efforts exist within the Food Network, a broader communication strategy that reaches beyond existing circles would help consolidate public support for long-term change.

Lessons and future directions

The range of successful regenerative projects, and the way Mértola has gradually become an example of a resilient territory in tackling desertification and promoting biodiversity regeneration, demonstrate the potential for locally rooted, collaborative approaches to drive change. One of the most significant lessons lies in how these strategies have gradually taken root: not through imposition, but through a process of social legitimisation, trust-building, and iterative adaptation.

A key element in this transition has been the **emphasis on social cohesion**. Rather than treating change as a technical matter alone, the Mértola case foregrounds the cultural and relational work required to foster transformation. Literacy around biodiversity and food

systems is promoted not through external imposition but through recognition of local knowledge, traditions, and forms of care. This participatory approach has made it possible to build legitimacy around new practices and their underlying rationales, allowing regeneration to be anchored in the lived realities of the territory.

Another valuable lesson concerns the **ongoing strategies that encourage people to experiment** with new techniques in areas such as water and biomass production (e.g., syntropic agriculture), wildlife population control (e.g., game management), and interspecies collaboration for soil regeneration (e.g., successional agroforestry systems). Several methods have proven effective:

- Engaging local and elderly farmers to share their knowledge while testing innovative practices;
- Inviting farmers to visit successful, evidence-based regeneration initiatives, encouraging change through peer-to-peer exchange;
- Promoting the gradual incorporation of regeneration-related criteria into funding schemes to support experimentation;
- Building alliances with nearby municipalities and territories to scale impact and generate learning beyond Mértola itself.

This **invitation to experiment**, for those already engaged in agroecological transitions, has been complemented by efforts to reach out to neighbouring municipalities. These strategies suggest that transformation does not emerge from isolated interventions, but from the creation of social, institutional, and ecological bridges that connect diverse actors and foster mutual learning.

While much has been achieved, the **persistence of gaps in youth engagement, minority inclusion, and territorial participation** highlights the need for more targeted and systematic efforts. This includes more structured approaches to youth sensibilisation, by challenging perceptions that Mértola lacks a viable future and building pathways to retain local talent, such as those offered by ALSUD. In terms of minority inclusion, the **Shelter Land project** represents an important symbolic and practical opening. Despite limited visibility in public narratives, it demonstrated that regenerative work can serve as a powerful tool for integration and agency-building, particularly for refugee and migrant communities. These gains, although modest, point toward scalable practices for fostering a more inclusive regenerative strategy.

This leads to a final key lesson: the **importance of combining institutional innovation with cultural work** that reshapes public narratives and values around biodiversity. Technical success alone is insufficient unless it is accompanied by strategies that deliberately work against community isolation, as well as structural inequalities and entrenched exclusions. Mértola's experience underscores that deep social transformation requires not only policy alignment and institutional support, but also cultural shifts, sustained dialogue, and a commitment to building just and inclusive alliances across the social fabric of the territory.

6.4 Co-learning

In the context of the Mértola case study, co-learning was both a methodological strategy and a political stance. It guided how BIOTraCes researchers, particularly CES, approached the field: not as observers collecting information but as facilitators of horizontal dialogue, committed to recognizing and strengthening the existing regenerative efforts already in place. Mértola is a mature case with ongoing processes of socio-ecological transformation. Therefore, the challenge for CES was not to introduce new solutions but to support reflection and consolidation, co-designing complementary strategies with local partners that could help address remaining gaps.

Co-learning as a Principle and Method

Co-learning in Mértola was conceived from the beginning as a strategic, methodological, and political approach. For CES, it involved more than sharing knowledge - it meant cultivating the conditions for joint reflection and decision-making across different knowledge systems, roles, and positionalities. The aim was not to transfer solutions, but to collectively think through what regenerative transformation could look like in a territory already rich in experimentation.

Recognising the maturity of local governance practices, CES approached co-learning as a way to support and critically accompany existing regenerative efforts. Societal partners such as Terra Sintrópica Association (TSA) and the Mértola City Council (MCC) brought deep territorial and institutional experience to the table. Equally important were the contributions of the Mértola Food Network (MFN), which mobilizes local producers, associations, local government public staff, and the diverse knowledge holders embedded in the region's social fabric - such as elders, community gardeners, artisans, educators, and other informal actors. CES's role was to foster reflective dialogues that could surface blind spots, consolidate existing strengths, and generate shared strategies for action. By recognizing these different voices as active co-constructors of regenerative futures, the co-learning process was able to articulate not only institutional perspectives but also grounded, embodied knowledges often left at the margins of policy and planning.

CES's approach throughout the BIOTraCes project was shaped less by a structured co-learning methodology and more by an ongoing process of adaptation and responsiveness to field realities. The team maintained close engagement with societal partners and community actors, which enabled small mid-course adjustments and the introduction of context-sensitive ideas as the project evolved. Rather than following a rigid implementation plan, this flexible approach allowed CES to remain attuned to emerging dynamics in the territory and to contribute to the local regeneration process in a grounded and supportive manner.

Rather than relying on predefined roles, co-learning unfolded as a relational practice shaped by mutual invitations to participate in strategic and reflective spaces. This included, for example, TSA's invitation to CES to engage in discussions about the Shelter Land and regenerative tourism projects, as well as CES's own initiatives to convene focus groups and workshops designed around local knowledge exchange and scenario building.

Through these engagements, a co-learning ethos emerged based on trust, continuity, and mutual recognition. The creation of a dialogical atmosphere - rooted in the ethics of non-imposition and respect for lived experience - was central. CES maintained a sustained presence in the territory, participating in local events and informal exchanges that provided a deeper understanding of how social and ecological knowledge was being mobilised locally.

Co-learning thus became a mechanism not only for producing knowledge, but also for generating legitimacy and ownership of proposed interventions. It anchored the research within a horizontal framework where the analytical gaze of the researchers was just one among many situated perspectives, enabling a richer and more context-sensitive understanding of Mértola's regenerative ecosystem. CES was not there to test or validate a model but to reflect alongside partners on how their own models could evolve.

Co-learning During the Preparation of D2.4

Co-learning was central to how Deliverable 2.4 was produced. The main structured co-learning moments included:

- **Internal CES workshop (IW)** (May 2024, Miro facilitation): served to clarify field strategy, reflect on ethical considerations, and prepare for respectful engagement in a mature and complex field. It aimed at discussing how concepts such as transformative change and co-governance might be understood in Mértola,

including ethical questions related to inclusive engagement. The workshop was attended by CES team members and the Terra Sintrópica Association (TSA).

- **Two focus groups (FG1 and FG2):** one with the **Mértola Food Network (MFN)** in December 2024 (**FG1**) and another in February 2025 with **other organizations and community stakeholders (FG2)**, more specifically, with one representative from each of the following entities: Terra Sintrópica, Mértola Business Association, ALSUD (vocational training school), the Mértola City Council, Mina de S. Domingo Business Association, one from Casa do Guizo (rural tourism business) de Santana de Cambas and one representative from the Union of Parishes. The two focus groups were held in a space provided by Mértola City Council. These moments prompted self-reflection among participants and introduced a broader diversity of perspectives into the analysis.
- **Feedback workshop (FBW)** (December 2025): to be organised as a collaborative review of preliminary findings and strategies. It is conceived as a moment of feedback, co-validation, and adjustment.
- **Cross-case co-learning workshop (CoIW)** (December 2025): the event called "Participation and the youth's role in regenerative processes: opportunities and challenges" will focus on youth and its participation in regenerative governance. The aim is to bring together experiences from Portugal and Brazil, more specifically with representatives from IRPAA (Instituto Regional da Pequena Agropecuária Apropriada/Regional Institute for Appropriate Small-Scale Agriculture). The focus of the discussion will be the presence of youth in the design and implementation of nature-based solutions as well as the innovative approaches to connect community-based change and semi-arid territories.
- Additionally, several **informal and embedded co-learning opportunities** occurred:
 - Networking with key stakeholders during a "Night at the Market" event.
 - Field visits to TSA's projects and participation in spontaneous conversations, including a knowledge-sharing visit and exchange with Luciane Lucas dos Santos and Fernanda Petrus on January 31, 2023.
 - TSA's invitation to CES to reflect strategically on the Shelter Land project (with Afghan refugees) to reflect upon possible changes and betterments.
 - and later to participate in the launch of the regenerative tourism initiative ("**TUI Field to Fork – Alentejo Regenerativo**", October 2024), where the concept of regenerative territory was once again brought to the scene as a kind of *leitmotif*. In this event, we engaged in discussions on sustainable tourism practices.
 - Pedro Nogueira's participation in CES's colloquium "**New Generations, Risks and Vulnerabilities**", representing TSA and leading a workshop on syntropy and regeneration through use. His workshop stimulated valuable knowledge exchange and fostered potential collaborations for further projects.
 - An invitation by TSA for CES to contribute to internal reflections at TSA, as the organization prepared for a shift in funding strategy following the end of European institutional support.

These moments allowed CES to **immerse itself in the lived dynamics of the territory**, forging a deeper understanding of local logics, challenges, and opportunities.

Focus groups also created opportunities for dialogue between the CES team and organisations from the Mértola Food Network, as well as with other local organizations. Based on these exchanges, it was possible to co-design a complementary action plan for Mértola. This plan prioritises actions in four key areas: (I) targeted communication and awareness-raising to support experimentation with new productive, consumption, and community redistribution practices; (II) identification and increase the valorisation of local

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knowledge to foster community resilience and social cohesion (these activities were labeled as "viveiros de experiências"); (III) promotion of experience-sharing with other initiatives in Portugal and abroad related to community participation in governance; and (IV) stimulation of regenerative economy initiatives. We highlight point III in particular, as it focuses on promoting moments of exchange between organisations that have faced similar challenges.

In December 2024, we conducted a first focus group, **FG1**, with the Mértola Food Network, which allowed them to enter into a self-reflection exercise regarding successful initiatives and possible shortcomings. The use of collaborative mapping allowed participants to visualize and strategise the importance of different aspects of the role of the network and aspects of regenerative processes in Mértola, fostering a sense of ownership and commitment to sustainable initiatives. In February, 2025, we conducted the **FG2** with other organisations and individuals that were not involved directly in the strategies related to MFN. It was a way of learning about other demands and perspectives from different stakeholders in Mértola.

We have also planned **FBW** scheduled for December 2025, which will focus on collectively reviewing the preliminary findings, particularly those emerging from the two focus groups. The workshop is designed to detect, together with local stakeholders, potential shortcomings in the current regeneration strategy in Mértola. It will include feedback forms, interactive sessions, and group discussions aimed at identifying areas that require refinement or adjustment. The ultimate goal is to use this collaborative reflection to enhance or revise elements of the existing work plan, ensuring it better aligns with the insights, concerns, and aspirations expressed by the community and societal partners.

The following table summarizes the formal co-learning activities.

Table 6 - Formal Co-learning events

Event	Participants	Location and date	Identifier
IW	CES and TSA	Online, May 2024	IW_PT_05-24
FG1	MFN	Mértola, December 2024	FG1_PT_12-24
FG2	Entities indirectly linked to the MFN	Mértola, February 2025	FG2_PT_02-25
FBW	All participants	Online, December 2025	FBW_PT_12-25
CoIW	CES team, MFN, IRPAA (Brazil)	Online, December 2025	CoIW_PT_12-25

Co-learning Dynamics in the Case Study

The co-learning dynamics in Mértola culminated in the development of a complementary action plan intended to support ongoing regenerative efforts by identifying opportunities for improvement and innovation. This was not a matter of replacing existing strategies, but rather of creating space for dialogue that could reinforce what was already in motion.

The plan was shaped through sustained interactions and shared reflections among CES, societal partners, and community actors.

A recurring theme throughout these exchanges was the difficulty of broadening participation beyond core organizations. Communication challenges emerged as a shared concern among local actors themselves. Mértola's geographic dispersion - its vast territory composed of multiple small and relatively isolated communities - was identified as a major obstacle, especially when it comes to reaching residents who are not already involved in regeneration initiatives. Notably, several stakeholders emphasised the particular challenge of engaging with younger populations, who often do not follow the same communication channels as older generations and may feel disconnected from institutional or community processes. While this difficulty was not unexpected, the co-learning process helped to increase the reflexion over the need to develop more tailored, age-sensitive, and accessible formats for communication and outreach. As a result, the action plan proposed by CES is informed by strategies aimed at stimulating dialogue, fostering intergenerational engagement, and lowering barriers to participation. These should be seen as experimental starting points rather than definitive solutions.

In the co-designed work plan, a space was thought for Mértola to exchange with initiatives beyond Mértola, in order to discuss issues such as youth engagement in transition or successful strategies to deal with the challenges in semi-arid areas. Drawing on existing networks, CES suggested the possibility of reflecting collectively with actors engaged in similar efforts in other territories. This was not meant as a prescriptive solution, but as an invitation to dialogue - offered with the intention of broadening perspectives, sharing experiences, and reinforcing mutual learning. The idea was well received, as it resonated with ongoing reflections among local actors about the value of peer-to-peer engagement. These exchanges have since become part of the action plan, contributing to the process in a supportive and non-directive way.

Challenges and Reflections

Despite its successes, the co-learning process faced limitations. One of the main challenges was the difficulty of directly engaging ordinary citizens.

While the team initially hoped to reach beyond institutionalised actors, logistical constraints and limited availability among the population made this difficult. In addition to these practical challenges, the fieldwork also suggested a prevailing tendency to prioritize engagement through institutional channels. Although social cohesion is an explicit concern in the local regeneration strategy, there appears to be an underlying assumption that institutions - rather than individuals or informal groups - should take the lead in shaping and implementing change. This does not imply a lack of interest in broader participation, but it does point to a structural orientation that may limit the emergence of more horizontal or community-driven forms of involvement. Recognising this pattern can help inform future strategies that aim to expand participation beyond organised actors.

Another challenge involved asymmetries in capacity and visibility: some organisations had more experience with funding, facilitation, or policy dialogue. CES had to be attentive to these dynamics, ensuring that proposals reflected the needs and contributions of less empowered actors as well.

A further point that deserves reflection is the tension between CES's commitment to social justice and the priorities identified by local actors. As part of its methodological and political orientation, CES consistently emphasised the importance of identifying and including underrepresented groups - such as racialised communities, migrants, and Roma populations- as part of the effort to foster truly inclusive regenerative governance. However, in Mértola, these concerns were not widely shared or prioritised by local partners. In some cases, it was not a matter of open resistance, but rather a lack of familiarity or tools to address these dimensions effectively.

Although the Shelter Land project, which supported Afghan refugees, was a powerful and commendable initiative, its continuity was paused to allow for a period of reflection on its social and environmental impact and to explore new approaches to reception. The project represented an important step towards more inclusive participation in Mértola. Yet inclusivity in the territory requires further attention and deepening.

It is worth recalling that inclusion is grounded in local perceptions and continually shaped by how difference is interpreted and negotiated. Co-learning processes must therefore address not only mechanisms of participation, but also the underlying understandings of justice, diversity, and equity. The Mértola case reminds us that co-learning is not always fully consensual — it involves negotiating tensions, working with discomfort, and identifying spaces for gradual transformation.

6.5 Testing of interventions

The interventions analysed in Mértola cannot be understood as isolated actions. Rather, they are embedded within a complex landscape of pre-existing regenerative practices, ongoing experimentation, and participatory governance dynamics. These interventions were primarily led by local actors - including the Mértola Food Network (MFN), Terra Sintrópica Association (TSA), the Mértola City Council (MCC), and ESDIME.

What was tested was not a single product or policy, but a set of situated, co-created strategies designed to transform the structural conditions that contribute to biodiversity loss and social exclusion. It is also worth noting that a work plan was co-designed with the societal partners and is already under implementation. This plan focuses on areas previously underexplored or requiring greater attention - such as targeted communication to engage young people in regenerative processes, and intercultural dialogue with successful initiatives, both in regenerative strategies for semi-arid regions and in the engagement of women and youth. Several of the strategies resulting from this co-creation process - developed through focus groups and collective reflection - are already being tested, while others are scheduled for implementation throughout 2026.

Testing, in this context, referred to the social, political, and adaptive process through which interventions were designed, assessed, and adjusted. Through co-learning and co-reflection, CES and its partners aimed to understand to what extent these strategies were effective in addressing entrenched lock-ins.

The testing of interventions was conducted through a range of participatory methods: two focus groups (one with MFN and another with different actors of the community), a feedback workshop, participatory observations, internal strategy meetings, and planned co-learning exchanges (see *table 6*). Rather than a one-time assessment, this testing was embedded in the **relational flow of the project**. The action plan co-developed through this process served as both a mirror and a vehicle for evaluation: it reflected what had been learned and proposed ways to move forward.

Stakeholder Engagement and Participation

The participatory strategies fostered over time by the societal partners succeeded in opening space for new dialogues-particularly through the MFN, which have been bringing together, since its inception, institutional actors and individuals who might not otherwise collaborate on a daily basis, including school nutritionists, cooks, producers, teachers, public health officials and municipal staff. This diversity of voices helped shape a more plural space for reflection, even though not all groups in the territory were equally represented. The process is expected to continue and deepen in the coming period, building on the trust already established.

Despite the undeniable engagement, important exclusions remained. Although the Shelter Land project with Afghan refugees demonstrated that inclusive work was both possible and welcome, its continuation is still expected, with hopes that it may inspire further inclusion

efforts in the future. Greater attention to internally marginalised groups would be an important next step, helping to advance spatial justice in the territory.

So far, underrepresented groups -such as Roma communities or recent migrants - have neither been engaged nor prioritised. From CES's perspective, this represents a key limitation in the transformative potential of the interventions: by their continued underrepresentation, the social justice dimension of the work remains incomplete. CES has consistently highlighted the need to better integrate these perspectives, since current interventions have focused mainly on strengthening social cohesion, shifting mindsets towards a regenerative approach, and changing practices in agriculture and livestock systems. These are crucial steps, but insufficient on their own to achieve fully inclusive and systemic transformation.

As documented in European reports on environmental justice and climate equity, communities such as Roma, migrants, and racialised populations often live under higher environmental risks and have lower visibility in environmental decision-making ([Marin & European Environmental Bureau, 2024](#); [Civil Rights Defenders, 2023](#); [European Migration Network Inform, 2023](#)). This empirical evidence supports CES's observation that the underrepresentation of these groups undermines the justice dimension of regeneration and limits its transformative potential.

Looking ahead, the co-created work plan and participatory strategies already in motion - particularly those developed through the Mértola Food Network - offer promising avenues to address these gaps and ensure that future interventions are more inclusive and socially embedded.

Knowledge Co-production and Collaboration

Knowledge co-production has been a cornerstone of Mértola's regeneration strategy. It builds on the municipality's efforts to foster concertation and dialogue and has become a defining feature of the partnership between CES and local actors within the BIOTraCes project.

At the local level, Mértola has promoted knowledge exchange through diverse formats - from informal conversations to MFN assemblies and hands-on workshops - highlighting local know-how in healthy food preparation, wildlife management, and regenerative agriculture. These moments created opportunities for dialogue both among organisations and between them and the community, fostering social cohesion and a shared space for learning. Initiatives such as *Night at the Market* (which combines conviviality with education on a local diet), and the *Therapeutic Garden* (where residents experiment with syntropic techniques in gardening) illustrate this integration of knowledge-sharing with everyday practice.

The MFN has functioned as a site where technical, scientific, and experiential knowledge could be confronted, layered, and reshaped. Its format and facilitation enabled a shift in epistemic authority, giving space to actors - such as cooks and farmers - who are usually left out of planning processes. This widened the circle of contributors and grounded the transition strategy in practical, lived experience.

At the project level, collaboration between BIOTraCes and Mértola's organisations and community unfolded through several key moments. Two moments illustrate this: (i) the first workshop with Mértola, where key elements for transformative change in the territory were jointly identified; and (ii) the co-created work plan, built from collective discussions during and after the focus groups. Informal exchanges, participation in MFN meetings, and the feedback workshop continue to feed this collaborative dynamic, enabling knowledge to circulate between researchers, practitioners, and residents.

Looking ahead, the work plan foresees three experience nurseries (*viveiros de experiência*) in 2026, designed to strengthen community resilience. These are spaces to surface tacit knowledge, experiment with new approaches, and reflect collectively on strategies for regeneration. This process aims to bring lay knowledge to the table on equal footing with

technical expertise, recognising it as a legitimate and indispensable element of just governance and co-production.

Impact on Policy and Decision-Making

At the policy level, the testing phase revealed the limits of institutional flexibility. Despite innovative ideas to source food locally and engage cooks and nutritionists in planning public meals, public procurement rules remained unchanged, creating a major barrier to systemic change.

To extend participation and bring decision-making closer to residents, the Municipality adopted a practice of rotating its public meetings across the parishes of Mértola, rather than holding them exclusively in the main village. This approach allowed citizens in more remote areas to engage directly with municipal representatives and created opportunities for the message of regeneration to reach communities that are often less involved in public debate.

In addition to this concern with multiplying the spaces where public issues are discussed, another factor that supported decision-making towards regeneration was the role played by policy intermediaries - particularly ESDIME - which acted as both facilitator and funder. These actors sought creative ways to adapt existing procedures and enable more regenerative procurement practices. While such initiatives did not result in formal rule changes, they encouraged small but significant shifts in institutional behaviour and helped build momentum for longer-term transformation.

Community-Level Changes and Social Perceptions

One of the most notable yet nuanced impacts of the interventions was the shift in community-level perception of biodiversity, land use, and regeneration. It is important to frame this not as an immediate or quantifiable transformation, but as an evolving process - one shaped by exposure, narrative, and participation.

The regenerative strategies led by Terra Sintrópica, Mértola City Council, and other organisations committed with regenerative approach have undeniably elevated Mértola's visibility as a site of experimentation. People from across Portugal and internationally now visit the area to learn about syntropic agriculture and community-based regeneration. Researchers, farmers, and policy actors alike have begun to see Mértola as a reference point.

Yet, within the territory itself, changes in local perception remain gradual. There is a growing awareness among residents of the importance of regenerative practices and of the risks posed by ecological degradation. Community-facing initiatives, such as school programs and participatory events like the "Night at the Market" have helped introduce these ideas into everyday language and practice. The interventions are fostering what could be termed a regenerative imaginary - a shift in how people envision the future of their landscape and livelihoods. The different temporalities in biodiversity literacy are important in this case. Also, the interventions are allowing people to know better about climate change, desertification - in other terms, to know and name the difficulties they are facing as well as the possible alternatives to overcome them.

The full effects of these efforts are not yet measurable. The interventions have laid groundwork, creating the conditions for longer-term cultural change, but the degree to which this will translate into transformed behaviors or policies will only become visible over time. If there is no possibility to state that there was a significant transformation in people's lives, it is certain that there is more awareness, and the vocabulary of regeneration is being ingrained in Mértola's community imagery. It is not possible to affirm how, when, and to what extent the consciousness will lead into an economic transformation in practices. As a very challenging territory dependent on environmentally harsh conditions, it is important to remember that the economic gains are unstable and small, and that economic instability

prevents experimentation and limits resilience in the face of potential losses from changing production systems. We are talking about a land where one invests time and resources with no guarantees of sufficient water supply, soil conditions, or temperature stability.

Another subtle but powerful transformation is the disruption of the idea that Mértola's landscape must remain unchanged. This reflects a crack in a dominant lock-in-the belief that the landscape's fragility precludes change. New conversations, partnerships, and strategies are nurturing a different imaginary, one in which Mértola's ecological challenges are not immutable but are open to collective response. The Mértola City Council has played a pivotal role here: beyond leading community calls for reflection, it has actively encouraged and supported the set of regenerative projects taking place in the territory. Alongside ESDIME (funding proposals), ALSUD (educational initiatives), TSA (regenerative projects that reinforce social cohesion), and MBS (research approach), this municipal leadership has contributed to a growing collective understanding of the future challenges the landscape will face. This shared awareness is a crucial starting point for tackling this lock-in that hinders the introduction of new agricultural practices.

Another lock-in being addressed is related to the beginnings of a co-governance culture and the value of community knowledge and participation of individuals and organisations in decision-making. In Portugal, the practice of participation is highly institutionalised and often does not accommodate ordinary citizens. While Mértola may not yet have fully tackled this lock-in - also due to territorial constraints and the dispersion of its population across hundreds of small villages - initiatives like "Night at the Market" represent meaningful investments in social cohesion and food literacy.

An additional persistent lock-in stems from a broader political and cultural mentality that values only scalable, externally designed solutions - typically formulated under national and EU directives that often lack articulation with local realities. While the EU aims to promote green and regenerative policies, many of the funding instruments available to agriculture continue to favor extensive, high-input practices such as tillage. This mismatch generates a significant contradiction: locally tailored solutions - crafted through participatory processes and adapted to Mértola's unique conditions - struggle to secure recognition and support. Their specificity, which should be a strength, becomes a barrier in systems that prioritize standardisation and replicability over place-based knowledge and governance.

The work with other municipalities and Mértola's capacity to attract interest in its regenerative strategies strengthen its internal value and legitimacy. This is particularly relevant in light of the ongoing plan to create an autonomous and healthy food system grounded in the food basin concept, which involves multiple municipalities, actors, and community members. It creates expectations, networks, and collective visions.

This Mértola that gains international recognition - attracting researchers, activists, and policymakers - also reinforces the value of its strategies for local residents. Mértola's participation in intermunicipal partnerships is generating a form of reflective recognition: as neighboring municipalities adopt similar approaches, residents begin to re-evaluate their own local efforts, seeing them not as isolated but as part of a broader regenerative shift.

This local momentum, however, still unfolds within a broader political landscape shaped by a prevailing national mentality that privileges scalable, externally designed solutions - for example, bringing water to dry areas - often without questioning how EU regenerative policies can realistically be implemented on the ground.

In this context, while measurable change may not yet be fully apparent, the interventions have clearly contributed to a shift in local imaginaries. More people are aware of the importance of regeneration, and more conversations are taking place about the future of the territory. This does not yet translate into structural transformation, but it represents an essential precondition: a community that is beginning to see itself - and its landscape - differently.

6.6 Discussion

Generally speaking, the political imagination in the Alentejo region has affected the recognition and scalability of Mertola's regenerative strategies. This prevalent imagination has been grounded on discussions on river transposition, adapted irrigation systems and subsidies improvements to guaranteeing economic activities, no matter how they are effectively connected with territorial needs. It has affected Mértola as policies and strategies developed have been concerned with making livestock and food production economic activities less impactful on the soil and on the water available.

Mértola not only has to confront regional and national imageries that disregard approaches such as syntropic agriculture, organic and local food production, and holistic grazing for pasture, but also faces the challenge of overcoming a prevailing perception that its fragile landscape is doomed - that many species will not survive in the most severe scenarios.

The lesson learnt is that changing mentality takes time, and science-based information is not enough to guarantee the change acceleration that is expected. Cultural change requires not only attention towards the rhythm of community and organisations but also the direct involvement of ordinary citizens in the design of the future expected scenarios; otherwise they will not be internally legitimated. It means that some strategies are crucial for making this change feasible, namely:

1. The ongoing invitation for the community to progressively experiment with new ways of doing and see the advantages for themselves (eg. less poor soil, less problems associated with the livestock size because of the holistic grazing model, the need for fodder purchase reduced during droughts).
2. The creation of opportunities for this experimentation by the public body and local organisations.
3. Mutual learning among those rooted in the land - who recognise one another as credible references for what is possible locally - has helped shape an informal community of practice. What Mértola's strategy has shown us is that this progressive cultural change might start to happen if farmers are stimulated to engage in experimentation. This progressive change and the way it was fostered can be seen in an interviewee's remark:

"What we said was that we knew a few different ways of doing things (grazing) that seemed to be working in semi-arid areas like ours, and the proposal was, 'What if we learned together?' And that's exactly what we started doing: visiting other farmers who had been doing this for longer and then holding workshops with other farmers who had been doing this for a long time and knew a lot about it, and together we learned. And together we made plans for each of them, and together we did pilot projects on each of their farms to see how it works, both this system and the key-line design system" (interviewee 11, our translation).

This testimony illustrates the essence of Mértola's regenerative approach: transformation is not imposed but co-created, through shared learning and experimentation. These collective experiences gradually build confidence, strengthen local networks, and open new pathways for cultural change across the territory.

Building on these shared learning experiences, it becomes clear that Mértola's regenerative efforts still face structural constraints that limit their potential scalability. Without embedding regenerative approaches in agricultural and other high-impact sectors, the agroecological transition remains delayed, and the impact of local experiments risks staying fragmented. A broader commitment from national and regional economic policies is necessary to align incentives with a nature-positive society and support the transition beyond the local scale.

Collaboration and the More-Than-Human Perspective

Mértola's case demonstrates the importance of experimenting with farming and grazing practices that foster a more balanced relationship between society and nature - one that recognises the agency of non-human beings.

Although syntropic agriculture is not yet dominant in Mértola, its principles can be observed in different initiatives, even when the term itself is not used. Its adoption in Malhadinha Vegetable Garden (Horta da Malhadinha) proved to be a smart way of both fighting against the soil impoverishment and regulating microclimate in a semi-arid region. By combining forestry and food production, syntropic agriculture has become a timely setting at the present time as it is grounded on the perspective of "regeneration by use". As its creator, Ernst Götsch, described, syntropic agriculture gives "each plant the ideal conditions for its development, placing each one in their just right position in space and time" (Andrade, 2019). This brings us back to a concept dear to syntropy: respect for temporality.

The more-than-human perspective adopted by syntropic agriculture reframes farming as an exercise in collaboration rather than competition. Collaboration here means recognising the co-dependence and productive interaction between plants, animals, insects, fungi and other microorganisms, making use of them towards soil recovery. This approach connects ecological restoration with a pedagogical process, allowing communities to experience regeneration not only as a set of technical solutions but also as a way of cultivating new relational practices.

Syntropy also encompasses an inclusive approach, engaging the community in decision-making processes related to biodiversity management. A lesson learnt from Terra Sintropica's approach has to do with their attention towards the cultural dimension, not only recognising each group's pace for the mentality change but also involving marginalised communities in the planning and implementation of biodiversity regeneration projects - as happened with refugees in the Shelter Land Project. Syntropic agriculture in Mértola contributed to Afghan refugees' self-empowerment but also allowed the regenerative project to benefit from their knowledge and perspectives. Terra Sintropica's concern with fostering the participation of different groups - including the older persons and children as vulnerable groups and refugees as a minority in European context - demonstrated the social relevance of encouraging community-led stewardship towards regenerative practices in the territory.

By positioning regeneration as both an ecological practice and a pedagogical process of recognising diverse knowledges, Mértola highlights that transformative change requires creating spaces where scientific, traditional, intercultural and experiential knowledge interact on equal footing. This plurality of knowledges reinforces the legitimacy of regenerative governance and ensures that biodiversity strategies are socially anchored as well as ecologically sound.

Isolation as a persistent lock-in for regeneration

Despite the many strategies directed toward biodiversity regeneration, **the geographic, social, and economic isolation** experienced by communities in Mértola remains one of the most persistent lock-ins faced in the territory. Isolation - whether physical, infrastructural, or informational - limits not only the flow of regenerative knowledge but also the distribution of its benefits. Some residents are unaware of local innovations, while others are structurally excluded from accessing them. For example, zero-carbon fresh food deliveries in Mértola (Fresh Food on Wheels Project) represent an important environmental achievement, yet they do not reach dispersed or mobility-restricted populations. This reveals a deeper challenge: regenerative measures must not only address ecological systems but must be consciously designed to foster community integration. Without a clear socio-cultural and economic axis, these initiatives risk reinforcing existing inequalities and overlooking the very populations most vulnerable to ecological collapse. This leads us to understand that territorial or spatial justice must be seen not only in connection with, but as an integral dimension of, social and environmental justice. In territories like Mértola, where mobility and infrastructural access are unevenly distributed, spatial inequality can

reinforce ecological vulnerability - making justice in space a precondition for the fair distribution of regenerative benefits.

In Mértola, territorial injustice and the uneven distribution of the fruits of regeneration practices contribute directly to the persistence and the resistance to change. Many individuals who remain geographically isolated do not have access to new scenarios, narratives, or practices of reimagination. This absence of exposure fosters a spiral of exclusion, reinforcing these areas as sites of resistance not due to unwillingness, but due to lack of opportunity. Overcoming this challenge requires more than institutional engagement; it calls for continuous invitations to participate, experiment, and imagine differently.

At the same time, the Mértola experience highlights the importance of integrating local and community knowledge into regenerative processes on equal footing with scientific expertise. Yet, territorial exclusion frequently hinders this integration. Isolated citizens often lack the opportunity to participate in knowledge-sharing spaces, preventing their valuable insights from contributing to broader strategies. This not only limits the potential richness of regeneration initiatives but also creates an epistemic imbalance where only formalised or institutional knowledge is prioritised.

It is important to note that the Mértola case - and its societal partners - demonstrate clear awareness of the importance of integrating local and community knowledge into regeneration efforts. However, their efforts have not yet been sufficient to fully address this issue, which is why we identify it as a persistent lock-in.

Another persistent lock-in relates to the difficulty of integrating ordinary, non-institutionalised citizens into co-governance and participatory processes. Although notable efforts have been made in Mértola to establish participatory forums - which stand as benchmarks when compared to the broader participatory culture in Portugal, largely centred on institutionalised participation - these initiatives have not yet succeeded in systematically involving citizens outside organised structures. . While our fieldwork did not reveal an unmet or explicit demand from these citizens, it remains a central principle of regenerative co-governance to cultivate a participatory culture as a core component of regeneration. Despite important community events, the participation of ordinary citizens in decision-making remains a work in progress. This dimension of participatory justice must evolve further to ensure the inclusive character of regeneration strategies and the sustainability of their outcomes.

Despite the existence of several forums and participatory spaces, the inclusion of underrepresented and socially marginalised groups - such as Roma and migrant communities - remains limited within Mértola's regenerative strategy.

Territorial injustice further exacerbates this exclusion, especially in the context of environmental vulnerability. These, together with the elderly and isolated populations, are often the groups most exposed to disasters like wildfires or extreme heat, yet they face barriers to accessing water, safe public spaces, or even health assistance. Without integrating these perspectives, regeneration risks being socially detached and unjust. Spatial justice becomes essential: mobility, access to services, and representation are prerequisites for any inclusive transition, and their absence directly interferes with the ability of these groups to engage with and benefit from regenerative change.

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MRU Social opportunities in ecological recovery

D2.5, Lithuania

December 2025

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Edited by Jonas Tertelis



Funded by
the European Union

Summary

The Anykščiai dam case study examines one of Lithuania's and Europe's most common river restoration challenges: restoring fragmented and degraded rivers and improving habitats for biodiversity in the contexts where support from society and local communities is lacking. Located in the small town of Anykščiai in northeastern Lithuania, the Šventoji River is an ecological corridor of national importance and a symbolic feature of Anykščiai town. Yet, like many European rivers, it has been altered by the construction of dams. The Anykščiai dam, originally built for hydropower but now functionally obsolete, remains a major barrier to ecological connectivity. It obstructs fish migration, degrades river habitats, and drives biodiversity loss. At the same time, the dam has become a visible part of the town's landscape and cultural memory, creating difficulties in discussions about its future.

This case sits at the intersection of urgent need for coordinated environmental action and local socio-cultural realities. At the European level, as many rivers are no longer free flowing due to heavy fragmentation (Balletti et al., 2020), the Water Framework Directive and the EU Biodiversity Strategy 2030 call for restoring good ecological status in rivers and reconnecting at least 25,000 km of free-flowing rivers. Lithuania's national environmental policies and action plans recognize the need for action, and scientific assessments identify the Anykščiai dam as one of the country's priority barriers for removal due to its ecological impact and limited socio-economic value. However, translating these policy frameworks into local practice is limited by a number of factors, including weak prioritisation of river restoration in political agendas, stakeholder opposition, limited financing, and weak community support and willingness to accept environmental change related to river restoration. Earlier efforts to initiate dam removal did not result in a restored river or strong community consensus, reflecting the challenges of aligning ecological imperatives with diverse local perspectives, values, and concerns.

The BIOTraCes project takes up this challenge by investigating how participatory action research (PAR) can support transformative biodiversity governance. Working with societal partners the project explores how inclusive and creative engagement methods can reframe contentious debates into opportunities for dialogue and co-creation. Through stakeholder interviews, media and policy analysis, and experimental participatory practices, the research seeks to understand how residents, authorities, businesses, and cultural actors construct meaning around the river, and how these meanings can be included in decision-making processes and creating a shared future for the Šventoji River, where biodiversity thrives and the river becomes an integral part of the community.

The significance of the Anykščiai case lies in both its ecological and social dimensions. Ecologically, dam removal offers an opportunity to restore natural riverine processes and habitats for the migratory fish. Socially, the case reveals how histories, identities, and attachments to place shape environmental governance. It demonstrates that biodiversity restoration requires building trust, integrating plural knowledge systems, and creating genuine spaces for shared decision-making in addition to technical solutions. In this sense, the Anykščiai dam is a symbol of the broader challenge of reconciling ecological sustainability with strengthening community engagement and gradually encouraging local ownership and leadership in environmental action across Europe.

1. Case Study Introduction

1.1 Justification of the importance of the case study

There is growing global momentum to restore rivers. Globally, only about one-third of large rivers (over 1,000 km) remain free-flowing along their entire length, with Europe being among the most affected continents (Grill et al., 2019). In Europe, rivers are affected by fragmentation at the rate on average one barrier every 1–2 km with over 1.2 million barriers detected (Beletti, et al., 2020). European policies such as the Water Framework Directive (WFD, EU, 2000) and the European Green Deal promote river restoration, yet implementation remains too slow for the urgency of the task. About 55% of EU and 63% of Lithuanian rivers fail to meet the WFD target of good ecological status and continue to deteriorate, regardless earlier commitments to achieve good status in all water bodies by 2027 (European Environment Agency, 2025, Lithuanian Environmental Protection Agency, 2023).

River barriers, especially dams, are among the main pressures. Dam removal is an effective and most holistic restoration measure (Bednarek, 2001), but progress is limited by low political prioritization, insufficient funding, and weak public acceptance. Genuine engagement with local communities is therefore essential, as poor involvement continues to hinder restoration efforts across Europe, Lithuania and also other parts of the world (Vogler, 2024).

The Anykščiai Dam case study addresses this challenge: how to advance river restoration in line with national and international goals while working with local communities and integrating their perspectives. The dam was identified as a high-priority barrier for removal due to its significant ecological impact and the fact that it no longer serves its original energy production function.

Earlier discussions did not lead to a restored river or an engaged community. However, this case shows that inclusive governance and open dialogue can create pathways for shared decision-making. Its significance lies in both, its potential biodiversity benefits, and its demonstration of how participatory approaches can turn environmental conflict into a more constructive dialogue about river futures.

1.2 Explanation of the focus of the case study

This case study, developed within the BIOTraCes project, focuses on transformative approaches to river restoration governance in Anykščiai, Lithuania. Working closely with societal partners, environmental specialist K. Gurjazkaitė and artist J. Tertelis, the research examines how participatory action research (PAR) methodologies can foster decision-making processes where community participation can strengthen biodiversity outcomes and support community-centered approaches to dam removal and river restoration. This study examines how different stakeholder groups frame the environmental problem, and how their relationships, values, beliefs and needs shape their sense of its relevance to the Šventoji River and its governance.

Progressing from individual stakeholder interviews to collective engagement activities, the research investigates how to build social infrastructure for environmental decision-making that recognizes both ecological imperatives and community identities. The intervention explicitly applies the PEPE principles (empowering, pluralizing, politicizing, and embedding) to understand and enable transformative change in biodiversity governance.

1.3 Research questions addressed by the case study

The case study addresses several interconnected research questions:

1. How do different stakeholder groups (residents, local authorities, business owners, environmental advocates, etc.) construct meaning around Šventoji River and Anykščiai

dam, and how can these multiple perspectives inform more inclusive restoration planning?

2. What conditions and processes are necessary to move from individual understanding to collective action in transformative biodiversity governance?
3. How can context-sensitive, environmentally and socially inclusive research approaches create legitimacy for participatory decision-making within existing institutional frameworks?

These questions explore how communities and institutions can develop capacity for making such decisions collectively, recognizing that transformative change in biodiversity conservation requires rethinking and transforming the social and political processes guiding environmental governance.

1.4 Reading guide

This case study explores how inclusive, participatory approaches can transform the environmental issue of a fragmented river into meaningful dialogue and pathways for biodiversity innovation in a community that does not yet recognise the need for action. It begins by introducing the ecological and social significance of the Šventoji River and the debated dam, then explains how participatory action research (PAR) was applied through adaptive, trust-building methods involving societal partners from environmental science and applied theatre. The study contextualizes the river's role in local identity, governance, and biodiversity loss, and analyses how limited knowledge exchange and emotional attachments constrain restoration efforts. It identifies niche innovators and bottom-up practices that could foster novel approaches to conservation and evaluates interventions—such as interviews and community events—that foster dialogue and relational engagement. The analysis concludes by reflecting on the transformative potential of these methods, emphasizing that real change depends not only on ecological restoration but on shifting how communities relate to nature and participate in decision-making.

2. Research Methods and application of PAR

2.1 Role of Societal Partner

In the context of our case study on restoration of free-flowing rivers in Lithuania, the role of the environmental societal partner was undertaken by K. Gurjazkaitė. She is a researcher in environmental sciences with a background in ecology. She joined the project as an environmental specialist and advocate for a systemic and long-term approach to river restoration. K. Gurjazkaitė continued as an independent expert and maintained active involvement throughout the research process.

Unlike some participatory action research (PAR) settings rooted in grassroots activism, our case did not originate within a local movement focused on a specific dam. As the deterioration of riverine biodiversity has become widely recognized, international and national goals to restore rivers were set within the intergovernmental organisations, the EU and the Member States, underscoring the urgency of coordinated action. In Lithuania, environmental NGOs, angler communities, and pro-environmental politicians advocate for river restoration, but the environmental authorities are currently leading the effort. The initiative to restore rivers is therefore a blend of political priorities and long-term national-level scientific research, monitoring, and assessments of river ecology and the pressures leading to their deterioration.

The involvement of the environmental societal partner was to bring knowledge on ecological issues, experience in environmental policy advocacy and practical restoration, together with an understanding the challenges of nature restoration within the context of stakeholder and community perspectives. She is actively engaged in collaborations with international organisations, seeking to transfer knowledge and good practice to Lithuania, supporting scientifically informed and community-inclusive restoration.

Throughout the project, K. Gurjazkaitė has actively contributed to the design of the research methodology. She conducted stakeholder analysis and interviews and performed policy and media analyses. Additionally, she organized meetings with decision-makers and mapped the discourses on river restoration and dam removal in Lithuania at local to national levels.

In addition to her analytical contributions, K. Gurjazkaitė organized two knowledge-transfer meetings with international experts specialising in researching socio-political dimensions of river restoration/dam removal and similar types of projects in Europe and the USA. Throughout these meetings, she facilitated discussions to gather insights on community engagement strategies and examined successes and challenges within such cases.

This exchange directly informed our approach to designing the research within the community. It reinforced the need to understand the complexity of the case, different stakeholder groups and their values and perspectives before introducing creative or participatory tools, such as applied theatre, particularly in early-stage or evolving cases like ours. Guided by these insights, the societal partner took part in shaping an engagement process. K. Gurjazkaitė remains involved in collaborative planning and continues to support the team by facilitating access to relevant networks, resources, and updates related to the dam removal topic.

Later in the project, a second societal partner joined the research team – J. Tertelis, a theatre and film director with a background in applied theatre methods. J. Tertelis holds BA and MA degrees in TV and film directing from the Lithuanian Academy of Music and Theatre and has experience working with vulnerable and marginalized communities and artistically analysing social aspects of urban development of Lithuanian towns, some of them particularly on topics related to energy and infrastructure. Although not connected to the specific dam or community, J. Tertelis brought a different kind of expertise that contributed to our exploration of engagement strategies.

J. Tertelis joined in October 2023. Since then, we have organized team workshops to share knowledge across disciplines and explore how applied theatre methods might support this

case study. These sessions introduced alternative ways of thinking about participation and opened space for considering creative experimentation within the broader research framework. The team also reviewed literature on applied theatre¹⁵, discussed previous plays directed by J. Tertelis (e.g., “Green Meadow”, LNDT, 2017)¹⁶ and other methods used in documentary verbatim theatre and film practices to understand, and explore possible benefits and use of this methodological approach with the case. A particularly important shift brought by J. Tertelis perspective was the invitation to step away from project-driven goals and instead focus on how the case is experienced from within the community. This helped us reframe our approach to fieldwork: rather than directing interviews through predefined questions, we allowed for longer (and at times shorter), more open-ended conversations and let concerns emerge naturally from the participants’ own priorities.

All researchers and societal partners were actively involved in preparing and conducting interviews, as well as planning and implementing the intervention. We intended to facilitate collaborative learning, given the need to better understand the **political, social, and ecological context of river restoration and dam removal** in Lithuania. Researchers A. Balundė, G. Kaniušonytė, A. Baikaitytė-Bagdonė, and societal partner K. led initial explorations of the case and coordinated early planning. Together with J. Tertelis, we invoke artistic practices to continue to examine and widen perspectives in narratives surrounding dams, stakeholder dynamics, and engagement pathways. The collaborative nature of our team reflects the iterative, exploratory spirit of PAR, where roles evolve in response to shared learning and shifting context.

2.2 Collaborative Research and Application of PAR

At the outset of our Lithuanian case study, both the topic of river restoration and the Participatory Action Research (PAR) approach presented new areas of practice for the team. Rather than applying a fixed research design, we employed an exploratory approach, allowing us to start broadly and then narrow our focus as the case revealed key patterns. This flexibility allowed us to respond to realities of the field as described in the following sections while working toward the core principles of PAR: reflexivity, inclusivity, and shared learning. The literature supported our methodological choices (Banks & Brydon-Miller, 2018; Burns et al., 2021; Chevalier & Buckles, et al., 2019; Fine & Torre, 2021).

We conducted national and international policy analyses related to water governance, which included identifying the main policy documents and their stated goals. This was followed by an analysis of previous dam removal cases across Lithuania and Europe, evaluating the lessons learned in these cases. To understand how the issue was discussed publicly in Lithuania, we analysed traditional media (both national, regional and local) as well as social media. The media review covered content published between 2013 and 2024 and included national outlets as well as regional platforms targeting specific audiences, such as agricultural communities. Local media were examined through the two main portals in Anykščiai.

We identified and collected articles referring to ageing dams, their repair needs and safety risks, environmental and fish-related issues, hydropower, and public discussions on dam

15 According to O'Connor and O'Connor (2009), applied theatre (AT) is a broad term that refers to non-traditional forms of theatre that go beyond the conventional Western stage. It often takes place in unconventional spaces, engages with marginalised groups, and blurs the line between performers and audience. AT is usually a response to social or political issues and is seen as a creative tool for transformation. One common approach involves a theatre director gathering stories from community members and shaping a play around them. The community is then invited to watch the performance, which is followed by a space for discussion and reflection. In some cases, community members take on the role of performers themselves. This was seen as a potentially powerful way to bring together different perspectives and foster dialogue between stakeholders.

16 LNDT - Lithuanian National Drama Theatre (2017). GREEN MEADOW. According to the stories of the workers of the Ignalina nuclear power plant and residents of Visaginas. Accessed 2023-11-26 on https://www.teatras.lt/lt/spektakliai/zalia_pievele_pagal_ignalinos_atomines_elektrines_darbuotoju_ir_visagini_eciu_pasakojimus/

removal. All materials were categorised by topic and summarised by stakeholder group (e.g. institutional actors, political representatives, the hydropower sector, scientific experts, civil-society organisations, etc.) and we analysed the types of perspectives expressed, including technical, scientific, economic, and emotional arguments. We also examined how dam- and dam-removal issues appeared across different media contexts and documented the range of stakeholder positions and argumentation patterns.

In the local media analysis, special attention was given to stakeholder and community perspectives not only on dam removal but also on issues such as flooding, drought, vegetation management, fish stocking and angling, visions of the river and history of the dam. This helped identify the topics most relevant to residents and the stakeholder groups we later sought to include in interviews and interventions.

Social media analysis focused on Anykščiai-based groups to determine the presence and framing of dam-related discussions and to identify the main themes emerging within the community.

Alongside this, we held co-learning workshops with our societal partners to build interdisciplinary understanding of river restoration and its ecological, social, and political dimensions. These early steps helped the team align internally and define the scope of the case more clearly.

Our analyses were supported by multiple site visits in order to engage in participatory observation and informal conversations with local residents. We also explored historical records (online, published, and those available locally in the library of Anykščiai), focusing on the period and context when the dam was built. These visits helped collect data on local perspectives regarding the river, its historical context, and visions for its future.

The growing understanding of the case led us to conclude that groundwork and a gradual approach are needed prior to bringing all stakeholders into a shared space, i.e., a traditional community workshop. As we learned more about the case, we noticed a lack of dialogue between diverging perspectives on dam removal and biodiversity. Some sharp media portrayals and strong public comments revealed existing tensions around the topic. Rather than seeking to manage these differences, we became curious about how people holding contrasting views might be brought into conversation. This led us to begin exploring gradual ways of fostering dialogue and understanding.

The initial concept was to develop and co-create a theatrical performance that represents different experiences and narratives surrounding the case. The plan was to conduct interviews with a wide range of stakeholders and, together with interested community members, translate key insights into a performance. We planned to follow the applied theatre practices (O'Connor & O'Connor, 2009; Heinemeyer et al., 2022; Paget, 1987), as a way to support dialogue in an indirect but meaningful way – allowing for different voices to be heard. Early interviews, however, revealed that such a method required stronger foundations of trust and readiness within the community. Recognizing this, the team decided to put the theatrical component aside and focus instead on building relationships and developing context-sensitive forms of engagement. This shift allowed the research to remain responsive to local dynamics while ensuring that all interactions were grounded in mutual respect and understanding.

The approach toward the interviews evolved over time. Initially, the interviews were conducted in a semi-structured format based on a list of potential participants established during the stakeholder analysis. We then increasingly opened the space for participants to guide the conversation. This was followed by the snowball interview method, where participants referred us to other people they believed should be included, helping shape the trajectory of the research. Although the interviews were not co-designed from the beginning, this ongoing adjustment in tone and structure reflects a move toward greater collaboration and responsiveness.

Internal workshops were held near the field site to reflect on our role as researchers and the potential impact of our work, activities, and presence within the community. These sessions highlighted the importance of attentiveness to the dynamics of power and trust.

We examined past experiences with community engagement and used these insights to guide our approach. By adopting lessons learned, we refined our assumptions and paced deeper engagement to align with the community's readiness—ensuring a thoughtful and responsive participatory process.

In designing our study, we ensured that at each step we created conditions for genuine and meaningful participation. We did not aim to triangulate our sources in a formal sense, but through this iterative process, cross-validation often emerged naturally. Our approach has remained adaptive, open to change, and sensitive to the unfolding context.

This approach follows a twisted model of PAR, where co-creation begins early and remains central throughout. We took all the necessary steps and efforts to understand as many multiple perspectives as possible, providing an opportunity for the safe, confidential environment for the participants to express their viewpoints, and for the team to listen and develop understanding. Our research model contextual application of PAR principles – cantered on trust, respect, and long-term collaboration (Cornish et al., 2023).

2.3 Triangulation

In our case study, triangulation developed naturally rather than through a predefined plan. As the research progressed, different research methods were layered while moving through the case. These approaches complemented each other and allowed us to look at the situation from different sides. The layering supported the project's main objectives while keeping us flexible and responsive to what was happening in the field.

To address **Objective 1 – understanding diverse values, knowledge systems, power, and behaviour** – we combined semi-structured interviews, participatory observation, historical research, media analysis, and participatory mapping. Each method offered a different angle: some revealed dominant narratives, others uncovered overlooked or locally rooted perspectives. They helped us see how different knowledge systems interact and how power shapes the way dam removal is framed and debated.

Objective 2 – demonstrating principles of transformative change – was supported by three internal team workshops, co-learning with societal partners, and joint planning. These spaces helped us reflect on our own assumptions and adjust our approach, especially given the community's experience with earlier public debates and engagements on this topic. Our team studied local performance practices together with J. Tertelis and discussed applied theatre as a reflective tool. This exploration helped us think more deeply about narrative, voice, and timing – and reminded us why trust and pacing matter so much in early-stage engagement.

For **Objective 3 – developing strategies for transformative governance** – triangulation helped us connect the dots between stakeholder interviews, policy analysis, and participatory system mapping. This allowed us to spot tensions, gaps, and potential entry points for more inclusive and adaptive governance approaches.

Although we didn't do participatory mapping in the spatial sense, our interview process played a similar role. By speaking with more than 60 people across a wide spectrum – policymakers, local residents, scientists, culture professionals, and others – we were able to trace how people relate to the river, to each other, to governance processes, and to the dam and perspectives if it was removed. These conversations revealed not just individual experiences, but also how influence, narratives, and values move across the system.

We think of this ongoing process as narrative and stakeholder landscape mapping. We wanted to understand who plays a role, who plays a role but doesn't realise it, and who may be affected without being actively involved. We also looked at specific people and organisations – how their knowledge systems differ, how open they are to change, and how they see nature: as something to be protected for its usefulness or as something with value in itself. This process helped us see the case in a more grounded, complex way – not through fixed categories, but through lived realities and shifting relationships.

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Some methods, like narrative mapping and context analysis, became more central than we expected. Others, like focus groups, were postponed in order to develop a deeper understanding of how to foster a productive dialogue capable of reaching a collaborative conclusion.

In the end, triangulation was used as a practical way to deepen our understanding of the case. By drawing on different types of knowledge – formal, informal, historical, and lived – we were able to better understand the situation and its complexities from multiple points of view.

3. Case Study Contextualization

3.1 Multidimensional Presentation

Geographical dimension

The case is based in Anykščiai¹⁷, a small town in northeastern Lithuania, located along the Šventoji River – the largest tributary of the Neris and a part of the Nemunas basin. The Šventoji is the largest river located entirely within Lithuania, with all other major rivers being transboundary, and it is the sixth-largest river within the country's territory. The Nemunas–Neris river system in Lithuania remains largely free-flowing, providing a unique migration corridor for anadromous species. Lithuania contains approximately 1,370 river barriers with minor barriers such as culverts on smaller rivers and streams largely un-inventoried) (UAB Aplinkos inžinierių grupė, Vytautas Magnus University, & Lithuanian Hydrobiologists' Society, 2022), reflecting a broader pattern of hydromorphological fragmentation observed across Europe, where many rivers are no longer free-flowing.

There are multiple dams on the Šventoji River. The most downstream structure is in Kavarskas, which operates a hydropower plant (HPP), and forms the first barrier in this system, it is equipped with an effective fish passage (UAB Aplinkos inžinierių grupė, Vytautas Magnus University, & Lithuanian Hydrobiologists' Society, 2022). Upstream from it lies the Anykščiai Dam, where fish passage effectiveness is considered limited, followed further upstream by the dams in Užpaliai (with HPP), Šventosios near Dusetos, and Antalieptė (with HPP). In the center of this research is the Anykščiai Dam (Picture 1), a low-head structure, formerly used for hydropower generation. At Anykščiai, the Šventoji has an average annual discharge of 30.6 m³/s; and the dam has created a 23.4 ha reservoir extending 4.1 km at normal water level. The distance from the Anykščiai Dam to Nemunas Delta, where the river enters the Curonian Lagoon, is approximately 340 km. The dam acts as a transversal barrier that disrupts the river's longitudinal connectivity and limits the free movement of aquatic organisms, including migratory fish.

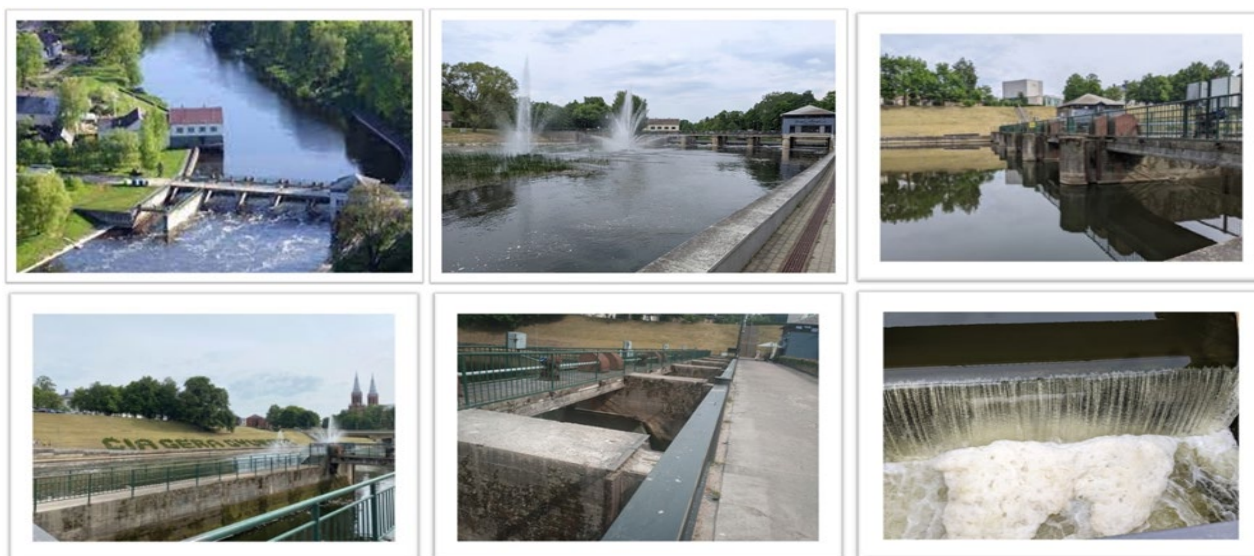


Figure 6 - Anykščiai dam from the different perspectives (source: site visit pictures and Anykstenai.lt)

¹⁷ <https://maps.app.goo.gl/Hbv7BGRoipWLzvUH9>

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The entire urban area of Anykščiai lies within a nationally protected area¹⁸. Parts of Šventoji River and its catchment is designated as Natura 2000 sites on the basis of its importance for habitat conservation (which obliges to improve conservation status of habitats and species in these sites) and supports a range of protected species, including Atlantic salmon, otter, river lamprey and the northern crested newt, among many others. A large share of the territory was inventorised as ecologically valuable habitats¹⁹. Land use combines residential areas, agriculture, forestry. The town is known for its tourism infrastructure, including the narrow-gauge railway (lt. siaurukas)²⁰, the tree canopy walkway (lt. Laju takas)²¹, Puntukas stone²², museums, and a growing kayaking scene along the Šventoji.

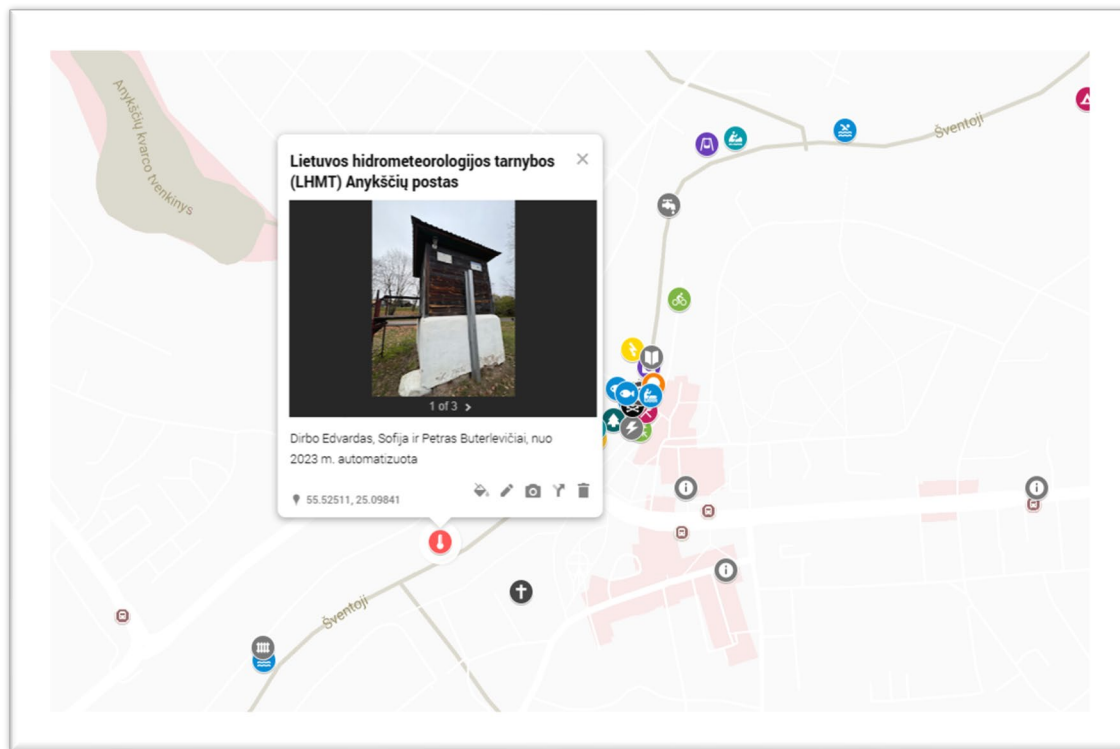


Figure 7 - Example of spatial analysis of Anykščiai and the Šventoji River

The data entries of figure 7 represent both formal and informal sites of social and cultural significance to the local community. The map is based on information collected through interviews with local residents. It currently highlights 55 landmarks of community significance, some directly associated with the Šventoji River—such as the dam or bridge—and others reflecting broader aspects of everyday use and collective memory, including popular angling areas, bathing sites, and locations linked to local identity (access to the interactive map is available under request)

The geographical perception of the Šventoji River varies among different stakeholder groups, and the ways they talk about it differ accordingly. Public sector and academic stakeholders discuss the river in geographical, biological, and political contexts that also

¹⁸ State Service for Protected Areas under the Ministry of Environment (Valstybinė saugomų teritorijų tarnyba). Saugomų teritorijų valstybės kadastras.

Available at: <https://stvk.lt/map>

¹⁹ Nature Research Centre (Gamtos tyrimų centras). Europos Bendrijos svarbos natūralios buveinės.

Available at: https://www.geoportal.lt/geoportal/subscribe/-/asset_publisher/I0YH9ZsWns4x/content/geoportal-lt-zemelapiu-narsykleje-galite-perziureti-europos-bendrijos-svarbos-naturalias-buveines

²⁰ <https://maps.app.goo.gl/NqYynUBCb9VSsmBN8>

²¹ <https://maps.app.goo.gl/P3enSbJy6f2nCFbt7>

²² <https://maps.app.goo.gl/EqGVUgQh7uQzLf7b6>

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have a geographical component (e.g., regionalization, part of a river basin). They tend to focus on the river as part of larger geographical, ecological, and political systems.

Within the local community, perceptions of the river vary significantly depending on the role the river plays in residents' lives and their direct experiences with it. Geographic factors such as living in close proximity to the river or using its infrastructure (e.g., footpaths, bridges, bathing sites, and other types of public spaces) shape how people perceive and talk about it. Local residents often discuss the part of the river closest to where they live or to which they have some form of relationship, through activities like angling, kayaking, or bathing.

Anykščiai residents frequently refer to multiple river-related features within the town limits, often mentioning the town dam and various infrastructure elements such as recreational areas and bicycle paths near the river. Respondents, particularly long-term residents of Anykščiai, also frequently described seasonal hydrological dynamics, such as spring floods, ice jams, and drought periods, and their perceived influence on the surrounding landscape. In some cases, residents extend their spatial perception beyond the town boundaries, referring to upstream and downstream river features, such as the dam in Kavarskas.

Demographic dimension

Anykščiai is a town of approximately 8,400 residents. The population has been declining, reflecting broader trends in small Lithuanian towns. Although young people commonly leave after school for studies or better opportunities elsewhere, the town still attracts newcomers, including artists, young families, remote workers, returnees from larger cities or abroad and people who have retired. These newcomers typically cite a quieter lifestyle contrasted with the fast pace of cities, close proximity to nature perceived as contributing to better quality of life, short commuting distances, a better environment for raising children, and more time for family as key motivations. Some respondents had worked in larger cities such as Vilnius or Panevėžys at different points in their lives, returning to Anykščiai permanently or commuting periodically (for example, on weekends or to visit family members). Limited employment opportunities were noted among main constraint to living in the town.

Among comparatively younger adults, many were active in business, cultural work, the public sector, NGOs, community initiatives. Although our sample size does not allow broader generalization, older residents also appeared highly active in community life. Feelings of loneliness and difficulties in forming social connections were mentioned across different age groups, including newcomers, as challenges, but were sometimes viewed as incentives for greater local engagement.

The town spans both sides of the river, with residential areas such as Ažupiečiai on the right bank and the Old Town and Jurzdikas on the left. Our fieldwork focused on areas near the river to reach residents with stronger river-related connections (as indicated in Picture 2). The dam divides the settlement into upstream and downstream sections, with many individual houses concentrated close to the river. In the upstream outskirts, the dam has limited relevance except in the Elma summerhouse communities, where residents experience flooding and some believe the dam might be a contributing factor, although this was not assessed in our study. In the town center, the dam remains more visible and important in daily life, compared to communities living further upstream and downstream of the dam.

Socio-economic dimension

The local economy of Anykščiai is based on a mix of manufacturing, agriculture, forestry, and tourism. In recent years, the area has also attracted investment in renewable energy, including a large solar power project. While tourism is visible and is supported by attractions like the tree canopy walkway, the narrow-gauge railway, and river-based activities such as kayaking, many residents rely on more traditional forms of employment.

The town is aspiring to obtain official resort status; the most of respondents of our study view this positively, believing it would attract higher-quality opportunities and jobs. A small group of residents expressed more conservative views, questioning the usefulness of this ambition. Public sector jobs and small businesses are common. There is also a distinct cultural sector, supported by an active library, several museums, a cultural centre, an art studio, and regular events. These institutions highlight the central role of cultural life in the town, and many residents view this as a key local asset, often describing the town as culturally oriented in the national context. The river and the dam also have a distinct socio-economic role. During interviews, we encountered leisure activities and income tied to the river and local environment. Residents living close to the river reported swimming there often during the warmer months, with a few enthusiasts even entering the water in winter. Living beside and using the river was frequently described as central to a good quality of life and contrasted with the rushed pace of cities. Those farther from the river usually rely on several designated beaches. Angling, both in the river and in the reservoir (which partly depends on artificial stocking), is a common hobby, particularly among men. A handful of eco-tourism, camping, and Airbnb-style businesses operate along the riverbanks. Kayaking and other nature-based wellness services are also present, although many operators described these as hobby ventures maintained alongside full-time jobs. The river also contributes to informal education. Overall, the prevailing narrative holds that the river's significance lies in recreation, place identity, and visual presence, rather than in direct economic dependence (such as commercial fishing, energy production, or irrigation).

While the dam in the town centre no longer plays an active economic role (power production) is from hydrotechnical point of view is obsolete, though it remains a part of the landscape, with a few restaurants and community building located nearby, as well as frequently-used footpaths around the reservoir. Residents mentioned several indirect socio-economic benefits associated with the dam: historical significance, the pleasant experience of crossing the footbridge as part of daily routines, and its function as a social spot for meeting, events, and photography. The issues were also mentioned: residents living upstream reported regular flooding that damaged their property and questioned whether the dam might influence flood magnitude (although this question was not directly addressed in our study, flooding could be noted as a potential drawback of living in close proximity to the river, that could be partly linked to poor residential planning during the Soviet period). A few accidents resulting in deaths and injuries (including kayakers) have also occurred at the dam site.

The role of the dam within the community, as well as the knowledge about its socio-economic benefits, varied. There is a strong consensus that the river itself, rather than the dam, is more symbolic of Anykščiai. The people who viewed the dam as having value typically shared a few traits: an interest in the dam's and the town's history, personal memories linked to the site, engagement in water-based hobbies such as boating or SUP, and in some cases business activities connected to the area. However, many respondents were not aware of the dam's functions and expressed interest in understanding how it impacts the landscape and ecology, whether it plays any role in flood protection or public safety, and what potential changes its removal might bring. Strikingly, a proportion of residents completely disregarded the importance of the dam to their lives; while most of them neither lived nor worked near the dam nor had a particular interest in its history, a few respondents who lived or worked in close proximity also downplayed the dam's importance in their lives, although this was mentioned more often downstream than in the reservoir area. In general, community members consistently expressed care for both the environment and the town's well-being, raising questions about how such transformations might influence everyday life in Anykščiai, and whether there is a possibility for compromise, i.e., saving the dam while improving environmental health of the river.

Political dimension

The Šventoji River in Anykščiai is widely recognised by environmental authorities (including the Ministry of Environment of the Republic of Lithuania), environmental scientists, NGOs,

and pro-environmental politicians as a priority site for restoring river connectivity, reflecting its high ecological potential (estimated to exceed €360,000 per year in value due to the potential for restored fish stocks) (UAB Aplinkos inžinierių grupė, Vytautas Magnus University, & Lithuanian Hydrobiologists' Society, 2022) and the relatively low socio-economic cost of improving its continuity. This aligns with a broader national context in which Lithuania's 1,370 registered dams (many of them Soviet-era structures) require public funding for maintenance, adherence to safety standards, and responses to increasing environmental pressures. Media analysis shows that small-scale dam failures occur annually (four cases in 2022), underscoring the need for long-term, preventive solutions that balance environmental and safety considerations.

National environmental authorities increasingly recognize dam removal as a necessary pathway to achieving ecological objectives. Yet this measure continues to face resistance from non-environmental stakeholders, particularly within the agricultural sector. Regional media serving agricultural audiences often frame dam removal and broader restoration efforts through a critical lens, deepening sectoral divides. Although new hydropower construction is currently not actively pursued and has rather low economic potential, interest in repurposing existing dams for irrigation is emerging and may intensify under climate-change pressures (Marcinkowski et al., 2024). At the same time, the 2025 national debate on expanding river navigation by dredging deeper channels showed that non-environmental institutions can dismiss existing environmental safeguards, including standards embedded in EU policy frameworks. Long-standing regulations are increasingly questioned and challenged. In this context, where cooperation across sectors is essential yet remains limited, meaningful environmental action becomes very difficult, placing further ecological progress at risk. Environmental considerations must be firmly embedded across all sectors, planning processes and development pathways. Institutions should thus act from a shared commitment to prevent further degradation and to enable restoration.

Environmental issues, especially water-related questions, remain comparatively low on national political agendas, and public awareness continues to develop. Although dam removal has been included in the environmental program of the Conservative Party and receives some support within the Green Party and the Farmers and Greens Union, restoration efforts face persistent budgetary constraints. Limited resources restrict interventions to essential groundworks and limit the number of dams that can be addressed. Technical considerations, such as sediment management, erosion management, revegetation, and ensuring the safety of bridges and other infrastructure, introduce additional costs and require coordinated planning across institutions. Meanwhile, fisheries management continues to rely on stocking, which is valuable in the short term but indicates that the integration of habitat restoration into fisheries objectives is still evolving.

The Anykščiai dam itself is no longer used for energy production and has low hydropower potential due to its small discharge and limited reservoir capacity. Media reports in the past noted recurrent maintenance needs, which might have reduced its attractiveness for the investors. Annual maintenance remains necessary, resulting in recurring public costs. These conditions brought the dam into local political debate in 2019. Proposals for removal appeared in positions of local politicians, yet community support was lacking, with many residents emphasizing the need for clear technical and scientific justification. Interviewees sought information on why this specific dam is prioritized, how the landscape may change, what ecological effects can be expected, and whether flooding risks might increase. Addressing these concerns requires transparent communication and the involvement of technical experts to ensure that decisions reflect evidence, public values, and long-term sustainability rather than the interests of individual stakeholder groups.

Overall, while national policy direction influences broader priorities, the Anykščiai case highlights the importance of coordinated action, transparent communication, and scientifically grounded dialogue. With these components in place, dam removal can shift from a politically contested issue to a shared, informed decision about the future of the Šventoji River.

Historical/Cultural Dimension

The story of the Anykščiai dam goes back more than a century (Picture 3) and reflects how the town's relationship with the river has changed over time. The original wooden dam was built in 1902, and in 1910 it was upgraded with a water mill and one of the first hydroelectric plants in Lithuania. Local chronicles consistently tie the dam's early development to Jonas Karvelis and Juozas Volnonis, local entrepreneurs who helped drive the 1910 upgrade of the water mill into a small hydropower plant, marking the town's early move into electrification. His initiative is cited as part of a broader wave of modernization that also included the narrow-gauge railway, which stitched Anykščiai into regional trade routes and supported timber transport that residents still remember as seasonal river work.

There is also a work of documentary prose by Rimantas Vanagas, *Malūnininkas ir Mėnuo* ("The Miller and the Moon"), which recounts the history of the dam. Several Anykštėnai mentioned this book as influential in shaping their views of the dam, noting that it helped them understand its past and form a personal connection to the town's history. The book also situates the dam within a broader historical context, describing Lithuania's drive toward modernisation, when hydropower offered independence from imported fuels that constrained development. One of the first technological changes experienced at the household level was electric lighting, which transformed everyday life. The plant was damaged during World War II, then rebuilt in 1947, and provided electricity to the town until 1969. The current concrete dam was built in 1986, in a similar location to the old one (a little bit downstream). It included a fish passage and two decorative fountains in the riverbed, which were restored in 2022.

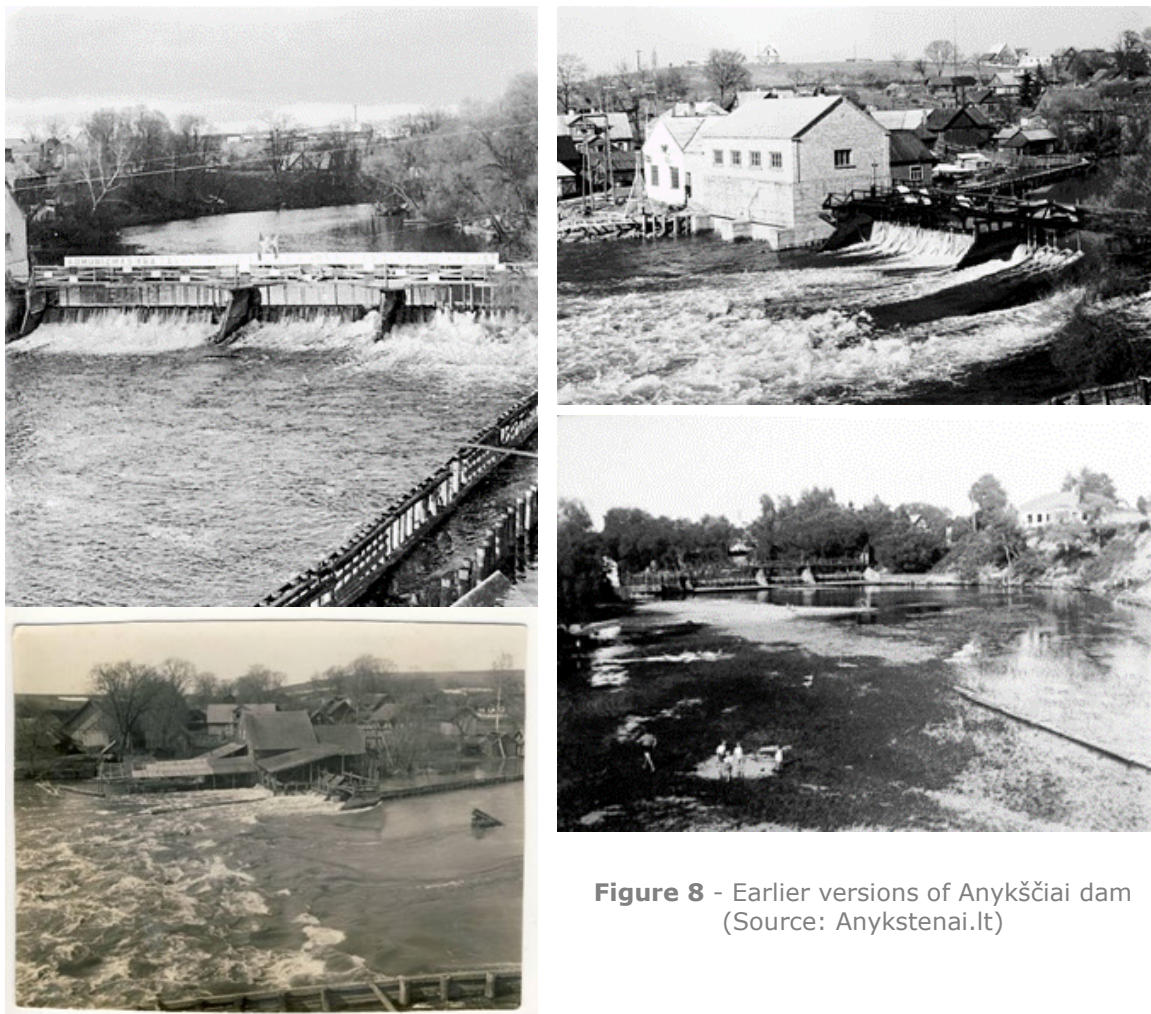


Figure 8 - Earlier versions of Anykščiai dam
(Source: Anykstenai.lt)

Some residents with a strong interest in the town's history regard the dam as a representation of engineering achievement, valuing it as a marker of technological progress. People from older generations, also recall how the river was once used for work, especially for floating timber on log rafts. These different views show that the dam, though originally constructed as functional infrastructure, has become an integral part of the landscape, carrying memories, cultural meanings, and emotional significance.

There is also a historical dimension to how ecology is perceived. Several respondents, particularly people from older generations who spent their childhoods by the river in Anykščiai, recalled a time when the river looked and felt very different. They described a river that once seemed more "alive," with a more dynamic landscape and a richer diversity of fish and other aquatic organisms. Species they remember as common—such as minnow (*Phoxinus phoxinus*), gudgeon (*Gobio gobio*), eel (*Anguilla anguilla*), barbel (*Barbus barbus*), and nase (*Chondrostoma nasus*)—are now rare or absent. Native crayfish, once abundant, have been largely replaced by invasive species. Many respondents attributed the observed decline in fish abundance to the construction of the Kavarskas Dam in 1962. Another important historical aspect concerns hydrological changes. Long-term residents of Anykščiai frequently quoted ice jams – phenomenon that is becoming rare in the recent years, and floods, and floods, suggesting that changes in the river have played an important role in their lives.

Finally, the way residents interact with the river has evolved. Historically, the river was valued for its provisioning services, including energy generation and other direct resource uses. Today, cultural ecosystem services are far more prominent. Over the past decade, Anykščiai has repositioned itself as a river-forest destination, exemplified by the opening of the Treetop Walking Path in 2015, which reimagines the river valley as a space for recreation, nature appreciation, and tourism. Interviews reflect this shift: residents increasingly describe the river not as a functional resource but as a setting that contributes to everyday wellbeing through walking, paddling, informal leisure, and observing seasonal change. At the same time, several participants noted that cultural-recreational use of the reservoir was historically stronger—for example, more frequent boating or the presence of small piers. These reflections suggest a perceived loss of earlier river-community connections and a desire to renew this relationship in a way that fits contemporary meanings and values.

3.2 Key Actors and their Impact on Worldviews

Who are the various social and ecological actors—both human and more-than-human—interacting within the case study? Please identify the main actors involved in each case, including economic, political, and civil society groups, and analyse their influence on biodiversity and the socio-ecological system more generally. Additionally, examine how these actors define concepts such as 'nature,' 'biodiversity,' and 'ecological degradation,' as well as their perspectives on 'ecological restoration' and 'regeneration' within the context of the case study. What is the local framing or narrative surrounding the biodiversity challenge? Are there different local interpretations or narratives of this challenge? If so, who holds these differing perspectives?

Social and ecological actors: human and more-than-human

Interviews were conducted between March 2024 and January 2025. We aimed for one-hour conversations, though durations varied from around 20 minutes to nearly three hours. Participants were recruited through stakeholder mapping, media analysis, snowball sampling, and consideration of spatial proximity to the dam.

In total, we interviewed 60 individuals across national and local levels, spanning a wide range of roles. These included local residents, community leaders, business owners, politicians, engineers, hydrology and ecology specialists, cultural and educational workers, media representatives, anglers, and representatives of local and national authorities,

NGOs, and scientific institutions (Table 7). This range allowed us to capture institutional perspectives, place-based knowledge, technical expertise, and everyday experience related to the river.

Participants contributed different forms of knowledge. Some offered regulatory or technical expertise; others drew on long-term familiarity with the river or experience with seasonal changes. Their accounts showed how practical, emotional, and ecological perspectives often intersect in how people understand the river's role in community life.

Some groups were less represented. Due to research constraints, people under 18 were not included. Ethics protocols require minors to participate through formal consent procedures involving schools and parents, which would have restricted participation to a very narrow group. To avoid bias and maintain informal, trust-based engagement during this early phase, we postponed direct work with youth until more appropriate conditions can be established.

Representation within the dataset does not directly correspond to influence or decision-making power. Some sectors contributed multiple participants, whereas others were represented by only one individual. In these cases, the depth of expertise or the specificity of the participant's institutional or experiential role provided analytically sufficient insight without necessitating additional interviews. Consequently, the configuration of the dataset reflects the relevance and substantive quality of contributions rather than numerical proportionality, yielding a nuanced understanding grounded in lived experience and situated forms of knowledge.

Stakeholder mapping also revealed substantial role fluidity. Many participants occupied overlapping positions; e.g., business owners who were simultaneously community organizers, or technical specialists who drew on long-term, place-based familiarity with the river. As a result, knowledge types frequently intersected, combining technical, cultural, and experiential dimensions. To preserve participant anonymity, we report findings at the level of broader stakeholder groups rather than presenting identifiable individual profiles.

Beyond human actors, biodiversity emerged as a salient non-human stakeholder, with migratory fish species—particularly salmonids—functioning as the principal flagship species. These species served as proxies for wider riverine biodiversity in public narratives. Other aquatic or riparian organisms were mentioned less frequently, aside from occasional general references to river vegetation or overall “river health.”

Table 7 - Stakeholder²³ Groups in the Lithuania Case Study (N = 59)

Group	Description
National Authorities and Policy Makers	Actors shaping national environmental policy and legal frameworks
National Scientific Experts	Researchers contributing expertise on ecology, hydrology, and engineering
Local Governance and Authorities	Officials managing land use, environmental issues, and public engagement at the municipal level
Local Politicians	Politicians active in municipal governance and community representation

²³ Concrete stakeholder groups can be made available upon request but are not shared openly, as individuals may be easily identifiable in the context of a small town, compromising their confidentiality.

Technical and Infrastructure Specialists	Experts involved in monitoring, engineering, or managing physical infrastructures
Local Businesses	Entrepreneurs linked to tourism, recreation, real estate, energy
Civil Society and Community Groups	Organized groups focusing on community wellbeing, environmental stewardship, and local development
Cultural and Media Sector	Participants shaping public narratives and cultural memory around the river
Unaffiliated Residents	Residents with no formal organizational ties, but strong place-based knowledge or emotional connection to the river

Beyond shaping perspectives, different actors also influence the river's future in concrete ways. National authorities, in collaboration with stakeholders and societal partners, set the frameworks for river management and biodiversity targets. Local authorities and politicians make decisions regarding land-use and infrastructure that directly affect river ecosystems. Technical specialists inform risk evaluations, helping define what kinds of interventions seem possible or safe. Business owners influence public narratives around economic risks and opportunities, particularly in tourism. Cultural actors contribute by weaving the river into collective memory, strengthening place attachment, and influencing how restoration is imagined at the community level. Community groups and residents are users of the river and the surrounding areas; they shape the river's future by voicing their needs and opinions.

Unfolding concepts of 'nature,' 'biodiversity,' 'ecological degradation,' 'ecological restoration' and 'regeneration'

During the interviews, we explored how respondents described "biodiversity," "nature," "ecological degradation," and "ecological restoration" in their own words. These concepts were understood less through formal definitions and more through daily interactions and personal relationship with the river. Unlike scientific assessments that rely on systematic monitoring and indicators, respondents emphasised elements of nature they know personally. For some, the disappearance of native crayfish signalled ecological decline; for others, biodiversity loss was tied to reservoir fish species, even when these were artificially stocked. Some also referenced bird species as markers of river health, though these are not always reliable indicators of riverine biodiversity conditions. These examples show how locally salient, experience-based observations shape perceptions of ecological change.

Respondents generally saw Anykščiai as surrounded by rich nature, with the river central to the town's identity. While some viewed artificial structures, such as the dam, as part of the landscape, others understood nature as an environment not shaped by human actions. Some mentioned that nature "should not be decorated," expressing discomfort with human interventions that make natural areas look artificial. These perspectives reflect differing norms for what is considered "natural." For some participants, Anykščiai is a town where nature is expected to be shaped to meet human needs, whereas others emphasised the value of allowing nature to follow its own course. These contrasting views influence how people assess human interventions and the perceived legitimacy of restoration actions. Across conversations, the idea of *river health* (including state of the biodiversity and water quality) carried multiple meanings. For some, it was about water color, clarity, and the attractiveness of beaches. Others linked it to sedimentation or vegetation growth, which

many saw as signs of degradation. The presence of fish was the most common way of describing river biodiversity, with older residents recalling greater fish abundance in their childhoods. A few also mentioned crayfish and birds as indicators of ecological balance. Many of the changes identified by residents align with scientific findings. Among interviewees, the strongest connections to biodiversity and the clearest observations of ecological change came from anglers, who linked decline to habitat degradation, dam construction, hydrological alteration, and changing hydrological processes (such as less frequent ice formation). The Anykščiai dam, however, was often viewed as less harmful than the Kavarskas Dam. Restoration, by contrast, was interpreted in different ways: some associated it with dam removal, others with improving fish passages or clearing vegetation. Many described restoration as a form of recovery—the return of fish and the clearing of sediments. For some anglers, removing the dam represented restoration; for others, it meant degradation, as they anticipated the loss of species important for recreational fishing, such as pike (*Esox lucius*), burbot (*Lota lota*), or roach (*Rutilus rutilus*). While some supported intervention, others questioned whether a balance between the dam and fish populations could be achieved. Their preference for improved fish passage reflects a tendency to frame restoration through compromise solutions that maintain familiar species and minimise perceived ecological or social disruption.

Some participants saw the reservoir as an established ecosystem that should not be disturbed, fearing that removal could itself cause degradation. There was a case when a respondent drew on analogy with agriculture, comparing dam removal to the abandonment of traditional agricultural practices and the resulting loss of agricultural biodiversity. In their view, the reservoir represented a form of human stewardship, and removing it could disrupt an existing balance. The analogy to agriculture reflects a real concern about farmland abandonment that also resulted in biodiversity declines, but it also conflates two different environmental issues; reservoirs follow different ecological dynamics, making the comparison only partially applicable.

Local Framing of the Biodiversity Challenge

Local understandings of biodiversity in Anykščiai were shaped primarily by direct interaction with the river rather than by scientific approaches such as monitoring or ecological indicators. This experiential perspective creates a strong sense of connection to place, yet it provides a narrower view of biodiversity as a broader, systemic issue. Awareness varied considerably: some residents, including anglers and others with strong nature-related interests, recognized that dams affect fish and habitats. Others perceived the Anykščiai dam as posing little ecological harm, and a number were unfamiliar with the issue altogether. Emotional attachment centered mainly on the river as a space for recreation, identity, and daily routines (with anglers being an exception), while the reservoir (present for decades) was normalized. Many residents, particularly older generations, regarded it as an established and familiar and valuable part of the landscape contributing to the overall aesthetics of the town (such as reflection in the water, soundscape of the running water,

Uncertainty about ecological outcomes also shaped how biodiversity concerns were interpreted. Residents raised practical questions about potential flooding, the future of swimming and recreation, anticipated landscape changes, and the reasoning behind prioritizing the Anykščiai dam rather than the Kavarskas dam. At the same time, many recalled occasions when the reservoir was drained and described the exposed riverbed as visually unpleasant, raising concerns that dam removal might recreate those conditions. These concerns were accompanied by low trust in politicians, NGOs, and activists, and a preference for clear technical or scientific explanations—information many felt was limited in local public discussions. Although some skepticism toward external actors was evident, trust in scientific expertise remained comparatively strong.

Together, these perspectives show that biodiversity challenges are locally framed through visible and tangible changes, everyday interactions with the river, and long-standing familiarity with the reservoir, rather than through institutional assessments or scientific

indicators. While residents expressed views ranging from support to caution or neutrality regarding dam removal, many were open to continued dialogue and emphasized the importance of expert-based information in shaping their position.

3.3 Biodiversity Loss Factors

Current state of biodiversity

Freshwater biodiversity is at risk globally, and Lithuania is no exception. European rivers, including those in Lithuania, continue to suffer from the effects of habitat fragmentation, diffuse and point-source pollution, invasive species, overexploitation, and hydromorphological alteration resulting from river straightening, hydropower developments, and river fragmentation by dams. About 55% of EU and 63% of Lithuanian rivers fail to meet the WFD target of good ecological status (European Environment Agency, 2025, Lithuanian Environmental Protection Agency, 2023). The Šventoji River supports several anadromous species, including Atlantic salmon (*Salmo salar*), sea trout (*Salmo trutta*), vimba bream (*Vimba vimba*), and river lamprey (*Lampetra fluviatilis*). The Kavarskas hydropower plant fish passage currently permits the migration of salmon, sea trout, and vimba bream, but remains ineffective for lamprey migration. Potamodromous species, such as grayling (*Thymallus thymallus*) and barbel (*Barbus barbus*), are also present in the river (UAB Aplinkos inžinierių grupė, Vytautas Magnus University, & Lithuanian Hydrobiologists' Society, 2022). Scholars note that the abundance and distribution of these populations have declined significantly compared to their historical range. All listed species would benefit from restored river connectivity. Today, while the river remains a valued part of local life, many changes have become normalized, seen as "how the river is," rather than signs of ecological degradation.

Similar findings are supported by interviews with local anglers and residents, particularly those who remember the river before the concrete dam was built in the 1980s. Locals report that several species once common in the river—such as European eel (*Anguilla anguilla*), gudgeon (*Gobio gobio*), barbel (*Barbus barbus*), and common nase (*Chondrostoma nasus*) have substantially declined or disappeared. A decline in crayfish populations was also mentioned. Many residents attribute these changes primarily to the Kavarskas dam, while also noting that when the power plant was in operation, injuries to eels occasionally occurred (a problem now reported at the upstream dam on the Šventoji).

Both scholars and anglers agree that the fish passage is not functioning effectively and is unsuitable for ensuring proper fish migration. While the fish passage at this site has specific technical limitations that could be improved, fish passages in general face broader constraints: they are used by a limited range of species, they primarily support upstream rather than downstream migration, and they do not address issues such as disrupted sediment transport, altered physical water properties, or habitat loss.

Main factors contributing to biodiversity loss

A wide range of drivers contribute to biodiversity loss in rivers. In the Šventoji River, the decline of aquatic species is primarily attributed to direct drivers such as river fragmentation. The Anykščiai dam, along with other dams on the Šventoji, disrupts longitudinal connectivity, hindering the movement of aquatic organisms and fish migration routes, while impoundments alter habitats and sediment transport dynamics. Installed hydropower plants may affect the natural flow regime and increase fish mortality in turbines (mentioned by respondents, that this was the case in Anykščiai when the local hydropower plant was operational).

The dam additionally contributes to habitat alteration. The creation of the reservoir transformed river habitats from flowing to stagnant conditions, favouring generalist species that are more tolerant of environmental change.

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Although not systematically monitored, local residents and NGOs report that poaching has also contributed to the decline of fish, particularly salmonids. Other potential pressures, such as point-source or diffuse pollution, are not reported to be of major significance in the study area.

Among indirect drivers, limited public awareness plays a key role. Many residents are unaware of the ecological problems caused by dams or believe that aquatic species have adapted to current conditions. The shifting baseline syndrome may also be present, as younger generations tend to perceive novel or degraded ecosystems as natural, having no personal memory of earlier, healthier river conditions.

At the policy level, gaps in implementation remain. Although EU directives and national strategic plans provide a solid policy foundation, translating these commitments into local action remains challenging. Common obstacles include limited institutional capacity, low political prioritization, and scarce financial resources.

Cultural, political, and identity-related factors

Culturally, the Šventoji River holds deep emotional, aesthetic, and recreational significance for the community in Anykščiai; Many residents regard it as an essential part of the town's identity. While "biodiversity" is not a concept frequently used in local discourse, residents express concern for the river's well-being through everyday activities and observations of its changes. The dam and its reservoir also contribute to the emotional landscape of Anykščiai, though their significance is consistently described as secondary to that of the river. . Local residents spoke of the river in deeply personal terms, drawing on memories of swimming, angling, observing seasonal changes, and childhood experiences. For many, the river is associated with "everyday happiness," described as the "axis of the city," a place of beauty, and a setting where community rituals once took place. Several contrasted the Šventoji's natural character with more industrialised rivers elsewhere, and some even suggested that the clarity and purity of the water historically contributed to its name ("Šventoji" meaning "the Saint"). Walking, cycling, kayaking, bathing, and simply spending time along the riverbank formed an important part of residents' daily rhythms, with some describing the river as "home" or a natural meeting place.

By comparison, the dam and reservoir hold a more modest emotional role. While not regarded as symbolic for the town, the reservoir was appreciated by some for its calm reflections, soundscape, and the recreational setting it creates. Residents mentioned past activities such as jumping from the banks or engaging in watersports, and several valued the well-developed infrastructure around the impoundment. Ongoing sedimentation has reduced the reservoir's attractiveness for some users.

Overall, the river remains the primary source of emotional attachment and place identity, while the dam and reservoir are viewed as familiar and pleasant but not central to how residents define Anykščiai. This shared appreciation offers common ground for dialogue between stakeholders, suggesting that identity can serve as a bridge rather than a barrier in efforts to restore biodiversity and reconnect the river.

During the Soviet period, the construction of dams was an institutionalized driver of biodiversity loss. In the contemporary context, institutions—especially at the national level—recognize the ecological consequences of these past decisions and have developed strategies to address them. The Šventoji River in Anykščiai is now nationally identified as a priority site for restoring river connectivity, due to its high ecological potential and the presence of valuable habitats for migratory fish such as salmonids. National authorities, supported by scientific research and NGOs, advocate for dam removal or modification as a measure to improve fish migration and restore ecological balance.

At the local level, institutional actors mostly acknowledge the need to address biodiversity loss, yet tend to favour compromise solutions, such as improving fish passages rather than full dam removal, to maintain landscape aesthetics and social acceptance of the restoration projects.

Closing reflection

Biodiversity loss in the Anykščiai case is shaped by the convergence of ecological pressures and social dynamics. Ecological problems such as river fragmentation, disrupted sediment regimes, and habitat degradation are well-documented, yet their resolution is constrained by social factors: limited public awareness of biodiversity, strong emotional attachment to the dam and reservoir landscape, and persistent gaps between national policy ambitions and local governance capacities. Although the need to restore river continuity is widely recognized at EU and national levels, and endorsed by scientific institutions and NGOs, implementation on the ground remains slow, fragmented, and politically fragile. Local discussions frequently gravitate toward compromise options—such as improving fish passages—which aim to reduce ecological impacts while preserving familiar landscape features.

Responding effectively to biodiversity decline requires strategies that acknowledge both ecological priorities and the social realities that shape local decision-making. This means strengthening institutional trust, ensuring that communities have access to clear and credible information, and creating conditions for meaningful participation rather than symbolic consultation. In this context, participatory approaches are not an optional addition to restoration efforts; they are necessary for ensuring that community perspectives are understood and respected, while also identifying and addressing the knowledge gaps that shape local concerns.

3.4 Culture-Based Dynamics

In the Anykščiai case, relationships with the river are shaped by a mix of emotional, practical, cultural, and ecological values, often blending formal knowledge with lived experience. People connect to the river in ways that do not fit into rigid categories.

For many residents, the river holds relational value—woven into daily life, memory, and local identity. Childhood swims, riverside fishing, and familiar views speak to a deep emotional connection to place. For these residents, the health of the river matters not only for its own sake but as part of who they are.

Others emphasize instrumental value: the river as a resource supporting recreation, tourism, or local businesses such as kayaking or nature-based tourism. Yet even here, the separation between profit and care is rarely clear-cut. Several local entrepreneurs involved in eco-tourism and nature-based retreats described their work as grounded primarily in respect for nature, with economic benefits viewed as secondary or emerging as a by-product of these commitments. Business owners noted that their activities were inspired by the landscape's beauty and their attachment to the place; some characterised recreational ventures as "hobby businesses" rather than purely commercial enterprises.

Generally, many residents view ecology as a value, but their perspective often differs from that of environmental professionals, academics, and activists. The latter often highlight migratory species, hydrological processes, and the need to protect habitats: the conclusions drawn from systemic long term monitoring efforts and data analyses.

In practice, few people hold one type of value purely. Most relationships to the river are hybrids—mixing emotional ties, practical uses, ethical commitments, and ecological concerns, most of which are raising through direct interaction with the river. This creates a strong connections rich and diverse mosaic of perspectives.

When the idea of ecological restoration comes up, these different values shape reactions. For some, restoration promises healing and renewal. For others, especially those attached to the current dammed landscape, it risks disrupting cultural heritage and even destroying the ecosystem that has adapted to current conditions. In this way, the conversation about the river's future is not only about nature but about which histories, hopes, and attachments will be honoured.

Over time, human–nature relations in Anykščiai seem to be shifting from seeing the river mainly as a backdrop for industry and recreation toward a more layered view—where nature is regarded as a partner, a heritage, and a responsibility—though not without conflicting views about what that partnership should look like.

3.5 Identity-Based Dynamics

Rather than focusing on predefined categories such as gender, ethnicity, or religion, our approach explored how different forms of identity emerged naturally from participants' narratives. We aimed to listen for how people positioned themselves in relation to the river, nature, and broader questions of progress.

Several identity-based dynamics became visible through this process. One important thread relates to historical and cultural experience. Some participants expressed a deep connection to nature rooted in local folk traditions and rural ways of life—echoes of a time when living close to rivers, forests, and seasonal rhythms was central to daily life. For these individuals, the river is more than a landscape feature; it is part of a living heritage.

Others reflected a worldview shaped by the Soviet industrial period, where human-made structures like dams were seen as symbols of progress and resilience. In these narratives, nature was often understood as something to be harnessed, improved, and put to human use. Although society has changed since independence, this way of thinking remains present in parts of the local institutional and social fabric.

Economic circumstances also seemed to shape how people related to biodiversity and landscape changes, although this pattern should be interpreted cautiously. In some conversations, we sensed that those with fewer resources focused more on practical, everyday concerns, while those with greater economic stability sometimes expressed stronger symbolic or ecological attachments to the river. Among participants involved in business, there were hints of tension: an appreciation for the river's beauty and identity, alongside concerns about how environmental regulations might affect future opportunities. These impressions suggest a complex field where economic position subtly intersects with attitudes toward nature.

Another distinction surfaced around trust. Some residents expressed support towards bureaucratic systems and formal authorities to make decisions about the river; others—especially those with a personal connection to the river or environmental work—emphasized grassroots responsibility and direct engagement with nature.

In this case, identities connected to nature are fluid rather than fixed. People move between traditions of care, memories of industrial modernization, present-day economic pressures, and emerging environmental ethics. Understanding these layers is crucial for any effort toward ecological restoration, as successful initiatives must navigate not only technical realities but also the lived cultural and emotional landscapes that shape how people see their river.

3.6 Political/Institutional Dynamics

Many factors act as political barriers to advancing biodiversity restoration in Anykščiai. Although EU and national policies provide a strong framework for river restoration, implementation remains slow due to limited funding, low political prioritization, and insufficient institutional capacity to engage effectively with local communities. A lack of experience with complex restoration projects further constrains progress, as does the challenge of finding solutions that reconcile ecological objectives with local expectations.

At the municipal level, environmental issues related to the river and the dam are generally not viewed as urgent. Political attention tends to favor preserving the dam and maintaining current water levels, with compromise measures—such as improving fish passages—preferred over full dam removal. This reflects a tendency to prioritize aesthetic and

recreational values over long-term ecological benefits. Environmental decisions also become politicized, which undermines public trust. Some residents believe that debates about the dam are driven by the interests of specific political actors rather than by considerations of community-wide benefit.

Communication remains a central barrier. Clear, accessible, and trustworthy information about the ecological impacts of the dam and the potential advantages of restoration is limited. The absence of local technical experts or scientists who could provide neutral, evidence-based explanations reinforces skepticism and leaves environmental perspectives underrepresented in decision-making processes. At the same time, politicians who have publicly discussed dam removal have sometimes faced negative publicity, which discourages open dialogue.

These challenges reflect a broader gap between national and local perspectives. Nationally, the Anykščiai dam is one of many barriers affecting river connectivity; locally, it is viewed as a distinctive and valued part of the landscape. This divergence, combined with limited institutional capacity and political caution, slows the adoption of effective biodiversity restoration measures.

4. Transformative Biodiversity Innovations

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4.1. Analysis of Inclusion/Exclusion Mechanisms

Exclusionary practices

In our case study, exclusionary dynamics do not stem directly from opposition to environmental goals (e.g. anti-environmental sentiment), but from more subtle processes: uneven flows of knowledge, limited opportunities for bottom-up environmental engagement, strong attachments to familiar human-shaped landscapes, and a broader societal detachment from the river and its biodiversity due to low dependence on them for livelihoods and well-being. Across nearly all interviews, a clear message emerged: community members feel a strong and sincere attachment to their river. Their connection to nature is formed through daily experiences, such as swimming, walking, observing seasonal changes, or angling, rather than scientific knowledge alone. Many participants expressed genuine affection and appreciation for the river's vitality, though their understanding of what constitutes a "healthy" river often differs from institutional or academic perspectives. This highlights both the depth of local connection to the river and the existing gaps in knowledge related to biodiversity and the ecological changes associated with restoration efforts. This difference does not signal disinterest but reveals an opportunity to connect diverse ways of knowing. Community perspectives, grounded in lived experience and sensory engagement, complement the formal biodiversity knowledge that circulates within scientific, NGO, and regulatory spheres. Strengthening dialogue between these domains can foster more inclusive, grounded, and co-created understandings of biodiversity and its role in community well-being — from recreation and cultural identity to food and everyday enjoyment of the river. Early initiatives to introduce dam removal in the community were primarily communicated by emphasizing the ecological goals of river restoration — particularly the improvement of salmonid migration. While nature-centred, they were less anchored in localized, tangible, and emotionally resonant narratives that could have connected more naturally with community members. In the absence of clear arguments showing how the project would benefit the community according to its own values and priorities (for example, interviews indicate that history and landscape aesthetics are valued more highly than financial savings), and without concrete, place-specific scientific justification that residents perceived as trustworthy and independent — including environmental impact assessments, models, visualisations, simulations, or storytelling grounded in the specific river and townscape — many residents were left to imagine the project's outcomes on their own. Rather than engaging with clear, relatable, and locally meaningful information, they had to rely on speculation, which limited the development of informed and confident support. At the same time, the discussion around dam removal became politicized. Some community members perceived the initiative as being led by particular institutional or interest groups rather than as a shared, community-centred effort. These perceptions, though not necessarily grounded in opposition to restoration itself, reflected broader concerns about inclusion, transparency, and trust in decision-making. Acknowledging and addressing these sentiments provides valuable opportunities to foster dialogue, strengthen trust, and build collective ownership of environmental change. The early communication approach also tended to overlook experiential and place-based forms of knowledge — such as memories of childhood swimming areas, observations of seasonal water changes, or local stories about fish populations. Although these insights may not appear to relate directly to environmental action needed, embracing these ways of knowing can help connect intended environmental measures with lived community experience and communities needs. This, in turn, can lay the foundations for more inclusive, trusted, and enduring forms of environmental stewardship.

Economic considerations further shaped local perspectives in nuanced ways. Businesses connected to tourism, such as kayak rental operators, expressed diverse views on the dam's influence. Some saw its removal as a chance to enhance safety for kayakers — especially given the history of tragic accidents at the dam site — while others felt the dam's

presence had little impact on their operations or even benefited their businesses. Meanwhile, several hospitality and entertainment businesses voiced concerns that lowering the reservoir could alter the scenic character and recreational appeal of riverside areas. These perspectives underscore the need to understand how environmental actions influence local economies and livelihoods, and how such concerns can be addressed within the project planning process. Recognizing these interconnections does not imply the pursuit of a universal compromise. While constructive agreement should be encouraged, it is not always achievable, and the possibilities and limits of consensus must be communicated transparently. What is essential is establishing a shared understanding of where common ground exists, where it does not, and how environmental decisions can proceed with clarity and accountability, including an honest consideration for the needs of the local businesses. Through open dialogue and transparent communication, environmental restoration can advance in ways that acknowledge economic sensitivities while maintaining a long-term vision of ecological renewal. At the institutional level, hierarchical decision-making remains visible. National goals for restoring longitudinal river connectivity are in place, yet their implementation at the local level progresses slowly. Respondents noted that information about planned projects is often presented in formal formats that are difficult to access or understand—for example, materials written in technical or non-user-friendly language or announcements that are not widely advertised. As a result, communication is not perceived as clear, relatable, or meaningful, and processes for inclusion or co-creation are also limited. Consequently, formal public hearings tend to unfold mainly between political representatives and institutional authorities, leaving local environmental perspectives less visible. This can reinforce the perception that responsibility for environmental stewardship lies primarily with external actors, such as national institutions or the EU. Within this context, existing power dynamics can unintentionally overlook the diversity of local perspectives — from those strongly committed to environmental restoration to others who value the dam’s cultural or historical significance. When these place-based insights by anglers, seasonal-residents, local environmental activists, community leaders etc. are not taken into consideration, environmental action can become vulnerable to scepticism and mistrust, even when its goals are widely beneficial. Strengthening participatory mechanisms and valuing local experience alongside formal expertise can support more balanced, inclusive, and context-aware river governance — one that aligns policy objectives with lived experience and the community’s longstanding care for the river. A lack of societal support and meaningful social inclusion can leave biodiversity policies structurally fragile. When communities do not fully understand, recognize, or trust the intentions behind conservation measures, even well-designed policies risk becoming brittle. The transformative potential of biodiversity conservation depends on whether society and local communities can see its benefits, relate it to their own values and lived realities, and feel encouraged to support and participate in the process.

Inclusive mechanisms

Despite these challenges, important foundations for more inclusive engagement are being established and gradually strengthened. Our open-ended interviews functioned as both a method of data collection and a modest social innovation. They created an open, respectful environment where community members could engage in dialogue about dam removal with curiosity and confidence. The conversations offered space for participants to share their experiences, express concerns, and formulate ideas and needs related to environmental decision-making. In doing so, the process fostered trust, reflection, and a sense of shared ownership over the future of the river.

The community demonstrates strong potential for bottom-up environmental innovation. A well-established culture of forest protection, supported by grassroots initiatives, shapes a broader appreciation for the natural living environment and the quality of life it provides. Many respondents described the Šventoji River as a core element of the town’s identity and emphasised how nature contributes to everyday wellbeing. Across interviews, there was also a clear sense of admiration for nature itself — a recognition of its intrinsic value,

not only its practical benefits for people. While individual perspectives varied, this respect for nature was still apparent and visible throughout many discussions. All this provides fertile ground for expanding environmental stewardship to include river ecosystems. Local actors engaged in eco-tourism, forest bathing, and nature-based education already embody relational values that connect well-being, livelihood, and care for the environment — forming promising nodes of local leadership. Strengthening and connecting these initiatives could play a pivotal role in advancing river restoration efforts. While external partners can help catalyse dialogue and provide resources, lasting transformation grows from within — emerging through locally grounded leadership and the community's own evolving sense of environmental responsibility and belonging. National-level NGOs have played a leading role in bringing the issue of dam removal to public attention. Their initiatives have advanced political advocacy, shaped environmental priorities, and raised public awareness, helping to lay the foundations for national discussions on ecological restoration. If relationships between NGOs and local communities evolve, there is growing potential to complement policy-oriented work with participatory approaches that strengthen local capacity, foster dialogue, and nurture shared ownership of river restoration efforts. Several interrelated factors emerged as particularly important in fostering greater inclusion in river restoration discussions:

Environmental impact assessment and visual tools: Residents frequently emphasised the need to clearly understand how dam removal would affect both the local landscape and the river's ecological dynamics. They sought practical, place-specific information about how water levels would change across seasons, how this might influence access to the water, the attractiveness and usability of existing infrastructure adapted to current water levels, how riverbanks would look, and what implications these changes could have for safety. Many also highlighted the importance of environmental impact assessments, scientific studies, and model simulations that could visually convey expected changes in hydrology, water levels, and ecosystem dynamics, as well as clarify the scope of construction works. Participants stressed that such assessments should address practical concerns, including potential implications for flood risk. Overall, community members expressed a strong appreciation for technical expertise and expected analyses that are both scientifically rigorous and communicated in an accessible, transparent manner.

Education and localized narratives: Ecological restoration becomes more relatable when biodiversity gains are explained through locally meaningful examples. Framing restoration outcomes in relation to specific, valued species — such as iconic or culturally important fish — makes change personally and emotionally relevant. Involving local environmental actors in shaping and communicating these narratives further strengthens trust, relevance, and continuity between scientific and community perspectives.

Co-creation workshops: The co-creation workshops may provide opportunities for participants to explore their relationships with the river and its impoundment, articulate shared needs, and envision future possibilities. Creation of place-identity maps allows community members to reflect on meaningful sites and activities connected to the river. Discussions also considered how the functions of the dam could be reimaged or substituted through alternative solutions, fostering creativity, collaboration, and a sense of collective ownership over the river's future.

Interestingly, the most transformative innovation in our case may be social rather than technical — the practice of genuine dialogue. By moving from one-way information delivery to the cultivation of open conversations, new pathways for agency, mutual understanding, and connection are beginning to emerge. Inclusion and exclusion are not fixed conditions; they are dynamic processes that evolve over time — shaped by every meeting, every story, every map, and even every silence. In this case study, moments of exclusion often arose from well-intentioned actions that were not fully communicated, while inclusion has taken root through patient dialogue and a willingness to engage with people on their own terms. Effective restoration in Anykščiai depends on revitalising the river and improving how information is shared, understood, and used in decision-making and planning. Creating space for different forms of knowledge and experience related to the Šventoji can

strengthen ecological outcomes and build a more informed, constructive relationship between the community and the river.

4.2 Niche Innovators and Key Players

In our case study of Anykščiai, identifying niche innovators and key actors required a more attentive and relational approach. Unlike regions with highly visible “champions” of change, the forces driving biodiversity innovation here are quieter — dispersed across multiple roles and often only beginning to take form. Instead of large, coordinated movements, we observed small yet meaningful initiatives: individuals, informal groups, and everyday community dynamics that signal the early roots of transformative potential. Though their influence may appear subtle, these actors play a crucial role in shaping how biodiversity practices emerge and evolve within the region.

Three main types of niche innovators emerged during our fieldwork:

Environmental NGOs

At the national level, environmental NGOs focused on fish conservation and the promotion of free-flowing rivers play a vital role in raising public awareness, educating youth, collaborating with governmental institutions, and addressing illegal activities such as poaching. Their extensive experience and expertise provide an essential foundation for advancing river restoration initiatives. Positioned at the intersection of science, policy, and community engagement, these organizations are well placed to serve as key partners in future efforts to strengthen river health and biodiversity stewardship.

Local nature-connected individuals

Within the community, a self-organized group has formed around a shared appreciation of nature and strong personal connections to the local environment. Many community members engage in activities such as forest bathing, angling, kayaking, boating, organising hiking trips, environmental education, eco-tourism, and cold-water swimming — practices that reflect a deep, experience-based connection to the place. Although they may not formally identify as “environmentalists,” their everyday engagement with the river and its surroundings positions them as promising catalysts for grassroots innovation and locally grounded stewardship.

Soft-bridge builders: researchers and intermediaries

Our team, drawing on backgrounds in psychology and counselling, placed particular emphasis on fostering constructive dialogue, cultivating relationships, and recognizing the diversity of values — ecological, cultural, and social — that shape local perspectives. Throughout the process, we remained mindful that nature itself represents a central stakeholder in this case, not merely a backdrop to human activity. While we did not seek to drive community change directly, our relational, participatory, and attentive approach created openings for reflection and connection — spaces where grassroots energies and local initiatives may gradually take root.

It is also worth noting that technical experts and academics can play a complementary role in this process by fostering technically grounded, non-political discussions with community members, addressing local concerns through accessible communication and professional expertise. In doing so, they can help translate complex ecological information into shared understanding, reinforcing trust and enabling informed participation in environmental decision-making.

The innovators identified in this study contribute in distinct yet complementary ways to river restoration.

National NGOs

Operating primarily at the national scale, environmental NGOs bring valuable knowledge about environmental issues, policy experience, and advocacy skills. When their activities include and empower local residents, they can effectively bridge scales of governance,

transforming potential distance into trust and shared purpose. Their influence is well established in policymaking and environmental planning, and with greater local collaboration, they hold strong potential to enhance community-level engagement and understanding.

Local nature-oriented individuals

Community members who engage in practices such as forest bathing, eco-tourism, or river-based recreation are deeply embedded in the local social fabric. Their credibility stems from being recognized as “one of us” — neighbours, peers, and caretakers of familiar landscapes. Their contributions to biodiversity and environmental awareness often arise organically, as a natural extension of everyday life rather than formal activism. This authenticity and emotional connection to place offer a powerful foundation for nurturing locally grounded stewardship and collective care for the river

Researchers and intermediaries

Researchers and other intermediaries serve as important bridges between institutional structures and community realities. Although external by background, their participatory and empathetic approach positions them as trusted collaborators. By emphasizing listening, dialogue, and co-learning, they help weave connections between scientific knowledge, policy priorities, and lived experience. This bridging role is essential for creating inclusive, adaptive, and trust-based approaches to river governance.

Interestingly, the “agency” of non-human actors — particularly the river itself and its components, such as fish — played a significant symbolic role in discussions about river health. Nature-connected individuals often described the river and its species not as passive background elements but as co-inhabitants — living systems deserving of respect. This recognition of more-than-human agency, though not always articulated explicitly, represents a subtle yet important form of innovation in itself.

Influence and recognition

The recognition of these niche innovators varies greatly:

Environmental NGOs are widely recognised for their national-level contributions to policy, advocacy, and education. In local contexts, however, they are often seen as external actors, which can limit trust and reduce the impact of their engagement on issues such as the dam. At the same time, interviews showed that environmental voices exist within the community itself, often expressing concerns and values similar to those raised by NGOs, yet remaining less active and/or visible. Strengthening the presence of environmental voices and organisations locally — through education, dialogue, and place-based engagement — could help demonstrate that ecological restoration is not only a national priority but also a matter of local relevance and benefit. Local individuals who are strongly connected to nature hold significant social credibility, yet they are not currently organised or engaged specifically around river restoration. As a result, their potential to contribute to local dialogue and support for restoration remains largely untapped. Our research-based efforts to build bridges were met with openness and thoughtful curiosity. Participants frequently asked whether our engagement was genuinely participatory or guided by predetermined agendas. Through transparency—being clear about our own positions while remaining attentive and willing to listen—we were able to foster a degree of trust. Although our work has not yet transformed local dynamics, many interviewees expressed appreciation for the opportunity for open dialogue, suggesting that sustained relational practices could gradually strengthen recognition and long-term impact.

Thus, while none of these innovators (yet) drive large-scale change, their combined presence is helping to loosen rigid frames around what the river could be. The approaches brought by niche innovators have some similarities, but to some degree differ from mainstream conservation practices:

NGOs advocate for the most effective practices from an ecological perspective, including dam removal, and they generally resist diluted solutions that weaken environmental outcomes. Their role often involves drawing attention to difficult or long-standing problems

that require decisive action, positioning them as one of the more ambitious voices in river restoration debates.

Local nature-appreciating individuals, by contrast, bring a relational and experience-based perspective to discussions about the river. Their focus is less on technical details and more on values, emotional connections to the environment. They act as informal stewards of place-based values, grounding environmental discussions in lived experience rather than in formal policies or quantitative targets.

Our research activities represented a form of relational science that values both technical expertise and lived experience, seeking to integrate them in dialogue.

These differing approaches challenge traditional "inform/instruct" models of conservation by introducing participation, emotion, memory, and belonging into biodiversity dialogues.

Involvement of niche innovators in field activities

Due to the specifics of the case study, there has been no structured collaboration with niche innovators beyond the research interviews themselves. Our engagement has mainly taken the form of **conversations** – open-ended, relational, and oriented toward listening rather than directing.

Environmental NGO representatives were included among the interviewees. They shared their views on river health and fish conservation, adding valuable perspectives to the broader understanding of biodiversity challenges. However, their involvement remained largely at the level of discussion rather than active participation in local initiatives.

Locally connected individuals also took part in the interviews, offering reflections closely tied to their lived experiences with the river. Their voices were deeply personal and grounded in long-standing relationships with nature, though not organized into formal advocacy efforts. Through these contributions, they articulated the meanings the river holds in everyday life and highlighted how the bond between the community and the river could be strengthened in future restoration efforts.

As **researchers**, our role was to support diverse actors and create space for these conversations to unfold in a transparent, respectful, and emotionally attentive manner — recognizing plural values and perspectives. We also sought to strengthen the foundation for future engagement by encouraging preparedness, building expertise, and providing scientifically grounded information to ensure that the community can make informed decisions about the future of the river and the dam. We made conscious efforts to demonstrate our willingness to accompany the community in its own reflections. This relational approach, while modest, has already begun to soften some of the defensiveness that often surrounds discussions of ecological change.

Engagement with niche innovators has focused on establishing relationships and dialogue. We see this as essential groundwork for future biodiversity restoration efforts that are rooted in the community itself.

Conclusion: the quiet power of small innovations

In sum, while Anykščiai does not currently have a high-profile movement for river restoration or biodiversity innovation, the groundwork is being laid through diverse and complementary channels:

National NGOs keep the scientific and policy discussion alive.

Local nature-connected individuals maintain a cultural and emotional link to the river.

Research-based relational engagement introduces new models for addressing complex environmental issues.

These niche innovations demonstrate meaningful ways of fostering dialogue, rebuilding trust, and expanding collective imagination — all of which are essential for inclusive

environmental governance. In a context where top-down solutions have often met resistance, these emerging practices are shaping the conditions for broader and more enduring transformations. Here, innovation is not defined by spectacle or speed, but by patience, care, and the steady creation of foundations on which deeper ecological and social change can take root.

4.3 Scalable Bottom-Up Innovations for Transformative Change

In the context of our case study, innovation is understood as a place-based and context-sensitive process — one deeply tied to local circumstances, relationships, and timing. Innovation for river biodiversity conservation depends strongly on context and should align with local needs, values, and capacities. In this case, many of the actions that qualify as “innovative” from the perspective of biodiversity and participatory research may appear simple on the surface, yet they represent forms of social innovation. Effective communication is essential: information must be understandable, accessible, and relatable to community life, clearly demonstrating the ecological and community benefits that restoration can bring. Alongside this, creating open spaces for dialogue, strengthening trust between institutions and communities, and developing holistic, long-term responses to complex challenges help establish the conditions for meaningful engagement. Providing technical knowledge on ecological restoration further reinforces this foundation. Taken together, these efforts function as soft innovations that rebuild trust, enhance legitimacy, and support shared ownership of environmentally significant decisions. In a community where public trust is growing, biodiversity awareness is expanding, and participatory practices are taking shape, these initiatives lay a strong foundation for lasting transformation by linking scientific integrity with social inclusion. The same principle applies to participatory practices: in some settings, creative co-creation methods — such as theatre, art-based workshops, or interactive mapping — can inspire rapid engagement and imagination. The introduction of such methods is highly positive when well-timed, as effective innovation depends on sequencing; building trust and communication before introducing more complex tools ensures lasting participation and stronger outcomes. Thus, context-sensitive innovation involves recognizing that (I) small steps can become radical when they shift entrenched patterns; (II) innovation is measured by the extent to which it opens new social possibilities for biodiversity and community well-being; and (III) meaningful change begins by meeting people where they are and fostering transformation from within their realities. In essence, innovation here is defined by relevance, timing, and relational care rather than by sophistication. In our case study, bottom-up biodiversity innovations are emerging through early seeds of transformation — small, scattered practices and community initiatives that are beginning to take root. Recognizing and nurturing these seeds with care and continuity is vital for the long-term restoration of biodiversity along the Šventoji River. Supporting and empowering environmental voices within the community is a valuable approach. In river-related contexts, however, these voices can be few, as changes in ecosystems are often visible mainly to specialists and dedicated enthusiasts. These small groups frequently seek collaboration and support from national-level actors to strengthen environmental advocacy locally.

Existing innovations and their transformative potential

At present, we see two main clusters of activity that could be considered emerging bottom-up innovations:

Local nature-appreciating individuals and informal networks

While there is no formal grassroots movement for river restoration, our interviews showed that an unorganised group of residents express strong concern for the river and recognise the need to address the challenges created by the dam. Bringing these voices into formal processes could strengthen local advocacy for restoration. Interviews also revealed a broader set of residents with deep, often personal connections to nature, though not always to the river itself. Many are engaged in forest conservation, eco-tourism, or nature-based wellness activities. While their current efforts are not focused on river biodiversity, they

represent an important foundation for future engagement. Their practices reflect a stewardship-oriented perspective that values ecosystems for their intrinsic and long-term vitality rather than short-term utility.

Relational research approaches and trust building

Our own role as researchers introduced a soft innovation into the local dynamic: a way of approaching the community based on relational trust, emotional acknowledgment, and careful listening. By prioritizing open-ended interviews, transparency, and dialogue, we demonstrated that sensitive topics like dam removal could be discussed. This method itself—low-cost, highly replicable—offers a scalable model for fostering biodiversity dialogue and may aid in creating space for more change oriented, well-informed discussions.

Both of these innovation pathways differ from mainstream conservation practices, which often emphasize technical fixes or regulatory compliance without deep engagement with the cultural and emotional landscapes of local communities. What makes these innovations "nature-positive" is their potential to realign community attention towards living ecosystems rather than static, human-engineered landscapes. Instead of framing rivers as infrastructure to be managed, these emerging practices see rivers as dynamic, living systems worthy of respect, restoration, and coexistence. Notably, in many conversations, the river itself emerged as a key non-human actor — a symbol through which residents connect to the broader ecosystem. Discussions about time spent by the river, leisure activities, and observations of nature — such as birds, fish, vegetation, or changes in sedimentation processes over the years — became important entry points for discussing ecological matters with local residents. At the same time, our relational engagement model promotes a slower, more participatory form of biodiversity action – one that recognizes local needs, beliefs and values rather than dismissing them. Access to these emerging innovations is uneven. People already connected to nature through livelihoods (e.g., eco-tourism operators) or personal values are more likely to engage. In contrast, other residents – especially those for whom the river is primarily a backdrop to daily life – may remain excluded unless engagement efforts are extended thoughtfully and respectfully. Integrating grassroots dynamics into formal planning creates a strong opportunity for more effective biodiversity action. By actively connecting institutional actors with community members, project planning and implementation can better reflect local needs and perspectives. This approach strengthens engagement, builds community support, and contributes to more durable and successful restoration outcomes.

Networks and social relationships

The social network supporting these innovations is still loose and mostly informal. It includes:

Residents with connections to the river and biodiversity (usually anglers, e.g. fly-fishing enthusiasts)

Residents passionate about local nature (but often not identifying as "activists"),

Local organizers of eco-cultural festivals,

Small business owners involved in nature-based tourism,

Researchers facilitating trust-based engagement,

And a few NGOs operating at the regional and national level.

However, connections between these actors are often weak or fragmented. Building stronger links—especially connecting personal attachments to broader ecological narratives—will be essential for scaling transformative change.

Diachronic insights: observations rather than comparisons

Because we did not conduct a systematic before-and-after evaluation, we cannot definitively describe changes in community attitudes or biodiversity practices over time.

Our fieldwork represents only a **snapshot**: a careful listening to how the situation feels and is perceived *at the time of our study*.

What we can say is that, based on interviews and community conversations:

Many residents noted that previous discussions about the dam and river restoration were largely initiated by political or external actors and were often perceived as politicised or ideological, rather than grounded in genuine environmental concern or clear, evidence-based arguments for action. Conversations that lacked clear technical or scientific justification struggled to build trust, dialogue, and support. In contrast, information presented as case specific in a factual, transparent, and technically grounded manner was regarded as trustworthy, reflecting a broader preference for scientific expertise over political rhetoric or bureaucratic argumentation, such as meeting policy goals.

During our engagement, people frequently expressed interest and willingness to discuss the river and its future, provided that the conversation remained transparent, respectful, and connected to their lived experiences. A recurring theme across interviews was the desire for concrete, localized information about the ecological impacts of potential changes — such as effects on water levels, public safety, landscape, adaptations to existing infrastructure.

Thus, while we do not claim to have measured any transformation, we can say that many community members appeared open to learning and reflection — provided that future engagement continues to be handled with care, respect for local knowledge, and the gradual building of trust through expertise and professionally delivered solutions rather than quick fixes. Our experience suggests that **the conditions for dialogue are present** – but must be nurtured patiently and relationally, rather than assumed to exist by default.

Challenges and opportunities

While promising, these innovations are still young and face risks:

Fragmentation among local actors,

Limited biodiversity knowledge among residents,

Potential for misinterpretation (e.g., seeing impoundment as "natural" habitats to be preserved),

Lack of participatory engagement methods.

Addressing these challenges will require:

Long-term commitment to community-centered dialogue,

Recognition of the emotional and historical attachments to the river,

Investment in building local leadership for biodiversity,

And policies that allow time for trust and informedness of the community to grow, rather than rushing processes in the name of efficiency.

Closing reflection

In the Anykščiai case, transformative change is most likely to unfold through steady, grounded processes of dialogue, trust-building, and the growing embrace of relational values toward the river. These emerging forms of soft, social innovation are modest in scale yet significant in impact, strengthening the social foundations for lasting ecological renewal. The transformative potential of restoration in Anykščiai comes from strengthening participation. This involves ensuring access to information that is accessible, understandable, independent, and relevant to community life, building a shared understanding of environmental issues, and creating meaningful opportunities for people to engage in planning and decision-making. Incorporating community perspectives can foster a situation where residents not only support but also help lead environmental change. Listening to local voices, recognising community values, and integrating them into planning are essential steps in this process. Sustaining and expanding these practices

allows biodiversity goals to take root both in policy frameworks and in the everyday relationships and practices that connect the community to its environment.

4.4 Initial Mapping of Interventions

In our case study, the development of interventions to foster biodiversity restoration was approached in a more grounded manner. Early in the research process, we reviewed national and international dam-removal case studies, scientific literature, media reporting, and expert insights from countries with large-scale ecological restoration practice. Our consultations with international experts experienced in dam removal showed that projects are most successful when they are grounded in local realities and align with how communities think and live. Experts noted that a project should have clear roots in the community and ideally emerge from local perspectives, which was not very strong in this case. Approaches that reflect local values help build genuine participation and more constructive dialogue. Engagement should involve the community and address its recreational, cultural, environmental, and everyday needs, while respecting how people understand the river and their relationship with it. It became clear that any intervention must begin by building trust through credible expertise, strengthening local understanding through communication that residents find accessible and understandable, and recognising the cultural values and emotional ties people hold toward the existing landscape, including the impounded river. International experience shows that rapid, top-down actions can provoke resistance when they overlook these cultural and historical meanings. While contexts vary, the evidence is consistent: integrating community perspectives alongside environmental and cultural considerations greatly increases the likelihood of achieving successful and lasting ecological restoration, including the removal of barriers that prevent rivers from functioning naturally. We also considered creative community engagement approaches, such as theater-based methods, which have been successfully used by our societal partner (a theater director) in other sensitive social contexts in Lithuania. However, we reflected and concluded that introducing theatrical participatory methods would not be suitable for our context. The case is currently at a stage where relational dialogue and transparent information sharing are essential, providing space for genuine discussion and reflection. Such discussions should be supported by communication grounded in expert knowledge and presented in ways that are accessible and understandable to residents. This includes clear visualizations, models, and environmental impact assessments that are tailored to the local context. It should be transparent what kinds of changes are expected, giving communities the opportunity to express their needs and proposals. At the same time, the process must be honest about the limits of what can be addressed, so expectations remain realistic and participation remains meaningful. Thus, while inspired by more experimental methods, we recognized that the true innovation required here lies in fostering genuine dialogue supported by contextual, technical, and evidence-based information, **along with gradual relational work and a willingness to address community perspectives.** Engagement must reflect a commitment to addressing community needs that could be affected by the project, ensuring that all concerns—ecological, hydrological, public safety-related, cultural, and beyond—are acknowledged and thoughtfully addressed. Our planned interventions focus on continuing and deepening structured conversations. Based on insights gathered so far, we have identified several potential soft interventions that could move beyond business-as-usual conservation approaches. These ideas aim to centre community relationships and emotional connections to the river as the foundation for future biodiversity work:

Relational interviews: continue conducting interviews and informal conversations, offering community members opportunities to share their diverse values, needs, experiences and hopes regarding the river's future. These exchanges can strengthen mutual understanding and help identify shared values and common ground that support collaborative action.

Localized information campaigns: if opportunities arise, we could encourage environmental stakeholders and planners to address community questions—through visual

materials, models, or other tools that help make technical information more relatable and meaningful. Such efforts could offer context-specific, evidence-based insights that are easy to understand, for example, illustrating how river water levels could change in the premises of the town.

Discussion workshops: organize workshops where community members can meet in a supportive setting to voice concerns, ask questions, exchange ideas, and collectively explore visions for the river's future. **Supporting local nature ambassadors:** Encourage individuals who already hold strong personal ties to nature (but are not formal environmental activists) to foster peer-to-peer conversations within the community and to advocate for restoration in an inclusive and inspiring way.

These possibilities are not yet formalized. They reflect directions that could be pursued depending on future community interest, readiness, and evolving relational dynamics.

A fundamental innovation in our context is the shift from information delivery to relationship-building. Instead of promoting technical solutions alone, we aim to strengthen the social fabric around the river, recognizing that healthy ecosystems and healthy communities must evolve together. Ecological decision-making, in this sense, becomes an opportunity to empower the community by encouraging participation and ensuring access to evidence-based information.

The possible course of action includes:

Building a more diverse picture of interests and perspectives through ongoing interviews and informal conversations.

Exploring small participatory actions—such as collaborative visioning workshops—provided that suitable preconditions are in place.

Considering larger public activities (such as exhibitions, co-design sessions, or consultations), if such actions are deemed appropriate in later stages of the process.

This approach emphasizes responsiveness and co-creation, fostering conditions where ideas and actions can emerge organically from within the community. Rather than prescribing solutions, it seeks to nurture community-driven momentum for river restoration, empowering local actors to shape and lead biodiversity initiatives.

4.5 Discussion

In our case study, exclusion from biodiversity decision-making stems from several factors: communication that does not effectively inform the local community about the need for environmental action, strong values rooted in the cultural landscape, unresolved questions about the changes that environmental action would bring, and limited approaches for involving the community, environmental voices, and even scientific experts in governance processes. Together, these factors reduce the momentum needed for socially robust biodiversity action. Most respondents in the Anykščiai community viewed nature as a core value of their town and expressed genuine care for the nature and the river. Their understanding of biodiversity is shaped through personal relationships with the river and its species. These everyday observations often foster strong stewardship attitudes and, in some cases, align with scientific evidence, though proposed solutions may differ. For example, older residents recalled that fish populations declined after dams were built on the Šventoji River. At the same time, a range of perceptions emerged across the community. While many anglers, especially those engaged in fly fishing, shared views consistent with scientific perspectives, others believed that the reservoir had developed new ecosystems that had adapted to changed conditions. These interpretations reflect real ecological processes, but they do not always align with scientific frameworks for assessing ecological value. People rarely speak in terms of "*ecological degradation*" or "*restoration*." Instead, they relate to the river through deeply personal and experiential lenses—memories of floods, ice jams, and the dam's construction; recollections of fish abundance; or everyday experiences such as bathing, fishing, or kayaking. As Fox et al. (2016) observe

in their study of dam conflicts in New England, what is often interpreted as resistance is more accurately an expression of place-based identity. The river, even with its dam, becomes intertwined with personal, familial, and collective memory—so that change can feel not like progress, but like loss. This becomes stronger when discussions focus on the idea of “removal” rather than “restoration”. In our interviews, several respondents noted that “it’s easier to destroy than to create,” emphasising the need for decisions that are careful, well-considered, and respectful of what the community has built over time. Several residents also linked their hesitation to past experiences with poorly planned or rushed decisions that affected the town, which contributed to diminishing trust in public projects. A key challenge concerns the way knowledge is shared and understood. Early proposals for dam removal in Anykščiai did not fully connect with local values or provide site-specific studies, visual projections, or impact assessments that could help residents understand potential changes. Without this information, people relied on their own assumptions, leading some to worry about flooding, bank erosion, fish losses, or reduced recreational access. At the same time, the lived knowledge held by residents — their stories, observations, and everyday experiences — had no clear channel for contributing to the discussion. These forms of “embodied, historical, and moral knowledges,” as described by Fox et al. (2016), offer important insights that can strengthen planning when they are acknowledged and integrated. Building processes that connect expert assessments with local experience can support clearer understanding, reduce uncertainty, and create a stronger shared basis for decision-making. On the institutional side, we observed willingness to engage but a lack of know-how—particularly at the national level—as well as limited capacity in terms of financial, human, and technical resources to effectively involve communities and to anticipate how such efforts might be perceived locally. National policies are translated to local and regional authorities, and debates are typically conducted through public hearings. However, although these hearings are open to the public, they do not provide the same depth or quality of dialogue as, for example, co-creation workshops. As a result, communities are more often formally *informed about* interventions rather than *involved in* shaping them, leaving them without a true sense of participation or ownership in decisions that directly affect their surroundings. This mirrors the micropolitical dynamics Fox et al. (2016) describe when power is seen as coming from “somewhere else,” even good ideas can feel imposed. A stronger foundation for policy implementation emerges when people feel genuinely included in shaping decisions. When communities have a voice and see their perspectives reflected, they are more willing to support change and more confident in the direction it takes. Recognising local values linked to the landscape strengthens this foundation, helping restoration efforts be understood not as external interventions, but as shared projects rooted in local identity and collective responsibility. By building this sense of participation and belonging, environmental action gains both durability and deeper public commitment. By conducting face-to-face interviews, we sought to create space for discussion and reflection. These conversations showed that community perspectives are deeply rooted in lived experience. People spoke about their direct relationship with the river, demonstrating how strongly the river figures in their daily lives. Many residents swim, kayak, and fish in the Šventoji, and they also pay close attention to its seasonal changes, recalling past floods, ice jams, and shifts in water levels. Their observations reflect substantial local knowledge of how the river behaves. We also identified untapped potential among residents already engaged in forest protection, eco-tourism, nature-based education, angling, and hiking. These activities show a strong existing relationship with the environment that could, with appropriate support, be extended toward greater engagement with river ecosystems. Practical steps such as targeted information sessions, community-led monitoring, or opportunities to share local observations can help strengthen awareness and encourage more integrated thinking about the river and its role in community life. National actors, such as academics and NGOs, contribute valuable scientific knowledge and policy expertise. Their next step, however, may lie in moving from delivering expertise to building local capacity—supporting communities to take the lead, rather than leading on their behalf.

To foster inclusion, we suggest to proceed with these actions:

Evidence-Based Communication and Visualisation Tools: Respondents emphasized the importance of transparent, independent, and factual communication supported by visual tools such as environmental impact assessments and modelled visualisations of potential landscape changes. These instruments were perceived as essential for depoliticising the debate and fostering trust by demonstrating technical aspects of the project and scientific justifications. Respondents noted that technical specialists should address community concerns, including potential ecological changes, changes in hydrological events (e.g., floods and ice jams), changes in water levels in the premises of the town, risks to public safety, alterations to landscape appearance, and effects on infrastructure, wells, upstream and downstream communities, and recreational areas, etc.

Co-Creation and Participatory Processes: The respondents highlighted the value of co-creation workshops and participatory methods as mechanisms for fostering local ownership of project outcomes. Engaging communities through inclusive dialogue helps address their needs, hopes, and perceptions of the landscape, while recognising and validating their lived experiences. Such collaboration was seen as vital for building new connections between communities and the river, creating shared understandings, and replacing outdated narratives with more constructive, future-oriented relationships. Some members of the communities noted that some of the surrounding buildings and infrastructure can be used for communities' activities.

Empowerment of Local Environmental Voices: Strengthening local environmental representation was identified as a critical factor in ensuring that environmental interests are represented in decision-making processes. This empowerment enhances transparency, inclusivity, and the perceived fairness of environmental governance.

The most meaningful intervention in our case is the creation of space for open discussion and reflection—shifting away from politicized debates aimed at persuading the public. This represents the kind of groundwork on which lasting transformation depends. Inclusion and exclusion in our case stem from limited institutional capacity in time, expertise, funding, and staffing, as well as uneven access to information. Formal procedures, such as public hearings, are an important, yet relying on them alone does not create the kind of engagement needed to build community support. This often leaves residents informed in a procedural sense but not fully involved in shaping decisions. As a result, lived knowledge rooted in observation, memory, and everyday experience is not consistently incorporated into planning. To build a future where biodiversity is genuinely reflected in decisions and embedded in long-term planning, this gap needs to be addressed. Strengthening the connection between scientific guidance and active public involvement can create the support necessary for lasting ecological success. We advocate for real change built on soft innovation together with strong biodiversity leadership. This means bringing together different perspectives, seeking common ground, and giving local communities the power to shape, and, if possible, to lead the future of their town and its river. The path is not simple. Yet within these challenges lies a profound opportunity: to renew the bond between people and the river, to rebuild trust, and to create a future where environmental restoration strengthens both the landscape and the community that depends on it.

5. Social-Ecological System Analysis

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5.1 SES dynamics, interactions, and relations

SES impact on different actor groups

In our case study, the Social-Ecological System (SES) is centred on the Šventoji River and the dam in Anykščiai, which affects different actor groups in various ways. National authorities and policymakers engage with the SES primarily through environmental policy and strategic planning. When specific policy goals or measures pertain to the Anykščiai, this engagement extends to cooperation with local authorities for implementation. Their work is informed by scientific and analytical insights, national political priorities, and advocacy from non-governmental organizations (NGOs). Many policy frameworks—such as those related to environmental monitoring, assessment, goal setting, and the identification of necessary measures—are derived from EU nature directives. Within this context, authorities develop regulations, establish objectives, and formulate plans that are subsequently operationalized at the local level.

National scientific experts contribute through research, environmental monitoring, and assessments, thereby informing policy and participating in political and decision-making processes (e.g., expert groups). Nonetheless, the communication of scientific findings to the public and communities remains limited, which can hinder broader societal understanding of environmental issues.

At the municipal level, local governance and authorities interact with the SES mainly through infrastructure management and public-oriented benefits such as recreation and landscape aesthetics. Although biodiversity concerns are acknowledged, they are not always central to local agendas and often emerge reactively in response to environmental challenges rather than through proactive strategies. Ecological expertise at this level is largely concentrated within regional environmental authorities, who manage an extensive range of responsibilities. Financial and human resource constraints, along with limited institutional capacity, further restrict the pursuit of more ecologically ambitious initiatives.

Local politicians, often personally connected to the river as residents, occasionally raise environmental themes within their agendas. However, their focus typically reflects a balance of multiple priorities. In discussions concerning the river and dam, more ambitious ecological proposals have faced limited community support and criticism, resulting in a stronger emphasis on visible social or maintenance-related actions, such as vegetation management.

Technical and infrastructure specialists tend to approach the SES through a functional and engineering-oriented perspective, emphasizing infrastructural concerns. Environmental considerations are integrated primarily through technological solutions rather than ecological approaches.

The influence of SES dynamics on local businesses is uneven. Recreational enterprises—such as canoeing, camping, and nature tourism—view environmental changes as both opportunities and risks. Other businesses, especially those not directly linked to the river, experience minimal impact.

Civil society and community groups represent a diverse and evolving sphere. Environmental NGOs and informal associations actively express concern for the river's condition, though their influence is often limited by resource constraints, uneven expertise, and occasional apprehension regarding political or social repercussions.

Among local community members, some adopt a cautious stance toward change, influenced by past experiences with public infrastructure projects and the ongoing need to rebuild trust. This trust depends on the assurance that any intervention related to the river will be implemented professionally, with technical competence, and with respect for the community's history and values. For new practices or governance strategies to be accepted

and to strengthen SES resilience, processes must demonstrate inclusivity, transparent expertise, and a credible commitment to long-term stewardship.

The cultural and media sectors engage with the SES primarily through event-based activities. While the river features prominently in festivals and artistic events, ecological themes receive less emphasis. Cultural narratives often highlight recreational and aesthetic aspects rather than biodiversity or ecosystem health.

Finally, unaffiliated residents—those with personal and emotional ties to the river through activities such as swimming, fishing, and walking—experience environmental changes most directly. However, they are seldom represented in governance processes. Some rely on environmental authorities, national NGOs, and politicians to advocate on their behalf, yet these same actors are sometimes perceived as external to the community, creating a tension between representation and local ownership.

Across all these actor groups—authorities, scientists, NGOs, politicians, businesses, and residents—the SES is shaped by a fragmented and hierarchical governance system. While environmental considerations are acknowledged, they are often secondary to socio-economic priorities. As a result, the river itself tends to remain a background element in governance and public discourse, with its ecological complexity and biodiversity insufficiently integrated into broader decision-making.

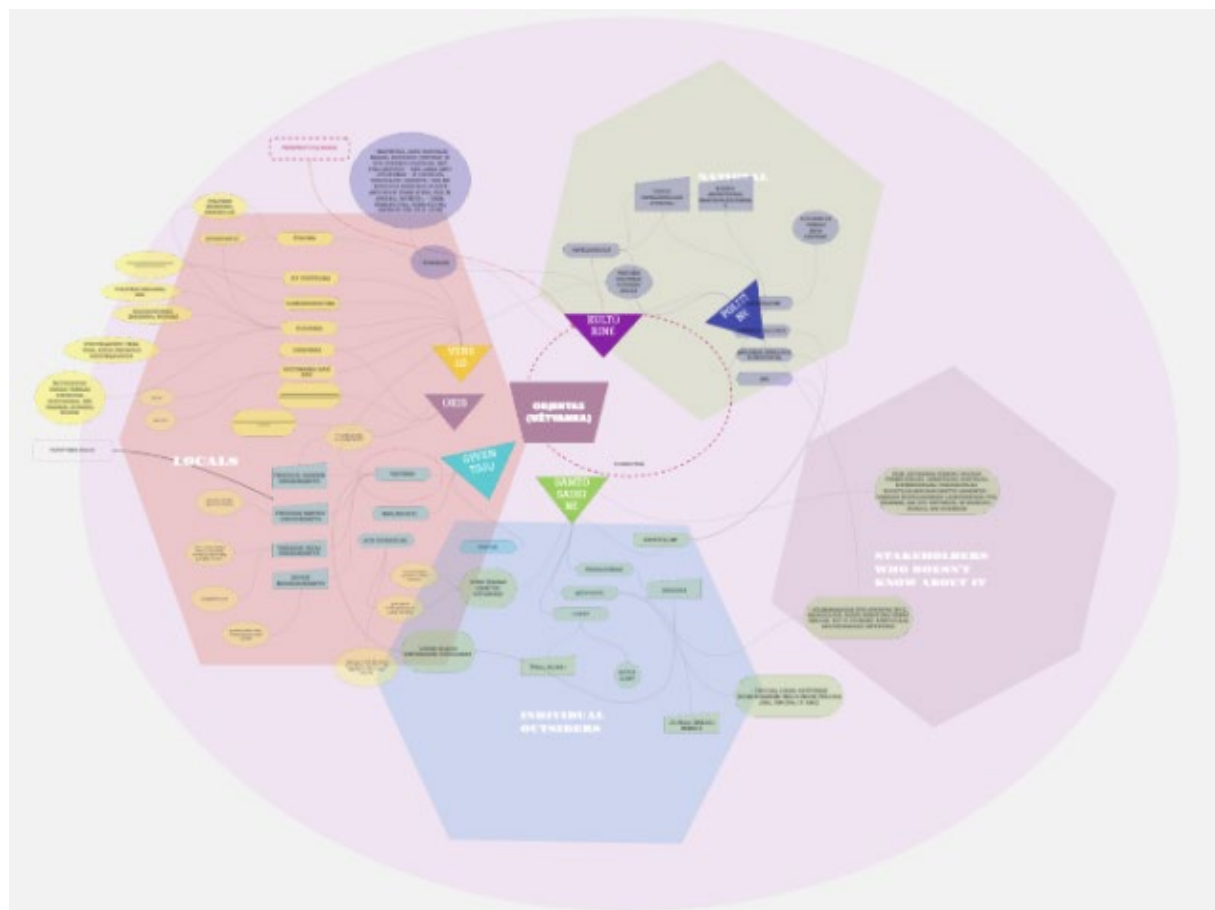


Figure 9 - Visualisation of SES in Anykščiai.

Decision-making processes and power relations between relevant actor groups

Decisions regarding the state of the Social-Ecological System (SES)—particularly those concerning the future of the Šventoji River and the Anykščiai dam—are shaped by a multi-level governance process. The overall objectives are defined by national authorities, who set strategic directions in alignment with broader environmental policy goals and expert

assessments. At this level, authorities and policymakers rely on data-driven analysis and scientific evaluations to guide decision-making. The Anykščiai dam, however, has been widely recognized by the NGOs, academic and angler communities as a priority site for ecological restoration. Dam removal remains an emerging topic in national contexts, with limited public discussion and implementation to date. In the case of Anykščiai, however, the issue has a longer history of debate, driven by sustained attention from multiple communities and stakeholder groups. Among more than a thousand dams in Lithuania, it is frequently highlighted for its ecological potential. Scientific findings have underscored the feasibility of restoration, while sustained attention from non-governmental organizations (NGOs) has generated national momentum around the issue.

National-level authorities—including policy makers and environmental managers—approach the issue through established regulatory and administrative procedures while also facilitating local consultations. These occur primarily through municipal council meetings, where local representatives, politicians, experts, and other stakeholders are invited to contribute. Despite these efforts, discussions are often constrained by limited time and supporting materials, and the inclusion of local environmental voices remains modest. This can create the perception that decision-making reflects primarily national interests, while the absence of strong local narratives further undermines community trust and a sense of ownership in the process. To enhance the legitimacy and effectiveness of such policies, complementary measures—including awareness raising, local engagement initiatives, and capacity-building—are essential to strengthen local understanding and readiness to take environmental action.

Local governance and municipal authorities act as intermediaries between national frameworks and community realities. They are responsible for implementing strategic objectives while balancing local social and infrastructural needs. These institutions form a crucial link in ensuring that high-level policies translate into tangible outcomes. However, local communities often remain outside the formal planning process and may have limited familiarity with governance mechanisms. This can contribute to scepticism and reduced trust in environmental initiatives. To unlock the potential of these strategies, emphasis should be placed on public awareness, transparent communication, and participatory planning, bridging the gap between expert knowledge and community experience.

Local politicians frequently acknowledge the significance of ecological health but strive to balance environmental objectives with community welfare. Such a pragmatic approach seeks compromise and social cohesion, yet it may fall short of achieving the most ecologically effective outcomes. In some cases, political actors explicitly oppose environmental interventions, reflecting divergent priorities and values within local and national governance.

Scientific experts play a vital role in generating and interpreting data that inform decision-making at higher policy levels. However, this knowledge often remains within academic or institutional circles, communicated through technical reports not easily accessible to local authorities or the broader public. As a result, valuable insights rarely reach those most affected by SES dynamics. Improved science communication—through simplified materials, local forums, and interactive dissemination—could facilitate mutual understanding and empower communities to participate more effectively.

Local businesses, civil society groups, and unaffiliated residents exhibit diverse and occasionally conflicting interests regarding the SES. While some actors actively engage, others lack the resources or environmental literacy needed for meaningful participation. Civil society organizations are often fragmented, and discussions tend to migrate to social media and informal settings. In smaller communities, concerns about social or political repercussions can also discourage open advocacy. Strengthening local environmental education and supporting community-based organizations could enhance civic participation and foster collective stewardship.

Power dynamics within the SES remain complex. Although environmental action is largely driven by top-down initiatives, its success depends on public acceptance and cooperation. When national authorities, local governments, and communities share environmental

values but differ in expertise or priorities, implementation gaps can arise. Local knowledge, while rich and context-specific, is seldom systematically incorporated into formal policy frameworks. Bridging this divide requires establishing mechanisms for multi-level coordination, mutual learning, and joint decision-making.

Ultimately, while the governance landscape remains fragmented, it also contains the foundations for more integrated and adaptive management. Harnessing the strengths of all actors—authorities, scientists, NGOs, businesses, and communities—could transform the current diversity of perspectives into a collaborative model of inclusive and sustainable river stewardship.

Types of knowledge informing decision-making and biodiversity framing

In this case study, multiple forms of knowledge about the biodiversity challenges linked to the dam and the Šventoji River's ecological condition circulate within the community, though their influence on governance remains uneven. Science-based expertise, produced by national-level experts and academics, informs the official framing of biodiversity issues, identifying impacts such as blocked fish migration, ecosystem fragmentation, and biodiversity loss. While scientifically robust, this knowledge largely remains within policy and administrative processes, with limited engagement at the community level.

Complementing this are traditional/experimental insights from non-governmental organizations (NGOs) and angler communities, rooted in direct experience with the river. These grassroots actors, often organized nationally, play an important role in advocating for environmental restoration and keeping dam-related issues (and other environmental issues) on the public agenda.

At the local level, experiential knowledge—based on daily observations of fish, riverbanks, and ecological patterns—reflects close ties with the river but is rarely integrated into governance. While initiatives like local urban greening plans could include these perspectives, river biodiversity concerns are overlooked.

Bridging scientific, local, and cultural perspectives can strengthen ecological restoration and community cohesion. Integrating these knowledge systems into governance would improve ecological outcomes and sustain social connections to the river. When restoration efforts focus only on ecological metrics, they risk weakening these ties; success depends on maintaining both ecological integrity and the community relationships that underpin long-term stewardship.

Ecological functioning of the SES and direct drivers of biodiversity loss

In this case study, the river exemplifies the intertwined ecological, social, and political dynamics characteristic of a social-ecological system (SES). Ecologically, the river once supported diverse aquatic communities within a high-quality natural environment shaped by fluvial processes such as unobstructed sediment transport, connectivity (with longitudinal connectivity being most relevant here), natural flow dynamics, and good habitat quality. These processes and characteristics have been altered by the dam (in combination with other dams on the Šventoji River), with longitudinal connectivity in Anykščiai playing the most critical role for aquatic organisms—particularly migratory fish species that depend on continuous river habitats (and access to tributaries) for breeding. The resulting artificial impoundment has transformed the river section in Anykščiai into a slower, more static system, favouring less diverse biological communities. These have been further modified by artificial fish stocking, involving both the reintroduction of lost native species and the introduction of species preferred by anglers. Collectively, the dam, along with other anthropogenic pressures, has simplified and homogenized the river ecosystem, diminishing its natural distinctiveness.

The social and institutional dimensions of the SES are equally significant. Community perspectives often emphasize recreation, aesthetics, and infrastructure, while ecological

functions receive comparatively limited attention or are addressed through technical solutions that seek engineered rather than systemic ecological outcomes. Potential interventions—such as dam removal—reveal tensions between cultural values and long-term ecological objectives, with uncertainty about the results of restoration influencing public attitudes and support.

Advancing biodiversity restoration in this context requires stronger ecological awareness and inclusive dialogue among scientific, institutional, and community actors. By integrating ecological functions with social and cultural values, governance can pursue long-term strategies that balance human use with ecosystem needs, thereby promoting both ecological recovery and sustained community stewardship.

Values underpinning decision-making processes

Policy- and decision-making processes in this case study are often organized around specific problems, with different policies targeting environmental, economic, or infrastructural concerns. Expert, local, and traditional knowledge may be considered within governance structures, yet integration tends to follow established procedures rather than co-creative practices, which limits opportunities for joint exploration and dialogue. Local perspectives reflect a careful approach to environmental change, emphasizing the need for responsible, well-planned actions. The dam illustrates this complexity: for many, it carries symbolic and practical significance as a familiar element of the landscape and a marker of stability and security, while also altering ecological processes and reducing the biodiversity.

Biodiversity concerns are expressed by residents, NGOs, and local actors, though they are often viewed alongside other priorities such as recreation, tourism, and infrastructure. Although the river is part of the town's identity, the dam is now viewed as something artificial and unnatural, it has been naturalized within the landscape. A different perception exists toward the forests; forests have long been seen as the defining natural feature of the region, and forest cutting is perceived as a problem both locally and nationally. These dynamics mean that while ecological issues are recognized, they are often addressed within a broader set of social, cultural, and economic considerations.

Strengthening biodiversity restoration therefore calls for approaches that are broader and more integrative, addressing ecological challenges in ways that also connect to community values and practical needs. This can be supported by developing co-creative processes that bring together scientific expertise, institutional actors, and community knowledge, and by fostering ongoing community relationships with the river. Such strategies can ensure that ecological objectives are pursued in parallel with social and cultural priorities, supporting both effective environmental management and long-term stewardship.

Political, cultural and institutional power dynamics

The governance of local social-ecological systems in Anykščiai is significantly shaped by the interplay of political, institutional and cultural power dynamics, which in turn affect the types of knowledge, values, and overarching narratives employed in decision-making processes.

Politically, river sustainability questions, although visible, are not systematically addressed within mainstream politics. Issues such as dam removal and other river-related topics (e.g., navigation, hydropower) enter national political discourse mainly through pro-environmental politicians, together with NGOs, proactive experts, academics, or the media, who bring them to public attention. However, these discussions remain sporadic rather than systemic and largely outside the core of national political priorities. At the local level, river-related topics are even more rarely discussed or prioritized.

Institutionally, governance operates in a top-down manner, where national authorities and agencies set goals and seek cooperation from local authorities for their implementation.

Locally, this may create a perception that environmental interests represent the concerns of narrow, non-local interest groups, undermining trust in environmental projects. Local-level initiatives are financially dependent on national and particularly EU funding. Proactive local political initiatives on opening up Šventoji river did not gain support within the community, creating favorable environment for compromises such as the construction of fish passages. Governance structures often lack sensitivity to local contexts, applying national norms and procedures without adapting to the area's unique socio-cultural and ecological realities. This further creates an environment that excludes local communities and, as a result, reduces community support for environmental projects. Consequently, biodiversity challenges are often framed through infrastructural lenses, prioritizing solutions that achieve easier social acceptance over those that ensure long-term ecological resilience.

Culturally, there is a values conflict. Although many community members value ecology, knowledge about the dam's impacts is uneven. Some are aware of its ecological consequences, others underestimate them, and a few dismiss them entirely. The dam also embodies cultural meanings, e.g. historical, human achievement, which complicate efforts toward ecological change. As a familiar landmark, it symbolizes permanence even amid environmental degradation. This dual significance often leads to compromise-based decisions, favoring technological solutions that address a narrow range of problems (such as fish migration) while neglecting broader ecological functions like sediment transport.

In summary, the interwoven political, cultural, and institutional power dynamics shape governance narratives and do not facilitate the inclusion of local knowledge and values, costing both local support for ecological action and the success of such actions, as well as limiting the transformative potential of progressive ecological values.

Embedding the local SES in the high impact sector

National institutions (particularly environmental authorities) initiate actions to address biodiversity challenges at the national level. They view fish migration and longitudinal river connectivity restoration as key elements of national water policy, and through it they interact with Šventoji river and Anykščiai dam. These institutions cooperate with local authorities to implement measures and drive change, but their approach rarely involves direct collaboration with local communities.

Local institutions operate under their own norms and focus mainly on local issues, often without considering the broader national dam landscape. As a result, dams are seen less as ecological problems and more as unique pieces of infrastructure for which they are responsible—maintenance, safety, and operation included. Local institutions engage more directly with communities, seeking to balance ecological objectives with socially acceptable compromises.

Economic structures' impact over the SES

The dam is no longer directly linked to economic activity. It was once used for hydropower, but operations have ceased due to low energy potential—a small reservoir and limited flow. In more productive river systems, hydropower can constrain environmental action.

Indirectly, the dam still influences local economic activity. Restaurants and small businesses in the surrounding area may benefit from the landscape, and investments are directed toward riverside infrastructure that supports recreation for both locals and tourists. Although the dam itself is not seen as a tourist attraction or a defining symbol of Anykščiai, current infrastructure has been developed in relation to the current river landscape.

Dam removal has been discussed—though not formally evaluated—as a potential way to boost angling tourism, with fishing licenses possibly generating some revenue. There were respondents who viewed this as an opportunity, but local attitudes remain mostly skeptical.

Some kayakers viewed dam removal as an opportunity to expand kayaking routes, and improve safety for paddlers, while others believed the dam had little impact on either their operations or the overall kayaking experience.

It is worth adding that water management and environmental development are often tied to EU financing mechanisms. While some projects may receive state funding, environmental protection remains underfunded within the national budget, making EU support the primary and most crucial source of funding for environmental initiatives.

Assessment of biodiversity challenge and related biodiversity trends in the high impact sector

In this case study, the locally identified biodiversity challenge centres on the ecological impacts of the Šventoji dam—particularly its obstruction of fish migration, disruption of habitats and river connectivity, and alteration of the natural fluvial ecosystem.

Biodiversity assessment is carried out through the national river monitoring scheme that is set as part of national implementation of EU Water Framework Directive. This framework identifies pressures and corresponding measures using a wide range of indicators, including biological parameters such as the fish index. These biological indicators are the key determinants of a river's ecological status. Data and measures related to ecological status are integrated into River Basin Management Plans, which set the overarching goal of achieving good ecological status in all rivers.

Supplementary scientific reports have identified the Šventoji dam as one of Lithuania's top priorities for improving fish migration, due to high ecological impacts, given its large upstream section that could be reconnected to the lower river if longitudinal connectivity were restored, and also low socio-economic benefits (e.g. no power production). The issue is further reinforced by national-level environmental organizations and NGOs, which consider the Anykščiai dam a key site for river restoration.

Locally, biodiversity challenges are recognized mainly by anglers who prefer natural river systems and by residents more aware of ecological issues. Older generations often recall past fish abundance, better water quality, and a more aesthetically pleasing river, noting visible declines in species diversity, fish numbers, and habitat availability over time—trends consistent with scientific monitoring data.

However, a large part of the community has limited personal or experiential connection to the river's biodiversity and therefore does not perceive ecosystem degradation as an immediate local issue.

Current enablers and barriers for transformative change

The current SES both enables and constrains transformative innovation through a complex interplay of institutional, cultural, political, and economic factors.

At the national level, recognition of the issue and strong incentives from environmental authorities—supported by political actors and NGOs—create clear opportunities for transformative ecological change. This institutional momentum brings willingness, resources, and policy support for restoration efforts.

However, major constraints arise locally. Transforming a top-down initiative into a genuinely community-centered process requires meaningful integration of local needs and values. Barriers include deeply rooted cultural attitudes that prize human-made structures and engineering achievements over natural systems, as well as a strong attachment to preserving built heritage. A general lack of environmental awareness limited personal connection to the river, and few people directly engaged with biodiversity further weaken local support.

Uncertainty surrounding the consequences of dam removal—changes to landscape, safety, and aesthetics—fuels scepticism. Distrust in externally led projects, often seen as serving narrow interests, further limits participation and acceptance.

Despite these constraints, several leverage points exist. True transformation must emerge from within the community to ensure durability and legitimacy. Encouraging residents to reconnect with the river's ecological and cultural significance could foster shared ownership and stewardship. Trust can be strengthened through transparent engagement: involving credible experts, presenting before-and-after visualizations, organizing participatory workshops, and genuinely embedding local priorities in project design.

Open communication, inclusive decision-making, and attention to broader social needs—especially of vulnerable groups—can turn scepticism into active engagement. Strengthening local environmental voices and granting them greater influence in governance remain key levers for lasting, community-rooted change.

5.2 Vision: What alternative SES could be?

Building on a nuanced understanding of the socio-ecological complexities revealed through interviews, this vision for the future of the local Social-Ecological System outlines a path toward inclusive, adaptive, and culturally grounded environmental governance. True transformation must emerge from within the community to ensure durability and legitimacy. It acknowledges the community's values that shape human–nature relations in the case study area.

The river—both physically and symbolically—stands as the central axis of potential transformation. Reconnecting with its ecological and cultural significance can foster shared ownership and stewardship, turning passive acceptance into active engagement.

Such transformation depends not only on technical interventions but on collective, ongoing processes of reimagining and restoring relationships between people, place, and environment. Building trust is essential: involving credible experts, offering before-and-after visualizations, hosting participatory workshops, and embedding community priorities directly into project design. Through this open and inclusive approach, meaningful and lasting transformation can take root.

Reimagining Relationships Between Social and Ecological Actors

In this envisioned future, communities relate to the river and recognize it as an integral part of their community with its own identity. The Šventoji River, once viewed merely as an infrastructural utility for power generation or a backdrop for occasional events, is reinterpreted as a living ecological entity and a member of the community. Emotional and place-based attachments are embraced as vital entry points for ecological education and stewardship.

The vision includes the creation of participatory forums where local residents, municipal authorities, businesses, cultural actors, environmental NGOs, and academic researchers engage in regular, structured dialogue. These gatherings would promote knowledge sharing, collective reflection, and joint decision-making on the management of local ecological assets. The very process of co-creating these forums fosters a culture of dialogue, trust, and collaborative problem-solving—grounded in awareness, collective effort, and social inclusion.

Pluralizing Knowledge Systems and Governance Practices

A core tenet of this vision is the recognition that plural knowledge systems—scientific, local, traditional, and experiential—are essential for resilient SES governance. This involves both acknowledging and, where possible, integrating existing knowledge into the shared vision for the river. Equally, it requires fostering new experiential knowledge through direct engagement with the environment to strengthen connections with biodiversity.

Schools might establish outdoor biology classrooms along the riverbanks, merging ecological education with local history and storytelling. Oral histories could document elders' memories of the river before dam construction, alongside young people's visions for its future. Such initiatives challenge epistemic hierarchies and democratize knowledge creation, nurturing ecological awareness and a sense of shared ownership across generations.

Institutionally, governance structures could evolve toward genuinely community-centred arrangements. This entails including ecological actors into decision making processes—individuals and groups who interact directly with the environment. These actors could inform local decisions, lead environmental awareness initiatives, and strengthen the bridge between community and nature. Local NGOs and youth groups, acting as mediators, can help ensure transparent communication between residents and authorities. Together, these efforts lay the foundation for community-driven governance in which residents are active stewards of their river's future.

Reframing Economic Structures Around Ecological Values

Economic drivers have long shaped river damming and remain central to other environmental pressures. This vision proposes reframing local economic development to embed ecological values and align prosperity with environmental restoration.

Sustainable opportunities emerge along the riverside through eco-tourism, artisanal markets, and nature-based retreats. The former hydroelectric station is transformed into a Museum of Rivers and Dams, showcasing the history and future of river restoration. It becomes both a cultural hub and an economic catalyst—creating jobs, attracting visitors, and sharing stories of renewal.

Participatory budgeting and municipal green investment funds channel resources into community-led ecological projects and nature-based businesses, tourism. These mechanisms help ease local perceptions about financial instability by promoting transparency, shared responsibility, and long-term resilience.

Local businesses begin to integrate sustainability into their operations. Canoeing clubs, cafés, fishing cooperatives, and wellness retreats centre their activities around a restored and ecologically vibrant riverfront. Economic narratives shift from extraction and short-term profit toward regeneration and community-driven growth.

Cultural Transformation and Community Identity Renewal

This vision places cultural transformation at the heart of SES change. Recognizing the historical conservatism and emotional attachment to tradition, it seeks to revitalize local identity through ecological narratives. Annual River Festivals, storytelling competitions, environmental art installations, and seasonal ecological rituals are instituted, reweaving the river into the cultural fabric of community life.

A community-driven Šventoji River Journal project documents daily ecological changes, personal reflections, and historical anecdotes, creating an evolving communal artifact that strengthens place-based identities. The inclusion of the river in local theatre, poetry, and school curricula fosters intergenerational dialogue about ecological futures.

The revitalization of the river as both ecological asset and cultural symbol breaks the perceived binary between environmental care and community prosperity. It positions ecological restoration not as a technocratic imposition but as a deeply rooted cultural practice aligned with local values of heritage, continuity, and collective well-being.

Institutional Adaptation and Participatory Decision-Making

Institutions embrace to embrace participatory and culturally sensitive practices. Regular open assemblies enable residents to articulate concerns, propose initiatives, and engage in policy deliberations without fear of professional or social reprisal. Informal intermediaries, such as local NGOs and educational institutions, serve as trusted facilitators of dialogue and knowledge exchange.

Municipal employment practices are evolving to prioritize civic engagement and ecological stewardship. The goal is to create an environment where public servants and residents work together to address ecological challenges. Leadership programs for youth and community activists are nurturing a new generation of environmentally conscious and civically engaged leaders.

Ecological Restoration as Cultural and Social Healing

Ecological restoration projects, focused on habitat restoration and reintroduction of lost species — are reframed as acts of cultural healing and community renewal. Restoration milestones are marked by communal celebrations and educational activities, reinforcing emotional ties to ecological processes.

The visible ecological benefits — improved water quality, restored biodiversity corridors, increased fish stocks — enhance local recreation, health, and well-being. These ecological gains, coupled with cultural and economic revitalization, transform the river from a neglected infrastructural relic into a dynamic, living protagonist in the town's collective narrative.

Conclusion: Realizing a Culturally Embedded, Inclusive, and Resilient SES Future

This expanded vision recognizes the current dynamics within the community, including a limited connection to river biodiversity, gaps in ecological understanding, perceptions of hierarchical governance, and the insufficient integration of community perspectives into decision-making. At the same time, it highlights meaningful opportunities for change—particularly the potential for ecological transformation emerging from within the community itself, rather than being externally driven.

Although supportive national and international frameworks are already in place, there remains a pressing need for locally grounded initiatives that foster momentum and strengthen collective commitment to environmental action, while minimizing resistance and ensuring shared ownership.

Through sustained dialogue, the inclusion of diverse knowledge systems, transparent governance practices, and the integration of ecological values into local economic and cultural life, the community can evolve from passive participants to active partners in shaping their ecological and social futures.

This is a pragmatic yet optimistic vision—rooted in local realities and community resilience—that affirms sustainable, inclusive, and culturally resonant transformation is both necessary and attainable through collaborative, adaptive, and participatory processes.

5.3 Discussion

The *Free-Flowing Rivers* case study highlights the dynamics of the social-ecological system (SES) in Anykščiai, shaped by the interplay between national policymakers, scientists, local authorities, and community actors. National institutions influence the system through EU-aligned environmental policies and scientific expertise, while local governance emphasizes infrastructure, recreation, and community well-being, though often within limited ecological capacities. Businesses and cultural sectors contribute in diverse ways, yet their focus tends to remain on recreational and social dimensions rather than ecological restoration.

The SES underscores the importance of strengthening locally grounded collaboration, nurturing the community's experiential connection with the river and its biodiversity, and fostering more community-centered practices. Building trust, inclusion, and meaningful participation in decision-making is essential for effective engagement. Encouraging a shared sense of ownership and care for the river can enable transformative change—where environmental outcomes emerge from an internalized commitment to stewardship and a deeper awareness of ecological interdependence.

Multi-Level Governance and Knowledge Integration Challenges

A defining feature of the Šventoji River social-ecological system (SES) in Anykščiai is the diversity of actors and knowledge systems that shape its governance. National authorities, policymakers, and scientific experts play a leading role in defining biodiversity-related goals through EU-aligned frameworks and environmental assessments. Their expertise provides an essential foundation for understanding ecological pressures such as disrupted connectivity and species decline, yet engagement with local communities remains limited, and scientific knowledge often circulates primarily within institutional and policy settings. This reflects a broader governance tendency in which technical and scientific approaches, while robust, are not always effectively connected to local experience or community dialogue (Turnhout et al., 2016).

Local authorities and municipal representatives act as intermediaries between national institutions and the community. While positioned to interpret local concerns, their autonomy is constrained by financial dependencies, administrative structures, and the need to balance ecological aims with priorities such as infrastructure, recreation, and visible public benefits. Consequently, ecological restoration is frequently pursued through technical or engineering measures (such as building and improving fish passages) rather than integrated, ecosystem-based strategies.

Civil society organizations, local residents, and businesses contribute valuable experiential knowledge and play an active role in maintaining public attention on river issues. However, limited resources, uneven access to decision-making, and cautious community attitudes toward change reduce their influence. Historical experiences of externally driven projects have reinforced a preference for stability and predictability in local governance. Together, these dynamics create a system characterized by fragmented coordination and uneven integration of knowledge, underscoring the need for trust-building, transparent communication, and the inclusion of diverse perspectives to strengthen shared stewardship of the river.

Scientific Frameworks and the Need to Integrate Local Values

The governance of the Šventoji River SES is strongly influenced by science-based approaches to understanding biodiversity challenges. These frameworks—focused on issues such as barriers for fish migration, habitat fragmentation and deterioration, and ecosystem degradation—provide essential analytical clarity and guide national and local environmental planning. However, their communication often remains confined to policy documents and technical assessments, with limited translation into locally relevant or culturally meaningful narratives (Wyborn et al., 2019).

Alongside these formal frameworks, the river is also understood through local and experiential knowledge, shaped by generations of direct interaction. This perspective provides valuable ecological insights and reflects deep cultural and emotional connections to the river, yet it remains largely absent from institutional decision-making. The uneven inclusion of different knowledge systems contributes to a gap between ecological policy objectives and community perspectives, often resulting in reduced local support for environmental initiatives.

This gap also reflects differences in how the river's significance is understood. For many residents, the dam remains a familiar and stable part of the landscape—associated with stability, familiarity and local well-being—whereas ecological restoration initiatives may appear uncertain or disruptive. Strengthening dialogue between scientific and community perspectives can help align biodiversity goals with social values, fostering a shared understanding of both the ecological and cultural dimensions of the river.

Institutional, Cultural, and Economic Barriers to Transformative Change

The case study identifies several institutional, cultural, and economic factors that constrain transformative innovation within the local social-ecological system (SES). Institutionally, governance remains largely top-down. Although many initiatives are pro-environmental, limited participatory engagement, low public trust, and the absence of a shared

community-driven vision for biodiversity create significant barriers to long-term change. This dynamic often leads to the pursuit of compromise solutions—such as the construction of fish passages—that appear practical and socio-politically acceptable but deliver limited ecological benefits and fail to foster genuine community involvement.

Culturally, the community's preference for stability is reinforced by past experiences with projects that were either poorly implemented or misaligned with local needs and values. These experiences have contributed to skepticism toward new initiatives, particularly those perceived as externally imposed or serving narrow interests. As a result, open dialogue about the river's future remains limited, and proactive advocacy for ecological restoration is rare.

Economically, barriers are less pronounced but remain relevant. The dam no longer serves an energy-producing function, and the reservoir provides only modest benefits, such as limited angling activities. However, the river's restoration could create new economic opportunities, particularly through enhanced recreation, kayaking routes, and angling tourism—if supported by strategic planning and community engagement. At present, local investments primarily focus on riverside infrastructure that sustains existing recreational uses, while broader ecological projects rely heavily on EU funding. Strengthening local capacity to leverage these opportunities and connect ecological restoration with sustainable economic development could help overcome existing financial and institutional constraints.

Opportunities for Transformative Governance and Local Engagement

Despite existing constraints, the case study highlights several opportunities for advancing transformative governance within the local social-ecological system (SES).

There is already a strong institutional foundation for action, with national and EU policy frameworks supportive of river restoration. This favorable policy environment could be reinforced by improving technical capacity for preparatory activities and strategically combining financial mechanisms. Aligning funding streams from different sectors—such as public infrastructure, rural development, and regional planning—could enable larger-scale, integrated projects that address both ecological restoration and broader community needs, rather than focusing solely on dam removal.

Facilitating deeper community engagement represents another key opportunity. Moving toward more community-centered decision-making, strengthening local connections to river biodiversity, and fostering a shared sense of ownership and care for the river can help generate long-term, durable change. Establishing participatory structures—such as community assemblies, biodiversity councils, or cross-sector working groups—would support inclusive dialogue, trust-building, and joint problem-solving (Newig et al., 2023).

Economic diversification further reinforces these prospects. Linking biodiversity restoration with sustainable local development—through eco-tourism, recreation-based businesses, and small-scale artisanal initiatives—could create new incentives for ecological stewardship. Realizing this potential requires a gradual shift from short-term, growth-oriented planning toward regenerative, community-centered models that integrate environmental restoration with local prosperity and social well-being.

Toward Inclusive SES Governance

The findings from this case study align with broader discussions in social-ecological systems (SES) research: effective biodiversity restoration depends on policy support, sustained financial investment towards environmental action, and genuine community engagement. Transformation cannot rely solely on technical solutions—it must also take place within communities, through processes that reimagine and redefine the relationship between people and nature. Such engagement is essential for achieving lasting ecological and social sustainability.

Within this context, relational approaches to SES governance—those that emphasize emotional connections, place-based identities, and intergenerational knowledge—hold significant promises for fostering enduring stewardship. Building trust between

communities and experts through transparent preparation, professional competence, and open communication can empower residents to take ownership of their environment and embed their values and needs into the shared vision for the river's future.

Transformative governance, therefore, calls for institutionalized participatory decision-making and the integration of ecological values into cultural, social, and economic life. Only through these inclusive and culturally grounded processes can ecological restoration translate into long-term resilience and community-driven stewardship.

Conclusion

This discussion highlights the interdependence of multi-level governance, scientific frameworks, and community engagement, shaping the Šventoji River social-ecological system (SES) in Anykščiai. At present, environmental governance related to free-flowing rivers in the region remains fragmented, with limited participatory capacity within the community and a predominance of technical solutions—such as fish passages—that foster good environment for compromises: they neither meaningfully integrate community perspectives nor deliver the most effective outcomes from an environmental standpoint. However, opportunities emerge from strong institutional support for environmental action, existing local connections to the river, and the potential to develop nature-based economic activities. Future efforts should focus on integrating scientific and local knowledge, strengthening participatory decision-making, and linking biodiversity restoration with sustainable economic and cultural development, ensuring that river governance evolves through shared ownership, trust, and long-term community stewardship.

6. Locally Tested Interventions

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6.1 Evaluation of strategies in action

Introduction

The Anykščiai case study examines biodiversity regeneration strategies within a locally specific environmental and social context. It focuses on a small town with an ecologically valuable river, that largely natural in character but shaped by the presence of a dam. The Anykščiai dam has been identified as a national priority for restoration due to its potential to improve fish restore connectivity, improve migration routes and improve conditions of aquatic habitats. Previous discussions about dam removal in 2018 did not gain broad acceptance among local residents, authorities, and political representatives, which halted progress toward river restoration. Within this complex setting, our evaluation examines the strategies developed through collaboration between the research team and societal partners Karolina Gurjaskaitė and Jonas Tertelis, implemented between March 2023 and June 2025. The central strategy aimed to create a space for dialogue among stakeholders, ensuring that diverse perspectives were heard while maintaining a focus on biodiversity protection.

Current strategies in action

We began engaging with the Anykščiai case by exploring local media coverage, historical materials, and other sources to better understand the background. The process then unfolded in three phases: (1) extensive individual interviews with stakeholders from diverse groups, (2) ongoing informal exchanges and regular presence in the community, and (3) a collective event by the dam in April 2025 that brought together insights gathered along the way.

This approach was co-designed through five workshops with societal partners between March 2023 and June 2024. Together, we established a working principle that emphasized shared learning — positioning local stakeholders as holders of essential, experience-based knowledge. This orientation differed from the more traditional, expert-led formats that are common across environmental policy and decision-making contexts.

The community event held on April 26, 2025, by the dam reflected the gradual process of understanding diverse perspectives. It was an open, informal gathering where participants took part in several activities, including (1) anonymous perspective-sharing drawn from earlier interviews, (2) sensory mapping of river experiences, and (3) writing personal reflections and wishes to the river. The event made visible that knowledge about the river extends beyond scientific data — encompassing emotional, sensory, and lived experiences that shape how the river is valued and cared for in community life.

Transformative potential

The strategies tested in the Anykščiai case demonstrated elements of transformative potential in several ways. They encouraged a shift from top-down decision-making toward more community-inclusive and participatory forms of dialogue, giving the community greater power, voice, and responsibility in shaping its environment. This process helped connect environmental policy objectives with local knowledge, values, and lived experience. It created opportunities for residents to share place-based insights and emotional connections to the river, opening what several participants described as “a different kind of conversation” — one that recognised the dam as both an ecological barrier and a cultural landmark.

The activities established a shared space for diverse actors who rarely meet in the same setting. NGO representatives, local residents, business owners, technical experts, environmentalists, and others had the opportunity to exchange perspectives directly and informally. Through this process, community members moved from being observers to active participants in discussions about their living environment, strengthening their sense of ownership, agency, and confidence in contributing to environmental decision-making. The dialogue fostered mutual curiosity, understanding, and respect among stakeholders, creating foundations for more inclusive and collaborative approaches to the river's future.

The participatory activities revealed that people value the river in similar ways and for similar reasons. In the wish-writing exercise, participants expressed hopes for a "living" river — a vision that united rather than divided perspectives on restoration. The sensory mapping activity illustrated the many ways people relate to the river — through sensory experiences, memory, and daily practice — enriching shared understandings of its ecological and social significance.

Addressing indirect drivers of biodiversity loss

Several indirect drivers of biodiversity loss became visible through the activities and discussions. One recurring theme related to how information about the river is shared and understood locally. The activities revealed that limited awareness and access to clear, trustworthy information about the dam's ecological effects have weakened people's ability to engage with biodiversity issues. By creating opportunities for participants to exchange their own experiences and perspectives, including environmental perspectives, in an informal way, the project helped address this gap. Through face-to-face discussions and the anonymous sharing of interview excerpts, participants could encounter different viewpoints. This format encouraged open reflection and curiosity about the variety of relationships people hold with the river, strengthening awareness and dialogue around ecological change.

In the case of Anykščiai, the dam remains in place even though the ecological impacts of dams are well documented in scientific research. This shows that scientific knowledge alone does not automatically translate into local awareness or collective action. It needs to be communicated in a way that is understandable and builds trust — and in our case, face-to-face communication in an informal setting supported this process. Open dialogue can help build trust and shared understanding — essential steps for addressing these indirect social drivers of biodiversity loss and supporting informed decision-making about the river's ecological future.

Scalability and replicability

Our engagement in Anykščiai offers several promising directions for strengthening biodiversity governance and community participation. Two complementary pathways stand out:

Horizontal scaling involves applying this engagement approach in other contexts — for example, along different dammed rivers or in other towns. The steps developed in Anykščiai — exploring local media and histories, mapping the social-ecological system and stakeholders, conducting interviews, and progressively opening dialogue — form a clear, adaptable sequence.

Vertical scaling focuses on deepening engagement within the same community. This includes expanding educational activities, integrating biodiversity and dam-related awareness into local institutions, and collaborating with schools, NGOs, and neighborhood groups to build knowledge and long-term capacity for river stewardship.

These ideas align with established frameworks in social innovation literature, such as the "scaling out / scaling up / scaling deep" model (Moore et al. 2015) and related work by Westley & Antadze (2010). Yet, many unknowns remain, especially how the method

translates across different political, cultural, or ecological settings. But laying out these possible scaling paths helps frame the next steps without overclaiming results.

Framing of Biodiversity and Local Meanings

The activities invited people to engage with the river in ways that extended beyond formal discussion. Through reflection, writing, and sensory exploration, participants expressed how the river forms part of their everyday lives. They were also introduced to a range of perspectives — including environmental viewpoints — and learned about the issue of change directly from other community members. Some creative elements, such as sensory exercises inspired by theatre, were used not as performance but as a way to make dialogue more human, open, and embodied. This approach encouraged a shift from conventional expert–public interactions toward a space where emotion, memory, and imagination could coexist with scientific perspectives, enriching collective understandings of biodiversity and its local meanings.

Conclusion

The activities invited people to engage with the river in ways that extended beyond formal discussion. Through reflection, writing, and sensory exploration, participants expressed how the river forms part of their everyday lives. They were also introduced to a range of perspectives — including environmental viewpoints — and learned about the issue of change directly from other community members. Some creative elements, such as sensory exercises inspired by theatre, were used not as performance but as a way to make dialogue more human, open, and embodied, forstering connection.

This approach encouraged a shift from conventional expert–public interactions toward a space where emotion, memory, and imagination could coexist with scientific perspectives, enriching collective understandings of biodiversity and its local meanings. Most importantly, it enabled community members to discuss environmental issues among themselves — to see that the river and its ecosystems matter not only to experts, but to locals as well. Through hearing one another’s arguments, experiences, and emotions, participants could move beyond simply voicing positions to building connections grounded in shared care for the river.

6.2 Enablers and disruptors

Attunement and mismatch with broader trends

The biodiversity goals in Anykščiai align strongly with national and European policy directions. Frameworks such as the EU Water Framework Directive, River Basin Management Plans, and the EU Biodiversity Strategy 2030 provide a solid foundation for restoring rivers and strengthening biodiversity across Europe. Authorities operate within these frameworks, and there is growing potential to enrich them with locally grounded approaches that bring policies to life in specific community contexts. Integrating social, cultural, and experiential dimensions — including local meanings, perceptions, and relationships with the river — can make these frameworks even more effective and meaningful for residents.

Policy efforts typically focus on technical indicators such as restored river kilometers pr improved environmental quality indicators. Complementing these measures with community perspectives — rooted in daily experience, memories, and attachment to place — can help bridge ecological goals with the ways people value and interact with their environment. Such connections transform policy implementation into shared stewardship, where success is measured both in ecological outcomes and in community engagement.

Local tourism and recreation businesses already demonstrate how biodiversity and economic activity can complement one another. By building on existing initiatives that

showcase the river and its surroundings, future restoration discussions can further integrate nature-based tourism with ecological renewal. This alignment between environmental care, cultural identity, and sustainable livelihoods positions Anykščiai as a promising example of how community and policy can move forward together toward resilient river landscapes.

Enablers and Capacity to Replicate

Several factors enabled meaningful collaboration and engagement. Two societal partners worked together, each contributing distinct strengths: one brought strong technical and environmental expertise, while the other added creative capacity and experience in community engagement. This interdisciplinary partnership fostered rich discussion and helped link community perspectives with institutional perspectives, making the project more balanced and effective than either could have achieved alone.

Existing informal groups within the community — such as people who use the river for recreation and those involved in local heritage — provided natural entry points for dialogue. These networks made it easier to reach residents and identify others interested in sharing their perspectives. During the April event, participants with diverse views interacted constructively, demonstrating that the community already holds capacity for dialogue and openness to differing opinions.

In Lithuania, a generally strong cultural connection to nature, especially to forests, supports public sensitivity to environmental issues, even where rivers are less central. In Anykščiai, the involvement of local cultural authorities played a practical and trusted role in facilitating introductions and identifying relevant contacts. This collaboration with respected community figures proved essential for building trust and could serve as a model for other contexts where engagement relies on familiarity and personal credibility.

Sustaining and replicating these approaches depends on strengthening local capacity. Training programs, long-term partnerships, and the integration of participatory methods into municipal practices could help maintain momentum beyond the project timeline. By investing in local knowledge, trust, and continuity, similar initiatives can take root elsewhere, linking communities, institutions, and environmental goals in lasting ways.

Disruptors and mitigation capacity

Disruptors can act as catalysts for transformation, revealing tensions and prompting reflection within socio-ecological systems. The capacity to engage with these moments through dialogue, learning, and adaptation determines whether disruption leads to division or constructive change.

A visible disruptor in our case is the ongoing conversation about the river and the dam, which unfolds across multiple levels. Media discussions show a mix of opinions — some in favor of keeping the dam, others supporting its removal. Local media has the power to facilitate informed discussion by reflecting this diversity of perspectives while also giving value to technical and ecological expertise. Public opinion and scientific knowledge are not the same, yet both are important: local voices bring lived experience and social meaning, while technical evidence provides the factual grounding for understanding ecological impacts. When the media highlights both dimensions and explores the reasoning behind them, it can help people see how different perspectives connect and foster a more balanced, informed dialogue. Similar debates have also reached local politics. What could help now is the creation of clearer and better-connected spaces for these conversations to continue — ensuring that discussion, wherever it happens, becomes more inclusive and constructive.

Another possible disruptor could be a broader recognition that the dam itself is one of the main sources of harm to local biodiversity. Many residents and stakeholder groups may still be developing an understanding of the scale of that impact and how far it reaches

beyond the immediate area. Building this awareness through school education, public learning initiatives, and creative communication could gradually shift how the dam is perceived — from a familiar structure to a visible part of the ecological challenge.

Public discussions, whether in local meetings or through the media, can also play an important role when they focus on learning rather than blame. Presenting science in ways that connect with local experience and identity can help people see the issue as shared and encourage collective reflection on the river's future.

Influence of governance frameworks

National and EU-level policies set ambitious goals for river restoration and biodiversity protection through mechanisms such as the EU Water Framework Directive, other nature directives, and the EU Biodiversity Strategy 2030. However, translating these frameworks into local practice is complex. Municipalities operate within diverse social and political realities that influence how environmental objectives are interpreted, prioritized, and implemented.

Previous efforts to present the issue of dammed rivers to the community became polarized and highly politicized. Many community members perceived these initiatives as representing narrow interests rather than shared goals, which limited trust and engagement. They reported feeling that information was delivered to them rather than co-created with them. Politicians who addressed the issue publicly also struggled to gain support, suggesting that earlier communication approaches left a lasting imprint on local perceptions. These experiences continue to shape how municipal authorities and political actors navigate the topic today.

At the same time, environmental perspectives are not consistently represented in broader local development planning. For example, the vision for the Anykščiai city centre reflects strong cultural, social, and ecological ambitions, yet gives limited attention to questions surrounding the dam. This suggests that while environmental considerations are increasingly present in urban planning, the specific challenges and opportunities linked to river management have not yet been fully integrated into the town's long-term vision.

It is understandable that municipal authorities must balance national environmental goals with local priorities such as social stability, heritage, and alignment with community expectations. Yet there remains limited understanding of how the issue is perceived locally: some stakeholders view the dam as uncontroversial, while others anticipate community opposition to its removal. This uncertainty makes public dialogue a sensitive process, where bold environmental decisions are difficult to advance and incremental measures, such as improving fish passage, are often preferred.

Interviews revealed a wide range of narratives surrounding the dam. Some residents expressed a strong sense of attachment, viewing the dam as a symbol of familiarity, historical continuity, and everyday use of the landscape. In this context, technical arguments about ecological connectivity can appear abstract unless linked to local meanings and experiences. Other participants emphasized the need for clear, trustworthy answers about hydrological, landscape, ecological, and safety aspects, showing confidence in scientific and technical expertise. Common narratives also surfaced — for instance, that ecosystems have adapted to human influence, or that other dams, such as Kavarskas, have greater ecological impact and should be addressed first. These perspectives cannot be addressed solely through administrative or regulatory instruments; they require time, dialogue, preparedness, and sensitivity that extend beyond standard governance procedures.

While our work did not focus directly on municipal administration, it became clear that national and EU biodiversity frameworks must be connected more closely to local realities. Patient involvement, education, and a shared vision for the future are essential components of this process. The challenge reflects procedural complexity, limited communication between governance levels, and practical constraints related to time and

resources. Nevertheless, it is evident that translating policy ambitions into local action requires more than formal compliance — it depends on continuity, coordination, and spaces for dialogue across institutional scales.

Together, these dynamics illustrate how governance frameworks both enable and challenge local environmental action — their influence extends beyond policy design, shaping the trust, participation, and dialogue required to translate ambition into tangible ecological outcomes.

6.3 Failed and successful practices

Successful Practices

Several practices described earlier (e.g., gradual engagement, mixed formats for participation, and the societal partners' complementary roles) also appear here as "successful practices." This overlap is intentional: the case timeframe is short, and the same elements that enabled progress also proved effective in practice. We chose to move step by step—starting with media analysis, historical sources review, interviews, then small-scale public activities—so that each next action was informed by what we had already learned rather than rushed by external expectations or premature experimentation.

The April 2025 event showed that a gradual process can create space for open and constructive discussion on a sensitive topic. Participants from different community groups joined throughout the day, engaging in activities such as sharing anonymous interview quotes, mapping meaningful places along the river, and writing wishes to the river. These varied formats encouraged participation from people with different comfort levels and viewpoints. The event demonstrated that careful groundwork can turn a potentially divisive issue into an opportunity for shared reflection and dialogue.

Working across different kinds of expertise proved important. Combining environmental science with creative, participatory methods showed that the dam issue is not only about ecology or engineering but also about people's relationships with the river. Looking at it from technical, social, and cultural angles helped us see that different stakeholder groups might have very different understandings about the river management.

The process also helped the team adjust participatory action research (PAR) to real-life river management. For researchers used to working with numbers and data, using participatory and creative tools opened new ways to link facts with people's experiences. This flexibility, mixing structured research with local stories and observations, could be a useful example for others dealing with similar, complex river restoration cases.

Failed or Less Effective Practices

The idea of using theatrical methods was set aside for now rather than abandoned. Early in the process, the team considered applied theatre as a way to explore community experiences with the river. However, interviews and observations showed that we did not yet understand the local context well enough to use such expressive tools.

Youth participation was limited, mainly because of ethical and procedural requirements for involving minors. Choosing not to proceed under these constraints was the responsible course of action, though it meant that younger voices were underrepresented. The team partly addressed this gap by including insights from educators, cultural workers, and young adults over 18 who were familiar with how younger residents relate to the river.

Critical Gaps and Missed Opportunities

While the early phase focused mainly on collaboration with societal partners, this deliberate choice meant that wider stakeholder engagement was postponed. Broader involvement —

especially during planning — will be needed in later stages, but at this point the priority was to build a solid foundation for dialogue rather than expand participation too quickly.

The engagement process did not extend to religious leaders, whose perspectives could be valuable in future initiatives. This remains an area worth exploring, as religious communities often hold influence in shaping values and public attitudes toward nature. Their knowledge systems — rooted in moral and spiritual interpretations of the natural world — can either support or complicate biodiversity efforts, depending on how they are approached.

During the feedback workshop, societal partners reflected on the reach and scope of the intervention. The April event demonstrated that constructive dialogue across diverse perspectives was possible — a key proof of concept for future engagement. Given the project's early phase, the event was intentionally kept small-scale to allow careful observation of interaction dynamics and to refine methods before expanding participation. Future stages may build on this tested format through broader outreach and collaboration with local organizations once readiness and interest grow naturally.

Overall, what may appear as “missed opportunities” were, in practice, deliberate pacing choices. Each step was designed to inform the next, ensuring that engagement grows sustainably rather than reactively.

Lessons and Future Directions

The experience confirms that transformation in biodiversity governance requires working at the pace communities can sustain rather than imposing external timelines. Future interventions must balance the proven success of careful, graduated approaches with the need for broader community inclusion. The lessons learned suggest that effective strategies must be simultaneously patient and proactive, structured yet adaptive, protective of fragile trust while ambitious about expanding participation.

Lesson 1: Process before scale. In contexts shaped by earlier, less successful attempts to engage communities, the order and pace of engagement determine whether dialogue is possible at all. Past efforts around dam removal were often highly political and focused on imposing “correct” solutions rather than understanding what mattered to local people. These top-down approaches, which overlooked the community's values, needs, and lived relationships with rivers, felt alienating and counterproductive.

Our approach sought to do things differently. Before moving to collective discussions, we focused on understanding the local context through a mix of methods—media analysis, individual interviews, and informal conversations. This process allowed us to recognize the diversity of opinions about river biodiversity and to create space for residents to express their perspectives and values freely helping us see what truly mattered to them.

This sequencing proved essential. By beginning with listening and reflection, rather than public debate, we helped transform a previously divisive issue into one that could be discussed with less tension and greater mutual understanding. True engagement, we found, does not begin with scaling up participation but with careful groundwork that makes participation meaningful. Before expanding the dialogue, it is crucial to understand what matters most to the community—and only then begin working together toward solutions.

Lesson 2: Knowing when (and how) to adapt as a form of success. Some planned activities—such as applied theatre methods or direct youth involvement—were postponed after it became clear that they were not appropriate for the situation and could risk closing down dialogue rather than deepening it. Recognizing these limits early helped avoid missteps and kept the process constructive and relevant to the context.

Instead of pushing for attention or triggering a major public debate, we explored how different approaches and messages resonated with the community. Our intention was to create space for reflection, foster participation, and strengthen local voices—to encourage collective, participatory action rather than rush toward predetermined outcomes.

This flexibility—adapting the pace, language, and tools of engagement—proved just as valuable as introducing new ideas. Adaptability became a form of success in itself, allowing the process to remain open, responsive, and aligned with the evolving dynamics of the community and the discussion.

Lesson 3: Steady and naturally growing participation. Future engagement should build on the connections and approaches developed so far, gradually bringing in new groups, especially young people, educators, and community figures. Working with schools, cultural venues, and local initiatives could provide ongoing ways for people to stay involved beyond single projects.

Lesson 4: From learning to governance. The implementation of national and international environmental and biodiversity goals is closely linked to successful collaboration with local-level actors. Strengthening this connection requires maintaining open communication between policy, research, and community levels. Specialists who understand both the local context and community dynamics can play a key role—helping translate broad environmental objectives into practical, locally meaningful actions.

Lesson 5: With interdisciplinarity to practice. Interdisciplinarity—linking social and psychological sciences, environmental science, and creative disciplines—has proven useful in connecting ecological, social, and cultural aspects of fluvial biodiversity and revealing new perspectives. Such collaboration fosters more innovative approaches to environmental challenges. Each interdisciplinary team combines unique skills, enabling novel ways of understanding and addressing local cases. Yet effective collaboration requires preparation, shared learning, and institutional support. To make interdisciplinarity a working norm rather than an experiment, it should be promoted at all levels: encouraged at the European level, embedded in national scientific and policy frameworks, and applied on local levels, e.g. via practical guidance or short-term interdisciplinary teams. Embedding such practices across governance layers would build a culture where interdisciplinarity drives innovation in environmental action.

6.4 Co-learning

Co-learning as a general principle and its relevance in our case

Co-learning served as one of the core guiding principles of this project. Throughout the project timeline, teams observed one another's methodological choices and progress as they developed their own cases. This exchange fostered mutual reflection, inspiration, and adaptation across disciplines.

For our team in particular, most members came from qualitative research backgrounds. Observing the work of other teams encouraged us to engage more actively with participatory approaches and to experiment with integrating them into our established methods. For instance, inspired by systematic literature reviews, we conducted a media analysis of national discourses surrounding dams. Drawing on reflective practices typical of qualitative inquiry, we approached the process carefully and analytically, taking time to map and understand each next step. We also consulted international experts with experience in researching the social dimensions of dam removal, incorporating insights from their approaches into our own work.

Within our research team, co-learning meant finding ways to bridge different disciplinary perspectives. Environmental scientists, psychologists, and creative practitioners each brought distinct methodological and theoretical orientations that needed to be aligned. We organized several internal workshops to clarify what each method could contribute, identify where approaches might overlap or diverge, and determine how to combine them to support the project's goals. This ongoing and reflective dialogue was essential to creating a truly shared approach rather than a collection of separate methods.

Co-learning also extended beyond the research team to our interactions with local communities. Through interviews and informal conversations, we gained insight into how

residents perceive the river—what values, beliefs, and needs are associated with it, and what visions they hold for its future. These exchanges challenged and reshaped our initial assumptions, broadening our understanding of the river’s complex, multilayered, and multidimensional meanings. The discussions also created space for reflection among some participants, helping them articulate their relationships with the river in ways that could not have been anticipated at the outset.

Co-learning in the writing process

The feedback workshop with societal partners on August 1, 2025, demonstrated the extent to which collective understanding had deepened over the course of the project. Participants collaboratively analyzed the transformation process, examining both outcomes and shifts in perspective that had emerged through interdisciplinary engagement.

A central point of discussion revolved around the meaning of transformative change. Two complementary perspectives emerged. The environmental societal partner emphasized measurable ecological outcomes—such as projects restoring river connectivity and generating visible improvements in ecosystem functioning—while the societal partner focusing on social aspects highlighted relational dimensions, including community capacity for dialogue, shared responsibility, and collective action. The exchange revealed that transformation can only be considered successful when these two dimensions—material and relational change—advance together. Ecological restoration without community engagement risks remaining superficial: for long-term sustainability, local actors must be informed, supported, and feel genuine ownership of the process.

The environmental societal partner further stressed that environmental issues need to be placed firmly on local agendas and prioritized through sustained technical, financial, and institutional support. Local communities should be recognized not as passive recipients of environmental policy, but as active contributors to national and European environmental goals. The societal partner focusing on social aspects emphasized that the persistent gap between regional and national governance levels must be addressed to ensure inclusion and coherence in decision-making.

True transformation also requires a shift in perception. People will not act if they do not recognize a problem or see their role in addressing it. Awareness and understanding are therefore preconditions for engagement. Inviting communities to take part in identifying problems and designing solutions cultivates both responsibility and motivation. Environmental change should not be viewed as the task of a few, but as a collective democratic effort—a shared process of caring for and restoring the natural systems that sustain us. When people see ecological restoration as an opportunity to give back to nature, it becomes not merely a policy goal, but a meaningful expression of reciprocity and belonging.

Co-learning in this case study

Throughout fieldwork, co-learning took multiple forms. Interdisciplinary research meetings integrated diverse knowledge systems. Team members brought contrasting yet complementary perspectives—the environmental researcher and the theater director, for example, approached community engagement differently but in mutually reinforcing ways. This interplay fostered understanding between scientific and cultural viewpoints, ensuring that neither was marginalized. It created conditions for authentic problem-solving and the pursuit of common ground, leading to productive and thought-provoking dialogue.

The April 2025 event exemplified co-learning with the broader community. Participants encountered perspectives they had not previously considered. The synthesis of “wishes to the river” expressed a shared vision of a “living river,” a locally co-created concept that conveyed collective aspirations more effectively than technical language.

Stakeholder interviews reflected similar dynamics. Technical experts and residents offered complementary insights: scientists documented biodiversity loss, while older residents described the decline of species and fish abundance through lived experience. Combined, these perspectives provided a more comprehensive and compelling understanding of environmental change.

Youth perspectives remained largely absent due to institutional consent requirements—a missed opportunity for co-learning. Future initiatives could include youth through educational frameworks that enable ethical participation. Discussions also revealed self-exclusionary patterns among some individuals who, having previously felt unsupported by their community, withdrew from collective efforts. Their absence reduced both the inclusivity of the process and opportunities for mutual learning.

Looking ahead, multi-stakeholder co-learning events could help envision scenarios for the river's future. Participants expressed interest in the involvement of technical experts and access to environmental impact assessments, visualizations, models, projections, and evidence-based information on potential changes affecting the community. Experts, in turn, could benefit from engaging with community members' experiential knowledge to better incorporate local perspectives into decision-making.

The central insight is that the river's future cannot be determined by scientific analysis or community preference alone. Sustainable transformation depends on sustained dialogue between different ways of knowing—a process that, though gradual and sometimes challenging, represents the most transformative outcome of co-learning itself.

6.5 Testing of interventions

What was tested and why it matters

This section revisits content from earlier chapters, as the guiding questions for this part of the report overlap substantially with topics already addressed. A similar framing is therefore used to maintain conceptual and stylistic consistency across sections.

In the Anykščiai case, the primary approach tested involved gradual engagement with the topic of river restoration and dam removal—an approach that differed markedly from conventional participatory methods. It emphasized creating conditions for constructive dialogue on a sensitive and complex issue, ensuring that diverse perspectives were expressed, heard, and incorporated into decision-making. Central to this process was enabling residents to participate meaningfully and feel a sense of ownership over outcomes, thereby fostering long-term, sustainable transformation in which environmental benefits are achieved through social and cultural change. In essence, the approach sought to nurture a shared sense of reciprocity toward nature—a willingness within the community to care for and sustain the environment. Such change requires support, understanding, recognition of existing values and meanings, and trust, rather than decisions perceived as externally imposed.

The approach focused on understanding relationships within the community and exploring the values, beliefs, and needs connected to the river. It sought to identify what kinds of change people desired, what they valued most, and how they envisioned the river's future before initiating collective discussions. The work unfolded in three stages: first, individual interviews with residents and stakeholders; second, ongoing informal contact and presence in the community; and finally, a collective event in April 2025 that brought together people from diverse backgrounds to reflect on the river's future.

This case reflects a broader challenge in biodiversity governance: how to facilitate dialogue in contexts where environmental change is necessary, yet intertwined with other deeply held values—historical, cultural, aesthetic, and recreational. These overlapping attachments and interpretations of what is “best” for the environment shape the complexity of transformation processes and highlight the importance of inclusive, trust-based engagement.

Description of the testing process

How it was organized

The testing process was organized around a feedback workshop held on August 1, 2025, involving the research team and both societal partners, Karolina Gurjazkaitė and Jonas Tertelis. This 2,5-hour recorded session served as the main forum for collective reflection on the intervention's effectiveness and impact. The discussion was structured around guiding questions addressing transformative change, stakeholder engagement, knowledge co-production, policy influence, community-level outcomes, and broader transformative potential.

Complementary evidence was drawn from the intervention event held on April 26, 2025, beside the dam, which brought together participants from diverse stakeholder groups. Activities included anonymous sharing of perspectives collected through interviews, sensory mapping of river experiences, and collective writing of "wishes to the river." The event successfully created an inclusive setting where participants shared personal experiences and memories of the river, exchanging opinions, knowledge, and reflections on its past, present, and possible futures. The event provided space for informal, unstructured dialogue—where people could speak freely, listen to others' perspectives, and explore different understandings of what the river means and what its future might hold. This atmosphere encouraged genuine exchange and mutual learning, allowing insights to emerge organically through conversation.

Who participated

The feedback workshop included:

- Research team members: Audra Balundė, Aistė Bakaitytė-Bagdonė, and Goda Kaniušonytė
- Societal partners: Karolina Gurjazkaitė (environmental specialist) and Jonas Tertelis (theatre director)

The broader testing process engaged a wide range of stakeholders interviewed throughout the study, local governance representatives, technical specialists, businesses, NGOs, cultural actors, and unaffiliated residents.

Results of testing across key dimensions

Stakeholder engagement and participatory processes

The intervention and accompanying interviews introduced participatory formats not previously applied in the local context. As observed by the theatre societal partner during the feedback workshop, the process rendered the topic of the river more accessible to a broader spectrum of residents by providing a shared setting in which diverse perspectives could be expressed, acknowledged, and discussed constructively.

The participatory process evolved through iterative reflection and adaptation. Insights from early interviews indicated that some initially planned methods—such as applied theatre—were not well suited to this stage of engagement. The team consequently reoriented its approach toward exploratory, discussion-based formats that encouraged gradual involvement and collective sense-making. This flexibility enabled the process to progress at a pace aligned with local dynamics and capacities.

The April intervention served as a practical test of this approach. Participants contributed a wide range of perspectives and expressed interest and surprise at encountering views from neighbors they had not previously engaged with. The anonymous sharing of interview excerpts during the event provided an opportunity for participants to reflect on alternative viewpoints, fostering openness and mutual understanding.

Knowledge co-production and collaboration

The testing process revealed evidence of knowledge co-production, though not always in anticipated forms. This unpredictability is integral to such processes: outcomes cannot be fully pre-defined but emerge through trust—both within the research team and between researchers and the community. Knowledge co-production, in this sense, is a relational practice grounded in openness, dialogue, and mutual learning.

During the feedback workshop, the environmental societal partner reflected that engagement with community members had reshaped her understanding of how sustainable change occurs. She recognized that lasting environmental transformation must originate within the community itself. The community cannot be excluded from the process; its members require access to clear, reliable information and opportunities to ask questions and engage critically in order to develop trust in environmental initiatives. She observed that residents sought shared ownership of environmental ideas and actions, demonstrating a strong underlying appreciation of nature and a willingness to contribute when their perspectives are acknowledged and valued.

The theatre societal partner described a similar transformation, noting: “I can no longer think about the river without considering the entire ecosystem. This now influences my creative work in other projects.” His reflection underscores that exposure to diverse forms of knowledge—scientific, local, and experiential—can reshape how individuals perceive environmental systems and approach their own professional practice. It illustrates that knowledge co-production extends beyond the exchange of information; it involves internalizing new perspectives that influence how people think, act, and imagine future possibilities.

Despite these insights, important gaps remained in what was tested. Several participants emphasized the need for concrete, localized analyses demonstrating the potential effects of dam removal and other environmental interventions. They expressed interest in clear assessments outlining both benefits and trade-offs—how such actions might influence the ecosystem, water levels, landscape, and public safety. Providing these context-specific projections would not only support informed decision-making but also strengthen trust between experts and communities by ensuring that environmental discussions are grounded in locally relevant evidence. Nevertheless, some community members continued to question whether change was necessary at all, reflecting the persistence of attachment to the current state of the river and differing interpretations of what constitutes improvement.

Impact on policy and decision-making

The intervention did not aim to produce immediate policy change but to generate insights for more effective environmental governance. The findings underscored that constructive dialogue on complex environmental issues is possible when discussions are framed around shared concerns and local meanings. Feedback discussions revealed persistent gaps in representation: environmental perspectives are often underrepresented in local decision-making processes, which can result in unbalanced or short-term outcomes. Strengthening their inclusion—through both formal mechanisms and informal engagement—could enhance the integration of environmental considerations into local governance.

At a broader scale, the case illustrates a fundamental governance challenge. The environment is increasingly at risk and addressing this requires collective responsibility, political commitment, and concrete action. Yet the key question remains: how can a stronger sense of ownership be cultivated within broader communities, particularly at the local level? Local contexts are shaped by historical, cultural, and social specificities that must be acknowledged and incorporated into governance processes. Sustainable transformation, therefore, is best understood as positive environmental change rooted in transformation within the community—where ecological restoration and social empowerment progress together.

Community-level changes and social perceptions

While no major shifts in community attitudes could yet be observed, the intervention provided valuable space for reflection on environmental issues related to the river and the dam. It offered opportunities for residents—including those who had not previously participated in public discussions—to express their perspectives, experiences, and questions. The process helped bring forward a wider range of voices, particularly those that had remained unheard between more polarized positions. These participants often approached the topic with curiosity rather than fixed opinions, raising questions and exploring uncertainties. Such openness proved valuable for fostering reflection and dialogue within the community.

Through the intervention, participants were able to articulate their own values and views regarding the dam and the river's future, and to recognize the diversity of perspectives within the community. The event also allowed residents to voice concerns and identify the kinds of information and conditions necessary for them to support potential future changes—such as access to trustworthy data, scientific evidence, and clear communication about impacts.

The intervention created a space for participants to discuss and reflect on the river, the dam, biodiversity, restoration opportunities, and the broader meanings attached to this specific site—community events, recreational spaces, daily walks, and memories of kayaking, swimming, or fishing. Moving beyond technical framings, the interviews and the April event invited participants to consider the river as something they are in relationship with. Writing “wishes to the river” and sharing personal memories encouraged emotional and reflective engagement, resonating with how people experience the river in their everyday lives.

The intervention's scope was necessarily limited. As the theatre societal partner observed during the feedback workshop, true transformation implies a depth of change from which “there is no way back”—a process that requires sustained engagement over time. The April event demonstrated that constructive dialogue about the river is possible; however, broader structural and policy transformations demand direct engagement with relevant stakeholders, formal proposals, and long-term commitment.

The testing also revealed hesitations toward environmental discourse. Several participants expressed skepticism about environmental initiatives, citing concerns over political agendas, frameworks detached from local realities, and doubts about the need for action. These perspectives underscore the challenge of building trust in environmental governance. Such trust depends on transparent communication, competence, and genuine attention to community well-being, supported by clear, evidence-based information.

The April event showed that relational approaches—grounded in place, memory, and everyday experience—can lower barriers to participation and foster discussion. This indicates a transformative potential for governance processes that prioritize inclusion.

Transformative potential

The testing revealed both the possibilities and limitations of change. The April event demonstrated that it is possible to discuss the river from a relational perspective—emphasizing connection, shared meaning, and community experience rather than technical or political framings. Including environmental perspectives proved essential for helping participants become familiar with ecological arguments and ensuring that these views were heard, understood, and supported. The event avoided politicization or imposition; progress was achieved instead through dialogue and relationship-building. Such relational exchanges represent early stages of transformative change, where new understandings and relationships begin to reshape how communities and institutions approach environmental issues.

The feedback workshop indicated that engagement also shifted perspectives within the research team and among societal partners. The environmental societal partner reflected that collaboration with community members had reshaped her approach—reinforcing the view that environmental change is necessary but must enable choice within the community and address a broader spectrum of concerns, such as accessibility, green spaces, and cultural heritage. The theatre societal partner noted that ecological thinking had begun to influence his creative work. These perspective shifts illustrate transformative change as a gradual reorientation of values and practices—change that occurs not through policy reform alone, but through learning, empathy, and reimagining relationships with nature and society.

The intervention was exploratory rather than comprehensive, but it created opportunities for dialogue within one community context. The approach could be adapted to educational settings—both formal and informal—where discussions about rivers and ecosystems may help foster long-term environmental literacy. The methods tested could also inform governance practice by offering ways to engage diverse groups—from local communities to national institutions—in experiential, trust-based dialogue. Such discussions, grounded in human connection rather than bureaucratic procedure or mediated communication, can build empathy, mutual understanding, and recognition of environmental complexity. In governance terms, this signals transformative potential—moving from hierarchical, technocratic decision-making toward participatory, relational, and trust-based processes. For such approaches to be effective, environmental perspectives—ranging from experiential and local to scientific and technical—must be actively included in these dialogues to ensure that ecological knowledge is represented, contextualized, and collectively understood.

A further challenge concerns the limited direct experience many residents have with the river's biodiversity. Apart from anglers and nature enthusiasts, few community members regularly interact with the ecological dimensions of the river. This disconnection can reduce understanding of environmental issues. Expanding opportunities for residents to experience biodiversity—through community events, educational programs, or creative interventions—could deepen relational engagement, strengthen emotional ties to the river, and foster more supportive attitudes toward environmental stewardship. These experiential processes are crucial components of transformative change, enabling individuals to reconnect with local ecosystems and to translate awareness into sustained care and action.

Reflections on the intervention's transformative potential

Based on the testing process, the intervention demonstrated that structured dialogue about environmental topics can work when conversations focus on relationships and shared experiences. The approach created space for diverse perspectives without requiring immediate consensus or generating conflict.

The transformative elements include:

- **Methodological approach:** The graduated process—moving from individual interviews to collective engagement—offers a model that could be adapted for other contexts. This approach complements expert knowledge by creating space for community perspectives in environmental governance.
- **Relationship transformation:** The intervention may have contributed to evolving relationships between researchers and the community, between different stakeholder groups, and between people and the river itself. While these shifts cannot be measured directly, the process created conditions in which they could begin to develop.
- **Narrative expansion:** By making visible the full spectrum of community perspectives and introducing relational framings of human–river relationships, the intervention expanded imaginative possibilities beyond dichotomic pro/anti-dam positions.

- **Experiential connection:** The testing also revealed that many residents have limited direct experience with the river's biodiversity, which can constrain understanding of ecological issues. Expanding opportunities for people to encounter and experience local ecosystems—through education, events, or creative activities—could further deepen relational engagement, strengthen emotional ties to the river, and foster more supportive attitudes toward environmental stewardship.

The testing also pointed toward areas for future development: building on this approach in other community settings, connecting insights to broader governance processes, and developing the site-specific studies that participants requested.

Lessons and open questions for future considerations

From these observations, several key lessons for transformative biodiversity governance can be drawn:

- **Consider sequencing.** In similar contexts, beginning with context analysis (site visits, media and historical review, stakeholder mapping) and then moving to individual conversations before collective events can help participants feel more confident and prepared for group dialogue.
- **Acknowledge and integrate multiple knowledge systems.** Technical expertise, local observations, emotional connections, and cultural values all contributed to understanding the river in this case. Recognizing and valuing these forms of knowledge strengthens legitimacy and inclusiveness in governance processes.
- **Prioritize process alongside outcomes.** The structure and facilitation of dialogue directly influence who feels able to participate and what perspectives surface. While such spaces do not eliminate disagreement, they clarify its basis and enable constructive exchange.
- **Center personal and relational connections.** Participants engaged most strongly when reflecting on their memories, daily interactions, and hopes for the river's future. Attending to these relational dimensions can foster empathy and motivate collective action.
- **Extend learning beyond discussion.** Creating experiential opportunities for residents to interact with biodiversity—through shared activities and observation—can reinforce awareness and deepen the social foundations for long-term environmental transformation.

Looking ahead, future initiatives could build on this approach by applying it in other community settings, linking locally grounded insights to broader governance processes, and developing the site-specific studies requested by participants. Together, these lessons suggest that transformation in biodiversity governance depends not only on institutional change but also on fostering relationships, dialogue, and lived connections with nature.

Several open questions emerged from the testing:

- **Knowledge integration.** What tools and processes can most effectively translate between scientific assessments of ecological change and community experiences of landscape transformation? Developing such mechanisms is essential for bridging the gap between data-driven environmental governance and lived, place-based understanding. Creating opportunities for communities to generate and share environmental knowledge through direct experiences—such as participatory monitoring, creative activities, or collective observation—could strengthen both ecological awareness and local stewardship.
- **Sustainability.** How can transformative processes be maintained beyond project timeframes when they rely on continuous relationship-building and trust? Sustaining transformation also requires addressing a broader spectrum of community needs—including those of people with disabilities, families, youth,

and the elderly—so that environmental initiatives are inclusive and socially embedded. Long-term sustainability depends on creating institutional structures and allocating resources that can support these relational and inclusive processes across temporal, spatial, and governance scales.

The testing showed that structured dialogue about the river is possible when approached through relationship-building and attention to community priorities. Building on this foundation will require sustained effort across multiple timeframes and governance levels. As the theatre societal partner noted, deep change means that “there is no way back.” The intervention succeeded in creating dialogue and testing methods; however, achieving enduring transformation will depend on long-term engagement, mutual commitment, and institutional support that carries these relational practices forward.

6.6 Discussion

Main insights from testing the interventions

The testing process demonstrated that meaningful discussion about the river can serve as a starting point for transformation within the community—strengthening care for the environment and fostering a more inclusive, community-centered approach to environmental problem-solving. Conversations that begin from lived experience and relationships with the river can build understanding, trust, and a shared sense of responsibility for its future.

The testing confirmed that understanding the river requires integrating diverse forms of knowledge. Scientific and environmental perspectives were complemented by local experience, personal memory, and emotional connection to the place. The most productive moments arose when these different ways of knowing met and informed each other. The process worked best when participants saw themselves as contributors in a shared learning space—different kinds of actors exchanging insights and learning together—rather than as experts and audiences divided by roles or hierarchies.

The way conversations were structured also proved decisive. The anonymous sharing of interview excerpts during the April event enabled participants to engage with contrasting views without feeling exposed, while the “wishes to the river” activity encouraged creativity and emotional reflection. The shared idea of a “living river”—which emerged from participants themselves—captured both ecological and social aspirations for the site. These activities demonstrated that connection precedes change: communities are more likely to care for and support environmental transformation when they feel personally and emotionally connected to the river. For transformation to be genuine, people must be willing to see and experience the river differently, not simply accept imposed changes. This willingness depends on familiarity—with the river’s biodiversity, its rhythms, and its living character. Expanding opportunities for residents to experience the river’s ecosystems directly—through shared observation, creative practices, or environmental learning—can deepen understanding, foster attachment, and build the foundation for lasting stewardship.

Aspects that showed promise or traction

The testing process highlighted several elements that proved effective in engaging participants and demonstrated potential for strengthening future environmental governance practices.

Individual interviews as a foundation for collective dialogue. Conducting one-on-one interviews before collective engagement allowed participants to share their perspectives privately and at their own pace. When anonymized excerpts from these interviews were later introduced during the April event, participants could listen to diverse community views without pressure to defend their own positions. This approach revealed the range of knowledge present—scientific, observational, and experiential—and established a constructive basis for open discussion.

Facilitating informal, inclusive discussion spaces. Informal discussion formats allowed multiple forms of knowledge to surface and interact. The April event's design—combining anonymous interview excerpts with participatory activities such as drawing, writing, and open conversation—enabled engagement without hierarchy or polarization. By bringing together scientific perspectives, local observations, and personal narratives, participants developed a more integrated understanding of the river's condition and its role in community life.

Supporting technical knowledge with local meaning. Framing discussions through personal memories, everyday relationships, and shared visions for the community's future made participation more accessible and meaningful. Activities such as place-based storytelling and sensory mapping resonated with how residents already relate to their environment, demonstrating that environmental issues can be explored through culturally familiar and emotionally grounded practices. At the same time, for the future, integrating clear and context-specific technical information—such as visualizations or localized assessments of water levels, biodiversity change, and safety—can enhance these relational approaches. When environmental and technical knowledge is communicated through locally meaningful narratives, it becomes more understandable, trusted, and actionable within the community, strengthening the connection between scientific understanding and lived experience.

Involving trusted and knowledgeable actors. The participation of environmental specialists, local enthusiasts, and in future iterations academics and technical experts can play a crucial role in fostering understanding and care for the environment. Trusted actors, such as environmental specialists, local environmentalists, and community enthusiasts—can help build stronger environmental narratives within local contexts, making these topics more relevant and relatable to residents. Such interpersonal engagement and credibility have proven more effective in raising awareness and building care than data-driven communication alone.

Future direction: fostering direct experience with biodiversity. Although not yet implemented, future initiatives could deepen community connection to the river through direct encounters with its biodiversity—such as guided walks, participatory monitoring, or community-led ecological activities. Experiential engagement of this kind can enhance ecological understanding, cultivate emotional attachment, and strengthen long-term stewardship.

Remaining challenges and areas for further work

Building broader participation. The intervention engaged about 30 participants through interviews and the April event, enabling constructive but limited dialogue. Future work could expand participation by partnering with local organizations, using varied communication channels, and involving community members as multipliers to embed environmental dialogue more widely and foster shared responsibility.

Inclusion of youth. Youth participation was constrained by consent and school coordination requirements, despite their stake in future outcomes. Future initiatives should develop educational partnerships and consent frameworks that enable ethical, meaningful engagement. Early involvement can foster environmental literacy and long-term stewardship.

Need for site-specific technical information. Participants sought concrete, localized evidence on potential outcomes of river restoration—visualizations, models, and projections showing likely changes in water levels, biodiversity, and riverbanks. Providing such information, though resource-intensive, would make discussions more tangible and support informed, evidence-based decisions.

Connecting dialogue to governance. While the April event showed that community discussions can be inclusive and constructive, how they influence formal decisions remains

unclear. Stronger mechanisms are needed to connect local dialogue with regional and national policy frameworks.

Balancing dialogue and advocacy. The intervention prioritized dialogue over advocacy, fostering open exploration rather than predefined outcomes. While this built trust, it left questions of environmental action unresolved. Future work could pair participatory dialogue with policy engagement to ensure reflection leads to concrete progress.

Final reflections and messages

The testing process demonstrated that structured, relationship-based dialogue can open meaningful pathways for environmental transformation. When community conversations begin from lived experience and local meaning rather than politicized framings, they foster trust, empathy, and a deeper understanding of differing perspectives within the community. The gradual approach—from individual interviews to collective dialogue—helped participants feel heard and prepared to engage, creating the conditions for openness and reciprocity. This process revealed that connection fosters mutual care, shared responsibility, and ultimately, a greater willingness to support environmental change when people feel personally and emotionally linked to the river.

The process also demonstrated that integrating diverse forms of knowledge—scientific, local, experiential, and emotional—enhances collective understanding and strengthens the legitimacy of environmental decision-making. Informal and inclusive settings enable different actors to engage as collaborators rather than as experts and audiences, fostering dialogue on equal terms.

Future efforts should build on these insights by broadening participation, strengthening the bridge between local dialogue and governance, and expanding opportunities for residents to experience the river's biodiversity firsthand. Sustained, trust-based engagement—supported by transparent information, inclusive methods, and respect for local values—can transform short-term initiatives into enduring frameworks for community stewardship and effective environmental governance. Local environmental actors should play a role in building environmental awareness, relevance, and care within the community, translating complex ecological insights into shared, locally meaningful understanding.

Engagement with transformative principles

The approach engaged with several transformative principles through practice rather than explicit design, illustrating how participatory methods can operationalize pluralization, empowerment, politicization, and embedding.

Pluralizing was achieved through the sequencing of individual interviews and group dialogue, which revealed the diversity of perspectives within the community. This process demonstrated that environmental understanding does not arise from a single authoritative view but through the interaction of scientific knowledge, lived experience, emotional connection, and cultural meaning.

Empowering emerged from creating spaces where residents—often excluded from formal processes—could share concerns and knowledge on equal footing. Treating participants as knowledge holders rather than research subjects surfaced insights often overlooked by conventional consultation. Empowerment could be further strengthened by amplifying local environmental voices and fostering a collective sense of ownership over the river's future, supported by growing care and responsibility within the community.

Politicizing occurred partly through the involvement of political actors in the research process and by acknowledging that environmental decisions are inherently political. Supporting politicization with robust technical evidence—through context-specific assessments—and grounding it in community experience can help balance competing priorities and values. However, transforming these dynamics requires institutional change beyond a single community initiative.

Finally, embedding was achieved by aligning the process with familiar local practices and conversational forms, showing that dialogue about the river can be both accessible and meaningful when rooted in place. Yet, deeper institutional embedding—linking community dialogue with governance and policy frameworks—will require sustained commitment, time, and multi-level collaboration.

Closing remarks

The Anykščiai case demonstrated that structured, community-based dialogue about local rivers is possible, even when addressing sensitive topics. The process required careful preparation, trust-building, and a thoughtful design that created space for diverse perspectives to be expressed, heard, and exchanged.

The interviews revealed that sound technical preparation is essential to ensure that all community-relevant questions are adequately addressed. Equally important is an approach grounded in genuine respect for local contexts and values—one that emphasizes a willingness to listen, reflect, and acknowledge both environmental concerns and community perspectives.

The intervention created opportunities for dialogue and tested participatory methods that resonated with participants. The continuation of these conversations will depend on community interest, institutional support, and their integration into formal decision-making processes.

The April event demonstrated that inclusive dialogue is achievable and highlighted the importance of experiential knowledge. Strengthening connections with the river and its biodiversity can foster greater environmental awareness, care, and stewardship within the community.

Ultimately, the case underscored that environmental change is inseparable from social transformation. Lasting ecological improvement must be rooted in the community's willingness to care for the river and to share responsibility for the change process. Building understanding and ownership requires time, trust, and continuity. Although this project alone could not transform governance systems, the methods tested provide a valuable foundation for those seeking to strengthen dialogue, trust, and collective stewardship of rivers and their ecosystems.

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UBB High Nature Value Farming

D2.5, Romania

December 2025

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Summary

The Saschiz case study comprehensively examines the challenges and opportunities that arise at the intersection of biodiversity conservation, sustainable agriculture, cultural heritage, biocultural tourism, and social innovation. Located within the Sighișoara-Târnava Mare region of Romania, the study area is one of the country's largest Natura 2000 sites, spanning approximately 85,000 hectares and boasting an exceptional range of biodiversity. This rich natural environment features 55 endangered bird species, 23 endangered mammals (including wolves, bears, and wild cats), and over 1,000 plant species, which account for nearly 30% of Romania's flora. The case study explores how biodiversity conservation can be harmonized with sustainable rural development to benefit both the environment and local communities.

A primary concern within the region is the delicate balance required to sustain High Nature Value (HNV) farmland, which is critical for biodiversity but increasingly threatened by land abandonment, agricultural intensification, and overgrazing. The study underscores how traditional land-use methods, which have historically preserved these ecosystems, are now under threat due to socio-economic pressures. The shift away from subsistence farming, mainly due to migration and economic hardship, has led to social inequities, particularly affecting marginalized groups such as the Roma community. Moreover, disparities in resource access further complicate efforts to achieve inclusive development. The case study highlights the pressing need for innovative land management strategies integrating conservation with sustainable economic practices.

The case study identifies several key socio-ecological challenges:

1. **Economic precarity:** Semi-subsistence farming is no longer economically viable for many local communities, prompting migration and leading to changes in land use.
2. **Land use and conservation conflicts:** Traditional farming methods are disappearing while overgrazing and chemical fertilizers threaten biodiversity.
3. **Stakeholder collaboration:** Tensions between local communities and conservation authorities necessitate participatory approaches to balance economic and ecological goals.
4. **Social innovation and governance:** The study underscores the importance of inclusive governance by involving local communities, decision-makers, NGOs, businesses, and academics in participatory planning efforts.

The research integrates both qualitative and quantitative methods to explore these socio-ecological challenges. The qualitative research (six workshops implemented in June 2024) focuses on how local communities conceptualize "nature", their perceptions of biodiversity loss, and its social, economic, and cultural consequences. It also examines governance structures and the potential for tourism and agriculture to coexist in a way that maintains biodiversity while supporting community development. Meanwhile, the quantitative research investigates what factors influence Romanians' intention to engage in biocultural tourism experiences in HNV landscapes, using factors such as awareness, values, trust, and behavioral attitudes to assess interest and potential demand. Understanding these behavioral drivers is essential for designing effective policies and initiatives to encourage more sustainable tourism and local economic engagement.

A key component of the case study is the involvement of the Romanian Local Action Group (LAG) "Dealurile Târnavelor", a network established in 2007 as part of the EU LEADER program. This organization is essential to the region's socio-economic and cultural development initiatives. The LAG works closely with local communities, researchers, and policymakers to craft strategies that promote tourism, preserve historical landmarks, and support sustainable farming and agro-tourism. Notable local products, such as rhubarb jam, elderberry syrup, and raw milk cheese from Saschiz, highlight the region's cultural and agricultural heritage. The Babes-Bolyai research team collaborates with LAG to organize workshops and engage local stakeholders in co-research efforts. Through Participatory Action Research (PAR), the PEPE principles (Pluralizing, Empowering,

Politicizing, Embedding) were translated into more accessible language to facilitate community understanding and engagement. This participatory approach strengthens local capacity and ensures that conservation strategies align with community priorities and long-term sustainability goals.

The Saschiz case study offers valuable insights into how biodiversity conservation and rural development can be integrated in a culturally and economically diverse region. The research highlights pathways toward preserving biodiversity while fostering economic resilience by exploring nature-based solutions and innovative strategies. By leveraging community-based initiatives and policy-driven support, the study demonstrates that rural biodiversity-rich regions can develop thriving local economies without compromising their ecological heritage. The study serves as a model for other rural areas facing similar challenges, demonstrating the potential of collaborative, community-driven approaches to sustainability. The findings contribute to broader discussions on sustainable development, rural resilience, and the future of HNV farmland in Europe and beyond through scientific research, local engagement, and policy innovation. Ultimately, the case study underscores that preserving nature is an ecological necessity and a vital component of sustainable livelihoods, cultural identity, and long-term regional prosperity.

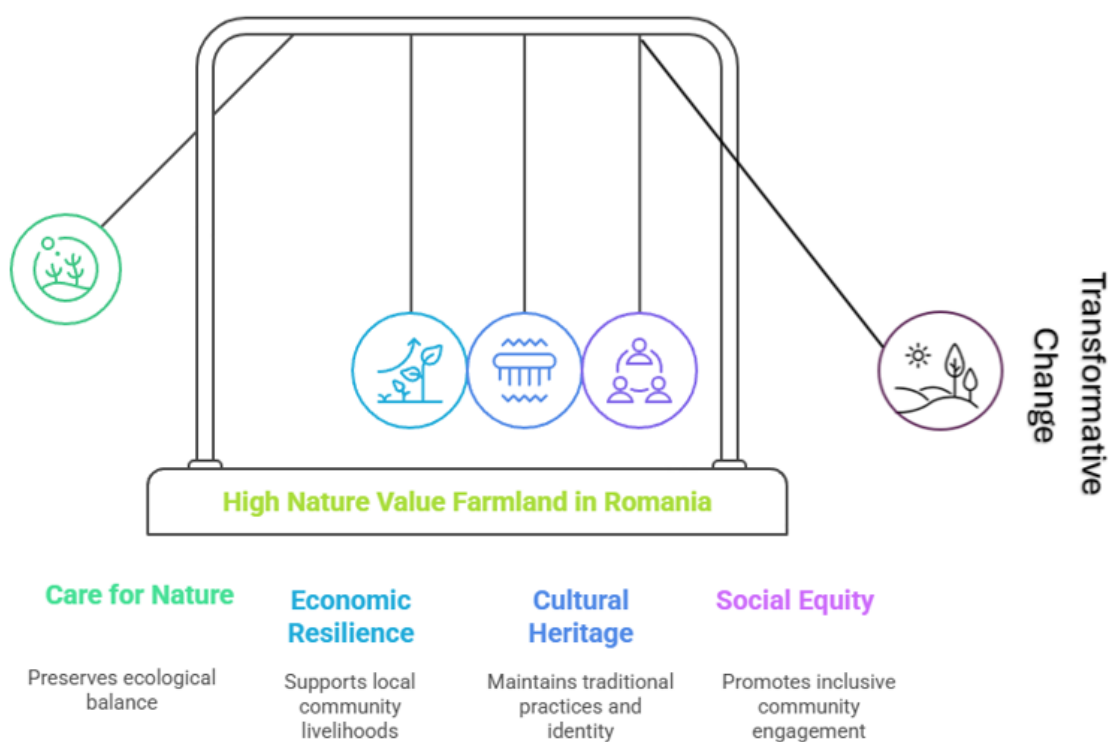


Figure 10 - Graphical abstract: Romania's case study

1. Case Study Introduction

1.1 Justification of the importance of the case study

The case study of Saschiz provides a unique opportunity to explore the intersection of biodiversity conservation, sustainable agriculture, cultural heritage, biocultural tourism, and social innovation. Its significance stems from several interrelated ecological, social, and economic dimensions.

The Sighișoara-Târnava Mare region is Romania's largest Natura 2000 site, covering approximately 85,000 hectares and hosting extraordinary biodiversity. It is home to 55 endangered bird species, 23 endangered mammal species (including iconic species such as wolves, bears, and wild cats), and over 1,000 plant species, representing approximately 30% of Romania's flora. These natural assets are nationally and globally significant, with many species protected under the Birds Directive, the Habitats Directive, and the Berne Convention. High Nature Value (HNV) farmland, a critical habitat for this biodiversity, dominates the area. *These ecosystems depend on traditional land-use practices, making them highly sensitive to changes in land use, such as abandonment or intensification. The study area exemplifies the urgent need to balance biodiversity conservation with sustainable land management in Europe's rural landscapes.*

The RO case study underscores the challenges of sustaining a dynamic rural landscape in a multicultural context. The local economy relies heavily on agriculture, tourism, and forestry. However, the precarious state of subsistence farming has led to economic and social inequities, where Roma people are often subject to interethnic conflicts. The abandonment of traditional land-use methods due to migration and the intensification of agriculture poses a threat to biodiversity and rural livelihoods. Additionally, overgrazing by sheep has degraded grasslands, underscoring the need for innovative management practices. The region's multicultural identity (Saxons, Hungarians, Roma, and Romanians) is an asset but also presents challenges in aligning diverse stakeholders' interests toward sustainable development. Encouraging local populations to recognize the cultural and economic value of HNV farmland is critical to preserving these unique landscapes.

The present case study is significant for addressing key socio-ecological challenges. One is *economic precarity*. The current pattern of semi-subsistence farming fails to meet the financial needs of local communities, resulting in migration and changes in land use. Another one refers to *land use and conservation conflicts*: Traditional land use methods, essential for biodiversity, are increasingly abandoned. Overgrazing and nutrient over-enrichment from chemical fertilizers are key threats. We also mention *stakeholder collaboration*: Conflicts between local communities and conservation authorities highlight the need for participatory approaches to reconcile economic and ecological objectives.

Additionally, the case study aligns with Sustainable Development Goal 12 (Ensure sustainable consumption and production patterns) by exploring innovative solutions to enhance the sustainability of farming practices. The proposed HNVf (food/community/transformational change) label represents a transformative approach to creating market value for biodiversity-friendly agricultural products. This innovation could incentivize farmers to adopt sustainable practices while addressing broader issues of sustainable consumption and production. Furthermore, the emphasis on *social innovation* – bringing together local communities, decision-makers, NGOs, academics, and businesses – offers a model for inclusive governance and participatory planning. Building partnerships and amplifying the voices of marginalized communities, particularly within the Roma community, is crucial for ensuring that diverse perspectives contribute to sustainable development.

The RO case study is essential for understanding how to balance nature's protection with rural development in a multicultural, economically vulnerable region. It addresses global sustainability challenges while providing a locally grounded framework for integrating ecological, social, and economic priorities. By exploring nature-based solutions and social innovation, this case could offer valuable lessons for other regions facing similar challenges.

1.2 Explanation of the focus of the case study

The Romanian case study examines the complex interrelationships between the protection of nature, sustainable agriculture, cultural heritage preservation, biocultural tourism, and social innovation within High Nature Value (HNV) farmland. Situated in the Sighișoara-Târnava Mare region, one of Romania's largest Natura 2000 sites, this case study explores strategies for integrating environmental sustainability with rural economic resilience. A primary focus is the preservation of HNV farmland, which is essential for maintaining biodiversity but is increasingly threatened by agricultural intensification, land abandonment, and overgrazing. Traditional land-use practices, once necessary for sustaining ecological balance, are disappearing due to economic pressures, migration, and the decline of subsistence farming. These changes have led to socio-economic disparities, particularly affecting marginalized communities, while also contributing to environmental degradation. The case study examines how local communities, policymakers, and conservation organizations can collaborate to develop sustainable land management practices that support nature and rural livelihoods. Ultimately, the case study aims to identify innovative solutions that strike a balance between ecological preservation and economic sustainability, thereby ensuring a sustainable future for the area.

1.3 Research questions addressed by the case study

- 1.a. How do local communities conceptualize “nature”²⁴?
- 1.b. What are the natural elements perceived as most important for their well-being and livelihoods?
- 2.a. What are the key drivers of biodiversity loss in the region?
- 2.b. How do local communities perceive the vulnerability of natural elements to these drivers?
- 3.a. What are the social, economic, and cultural consequences of biodiversity loss?
- 3.b. Which are the groups within the community most affected by biodiversity loss?
4. How can local governance, tourism, and agricultural practices be integrated to maintain biodiversity while supporting community development?

Qualitative research

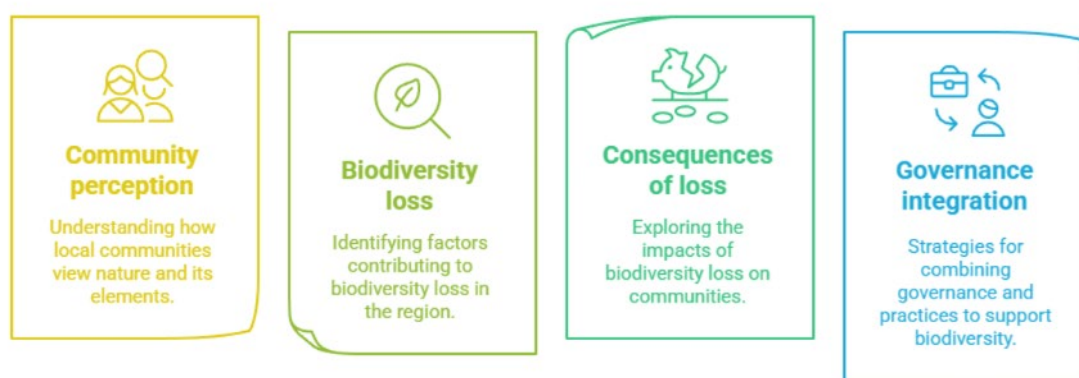


Figure 11 - Qualitative research

²⁴We used the term “nature” because it is culturally closer to the local community than the more abstract ‘biodiversity’. Similarly, the term “ecosystem” was avoided for the same reason (Peterson et al., 2018)

For the quantitative research (Figure 11):

“What factors influence Romanian people’s INTENTION to have a biocultural tourist experience in an HNV (BCTEinHNV) rural landscape?”

We identified the factors that influenced the INTENTION to have a biocultural tourist experience in the Romanian rural landscapes of HNV. To this end, we analyzed the effects of Awareness, Knowledge, Values, Trust, Attitude (ATT), Subjective Norms (SN), and Perceived Behavioral Control (PBC) on the INTENTION to have a biocultural tourist experience in an HNV (BCTEinHNV) rural landscape.

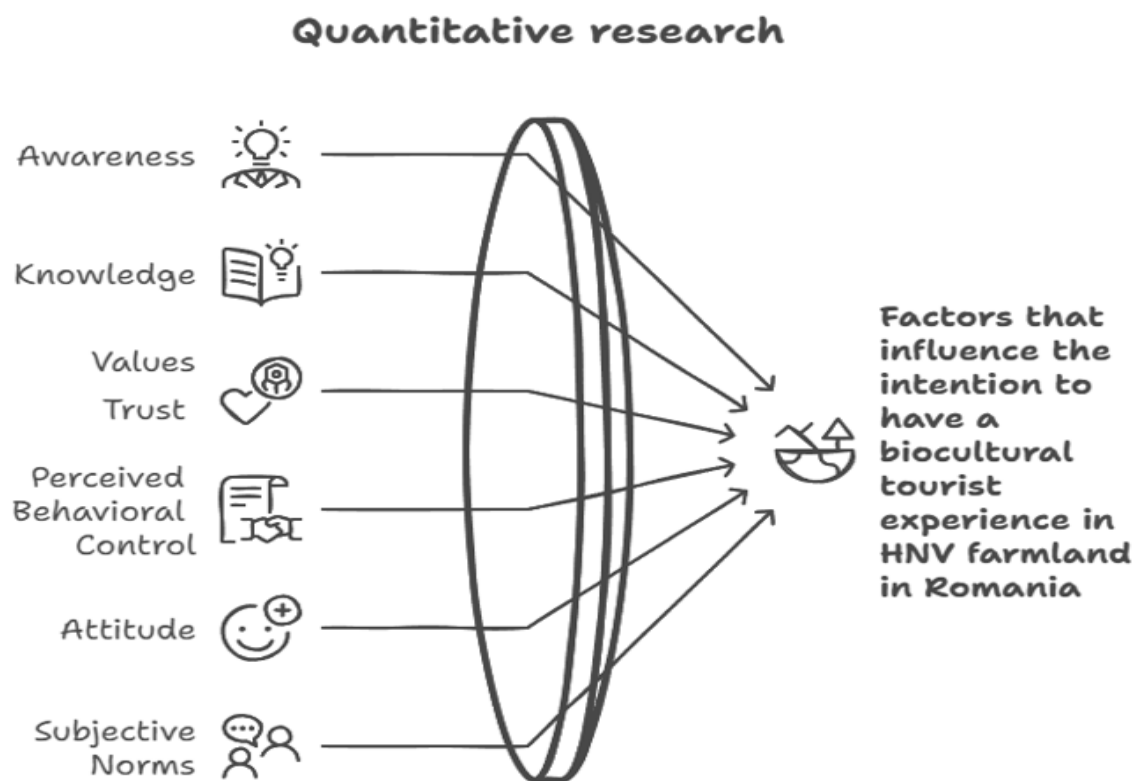


Figure 12 - Quantitative research

1.3 Reading guide

This report presents the Romanian case study from Central Romania within the Horizon Europe project BIOTraCes (Biodiversity and Transformative Change for Plural and Nature-Positive Societies). It weaves together the work carried out in three interconnected deliverables: Transformative Biodiversity Innovations (D2.2), Socio-Ecological System Analysis (D2.3), and Locally Tested Interventions (D2.4), to offer an integrated perspective on how biodiversity, agriculture, cultural heritage, and governance interact in High Nature Value (HNV) farmlands in Romania. The case shows that while natural capital in the region remains comparatively rich, the social, economic, and institutional conditions that once supported biodiversity-friendly land use are under increasing strain.

The report begins by introducing the Saschiz area and the broader Sighișoara-Târnava Mare landscape as a biodiversity-rich but socially vulnerable rural region. It highlights how population ageing, youth migration, and the decline of subsistence farming weaken the labor base needed to maintain hay meadows, extensive grazing systems, and traditional land-use practices. Biodiversity conservation is thus framed from the outset as a socio-ecological challenge: ecological assets remain strong, but the communities and institutions that sustain them are fragile.

Building from this backdrop, the work reported under Transformative Biodiversity Innovations (D2.2) examines emerging practices, actors, and ideas that connect biodiversity protection with social inclusion, cultural identity, and rural development. The analysis focuses on how local food products, cultural events, community-based tourism, and the revitalization of traditional orchards and pastures serve as seeds of change, reembedding biodiversity in everyday life. These innovations are predominantly social and institutional rather than technological. They depend on trust-building, local leadership, and cross-sector cooperation. At the same time, the report highlights that not all groups benefit equally. Roma communities and small-scale farmers often face structural barriers to funding, visibility, and participation, raising important questions about who is included in, and excluded from, biodiversity-centered innovation.

The socio-ecological system analysis developed in D2.3 deepens this picture by examining how ecological dynamics, land-use practices, values, and institutions interact across scales. Drawing on a mixed-methods approach that combines deliberative workshops in six villages (June 2024) with a nationally representative survey of 1,007 respondents, this strand of work shows that local communities primarily understand nature through relational meanings: forests, meadows, and water are seen as sources of identity, continuity, and livelihood. Participants identify land abandonment, overgrazing, water scarcity, monoculture farming, and weak enforcement of existing regulations as the most pressing threats to biodiversity. Climate change appears in the narratives through very tangible experiences, such as drying wells, cracked soils, and altered vegetation. The quantitative analysis reported in D2.3 complements these qualitative insights by investigating what shapes Romanians' intention to engage in biocultural tourism in HNV landscapes. The findings show that behavioral intention is influenced less by knowledge alone and more by attitudes toward nature, perceived behavioral control, and trust in relevant actors and institutions. People are more inclined to visit and value HNV areas when they see such experiences as meaningful, feasible, and socially supported. This points to a crucial implication for governance: awareness-raising will have limited impact if credible institutions, empowering conditions, and consistent policy signals do not accompany it.

Within this socio-ecological analysis, HNV farmland emerges as a landscape under dual pressure. In some areas, intensifying livestock systems, encouraged in part by agricultural subsidies and market demand, contribute to overgrazing and habitat degradation. In others, outmigration and demographic decline lead to land abandonment, scrub encroachment, and the erosion of open, species-rich grasslands. Traditional ecological knowledge is still present and valued, but it is increasingly associated with poverty and a lack of opportunity, which discourages younger generations from reproducing traditional practices. Farmers emphasize economic survival and predictability, NGOs prioritize habitat and species protection, and local authorities look to tourism and branding strategies as a possible bridge between conservation and development.

Locally Tested Interventions (D2.4) build on the insights from D2.2 and D2.3 by examining how strategies and experiments "in action" address these intertwined social and ecological challenges. This part of the report follows a sequence of qualitative engagements: six in-person workshops in June 2024 and a follow-up online workshop in March 2025. Taken together, they document a cumulative learning process involving UBB researchers, the Local Action Group GAL Dealurile Târnavelor, and community members. Discussions in the final workshop, for example, underscored that genuine transformative change requires more than isolated projects or incremental adjustments. Participants stressed the need for the effective enforcement of existing environmental legislation, the redesigning of incentives for sustainable farming, a shift away from purely individualistic profit logics, and the creation of communities of practice that can sustain mutual learning and support. D2.4 assesses concrete interventions, such as pasture restoration using native seed mixtures, adaptive grazing regimes, educational initiatives, the creation of informal farmer networks and the use of local cultural symbols like orchards, butterflies or stork nests as anchors of identity, in terms of their transformative potential, their capacity to address indirect drivers of biodiversity loss and their vulnerability to broader disruptors like climate change, land

privatization and institutional inertia. The analysis shows that regenerative efforts are most successful when ecological objectives are closely linked to social benefits, cultural meaning, and realistic economic prospects. Conversely, interventions fail where governance is weak, financial pressures are acute, or local voices are marginalized.

Across these three deliverables, the Romanian case study converges on a shared conclusion: biodiversity loss in HNV farmland is driven less by purely ecological processes than by social, economic, and political dynamics. Natural capital remains high, but social capital is fragile and unevenly distributed. Transformative change in biodiversity governance, therefore, depends on rebuilding trust, addressing structural inequalities, aligning policies with lived realities, and supporting those locally grounded initiatives that already combine ecological restoration with social meaning and economic viability. By following the trajectory from transformative innovations (D2.2), through socio-ecological system analysis (D2.3), to locally tested interventions (D2.4), Romania's case study contributes to BIOTraCes by illustrating how plural knowledge systems, co-produced evidence, and collaborative governance can open pathways towards more nature-positive and socially just rural futures.

2. Research Methods and application of PAR

2.1 Role of the societal partner

The Romanian Local Action Group (LAG, GAL in Romanian) "Dealurile Târnaveilor" was established in 2007 as part of the LEADER program. Its mission is to encourage the socio-economic and cultural development of the Mureș and Sibiu counties. The group collaborates with public and private organizations to develop a local strategy. Key objectives include enhancing tourism, preserving historical landmarks, and promoting the cultural heritage of ethnic minorities. The group also focuses on sustainable farming, agro-tourism, and creating value-added agricultural products. Among the region's highlights are delicacies like rhubarb jam, elderberry syrup, and the flavorful raw-milk cheese from Saschiz – local treasures that exemplify the area's culinary richness. The group, now consisting of 47 members, includes eight public sector representatives, 14 private sector actors, 12 Non-Governmental Organizations (NGOs), and one key figure relevant to the region. The societal partner, GAL Dealurile Târnaveilor, plays a crucial role in the research process. Based on the Biotraces project, we have signed a contract with the GAL. Based on this, GAL was committed to organizing workshops in the study region. Their engagement goes beyond a consultative or advisory role. Instead, they actively co-research through direct participation in workshops, collaboration in relationship mediation, and facilitation of connections between the research team from UBB Cluj and local community members. Their dual role as facilitators and participants exemplifies a participatory and collaborative approach. This level of involvement enables societal partners to contribute insights from their lived experiences and local knowledge, enriching the research outcomes. GAL also co-authored a joint research paper (Reti et al., 2025) with insights from the workshops.

2.2 Collaborative Research and Application of PAR

The six workshops held in Saschiz and other localities of the GAL Dealurile Târnaveilor area were structured to encourage the active involvement of community members and societal partners. The approach allowed for a two-way knowledge exchange. The community members shared local ecological knowledge, while the researchers introduced theoretical frameworks such as systems thinking and systems dynamics to support an integrated analysis of High Nature Value farmland (HNVf) loss (e.g., we captured the direct and indirect causes of HNV farmland loss). The role of PEPE principles in simplifying complex concepts and engaging participants highlights the project's effort to promote accessibility and inclusiveness. By breaking down these concepts into understandable language and using tangible examples, the project effectively fostered the participation of community members, including GAL members and residents.

Deviations from the classic PAR approach: Certain deviations were necessary due to contextual factors. Traditional PAR typically requires continuous and sustained involvement from the community throughout all phases of the research. In this project, however, the following deviations were observed: a) temporal flexibility: The agricultural calendar constrained participation in workshops. Local people in some villages had limited access during the summer due to fieldwork. As a result, the engagement strategy had to be flexible and respectful of local time constraints; b) Selective participation: Stakeholders from all six villages could not be involved throughout the entire research process (preliminary meetings when we explained the project objectives, variables that we included in the questionnaire were held with the most representative people of GAL). The deeper engagement of specific GAL members (who are also community members) reflects a selective but impactful approach. This was a pragmatic decision to ensure sustained involvement from key local stakeholders actively engaged in the process; c) Adaptation of conceptual tools: By converting PEPE principles into accessible concepts, the researchers shifted the traditional approach of information exchange in PAR. The societal partner, GAL Dealurile Târnaveilor, has a vital role in the research process. Based on the Biotraces project, we have signed a contract with GAL. Based on this, GAL is committed to organizing workshops in the study region. Their engagement goes beyond a consultative or advisory

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2.3 Triangulation

Quantitative survey

The quantitative component of the study consisted of a national survey, reported in Petrescu-Mag et al. (2025), which collected 1,007 valid questionnaires through a specialized survey company. The questionnaire was administered online using a nationally representative sample of Romania's adult population (18+), stratified by age and gender.

Co-design of the questionnaire: The questionnaire was co-created with the social partner through two workshops held in the summer of 2023. During these meetings, researchers and local stakeholders discussed which variables would be most relevant and valuable to local communities and the project's objectives. Given that the study area overlaps with High Nature Value (HNV) farmlands and is also a popular tourist destination, it was agreed that the key outcome variable would be tourists' intention to visit an HNV rural area for a biocultural experience (TBCEHNV). This focus ensured that the research addressed both biodiversity conservation and sustainable rural development concerns simultaneously. The database with the variables used to explore the intention to have a biocultural tourist experience in HNV farmland was uploaded to Zenodo (Babes-Bolyai University, 2024).

Theoretical framework and model design: The survey was grounded in the Theory of Planned Behavior (TPB; Ajzen, 1991), which served as the primary theoretical framework for predicting respondents' intention to spend at least 2 nights in an HNV area for a biocultural experience. TPB was selected based on several strengths highlighted in the scientific literature on biodiversity-related behavior: a) Established theoretical framework: TPB is widely used and well recognized, ensuring conceptual consistency and comparability with other studies; b) Strong predictive power: TPB enables the estimation of how likely certain variables are to influence behavioral intentions; and c) Flexibility: TPB can be adapted to a wide range of behaviors and contexts, including conservation-related tourism and sustainable practices.

To better capture the social complexity of biodiversity-related decision-making, Ajzen's original TPB model was extended with additional variables inspired by: The PEPE framework (pluralizing, empowering, politicizing, embedding); and concepts related to human-nature relationships (Chan et al., 2016). In addition, the questionnaire included items that measured respondents' perceptions of biodiversity status and short- and long-term trends, integrating societal understanding of nature loss into the predictive model. These perceptions also informed the Participatory Action Research (PAR) process.

Data analysis: Partial Least Squares Structural Equation Modeling (PLS-SEM) was used to estimate relationships among variables and identify the strongest predictors of intention to engage in a biocultural tourism experience in HNV areas. This method allowed for: i) Testing complex causal relationships; ii) Assessing the explanatory power of the model; and iii) Identifying leverage points for policy intervention and stakeholder engagement.

The qualitative part of our research involved workshops and interviews with local people in the study area (as detailed in the subsection below, "Deliberative workshops"). We initially intended to use system thinking and community-based system dynamics (CBSD) as the conceptual framework. However, CBSD is not set in stone because specific methodological changes may occur along the way, depending on participants' availability, openness, and other factors. We initially opted for CBSD because it is a participatory methodology that involves community members in understanding a system. Furthermore, we selected it because the CBSD approach recognizes that communities possess valuable

knowledge and experience about the systems in which they live and work, which can be leveraged to improve the system's performance. We first tested CBSD to evaluate its suitability for our case study. Therefore, we applied PAR by engaging key informants in workshops to co-develop causal-effect diagrams, thereby fostering a shared understanding and local solutions to land degradation (LD). Its strengths included empowering participants and generating context-specific insights, but limitations arose from potential biases and challenges in reaching a consensus. The process involved consensus-building exercises and iterative model validation, which required substantial time commitments from researchers and community participants. This could deter participation, especially from those with limited availability. The results of this "experiment" can be found in Petrescu-Mag et al. (2024). Consequently, the original plan to use CBSD was abandoned because it mainly required significant time commitments:

- i) Time constraints also imposed by stakeholder summer agricultural activities: The original plan to use CBSD was abandoned because it required considerable time commitments from the research team and community members. CBSD involves consensus-building, iterative discussions, and multiple rounds of validation, which would have required repeated community involvement. This process was considered too time-intensive, especially since many participants (local farmers) had limited availability due to seasonal agricultural work.
- ii) Adaptation of workshops: To address this limitation, the UBB research team used a more time-efficient approach based on system thinking principles but without requiring multiple iterations of "real" model validation, as needed in CBSD. This approach achieved similar objectives but required fewer commitments from the participants.
- iii) Co-creation approach: The workshops were still collaborative and participatory but did not follow the full CBSD protocol. Instead, the workshops adopted a co-creation and reflexive approach, in which participants were asked to identify causes, effects, and solutions to HNVf loss, similar to what would be done in CBSD. Instead of iterative model validation (a key step in CBSD), the researchers analyzed the participants' input after the workshops. However, by maintaining the PEPE principles and creating, based on participants' inputs and visual graphics/models, the research team retained a strong participatory focus.

The triangulation of methods (co-creation & deliberative workshops, survey) and theoretical frameworks (TPB, system thinking) enabled UBB to obtain a more integrated analysis of, e.g., biodiversity loss in HNVf. Integrating qualitative (workshops) and quantitative (survey) methods ensures the reliability of the findings. The change from CBSD was a strategic response to logistical constraints, while maintaining methodological rigor. The shift enabled the team to strike a balance between efficiency and depth. This adaptive approach contributed to community engagement and produced insights aligned with PAR principles of co-creation and stakeholder empowerment.

Deliberative workshops

The Romanian team developed and shared a workshop guide with the consortium to ensure a consistent methodological approach. The whole workshop script is documented in Reti et al. (2025) (see Annex 1 of the study).

Purpose of the workshop guide: The workshops aimed to explore how local communities perceive nature, its vulnerability, and the consequences of biodiversity loss for their livelihoods and well-being. The objective was to understand local narratives, values, and perceived future trajectories of biodiversity in High Nature Value (HNV) rural landscapes.

Conceptual approach: Rather than relying on traditional conservation discourse that emphasizes "loss", "decline", or "degradation", the workshop adopted a vulnerability-based framing. This approach was designed to avoid presuming environmental deterioration and instead encouraged participants to reflect on:

- a) *Vulnerability*, by identifying potential threats without assuming degradation;
- b) *Probability of change*, by assessing the likelihood of shifts in biodiversity and Nature's Contributions to People (NCPs);

- c) *Flexibility in perspectives*, allowing participants to express whether or not they perceived vulnerability in their landscapes.

This framing was particularly relevant for Central Romania, where natural capital remains relatively strong, while social, human, and financial capital have experienced significant erosion.

Implementation: The workshops were organized by the societal partner (LAG/GAL) in six villages in June 2024. All sessions were audio-recorded for analysis, and ethical approval was obtained from the Babeş-Bolyai University Ethical Committee before data collection. Key concepts were explained to participants to ensure a shared understanding and informed discussion.

Themes explored: Discussions were structured around four core themes that guided both workshop conversations and the design of the survey questionnaire:

Theme 1: Definition and importance of nature

Participants were invited to define what “nature” means in their local context.

Examples of related questions included:

Workshop: “What does nature mean for local people?” and “Please co-define nature from the perspective of the local community.”

Survey: “What is the current state of biodiversity in High Nature Value rural landscapes in Romania?”

Theme 2: Human–nature connections and vulnerability

This theme explored perceptions of how people and nature interact and the degree to which nature is considered vulnerable.

Workshop: “How vulnerable is nature in your region?” and “What are the drivers of change related to people and the environment?”

Survey: “The socio-cultural, economic, and natural values in High Nature Value rural landscapes are closely interconnected and should be addressed together to ensure a sustainable future.”

Discussions addressed both environmental pressures and social drivers, including land abandonment, overuse, and governance challenges.

Theme 3: Consequences of biodiversity loss for local communities

Using the PEPE framework, the discussions examined the implications of biodiversity loss through four perspectives:

Empowering – identifying who gains and who loses from biodiversity decline;

Politicizing – considering how local political agendas shape conservation outcomes;

Embedding – exploring ways to integrate agriculture, nature, and tourism;

Pluralizing – capturing diverse perspectives across stakeholder groups.

Example questions included:

Workshop: “What are the consequences of biodiversity loss for local communities?”

Survey: “What do you think is the short-term (1–10 years) and long-term trend (more than 10 years) of biodiversity?”

Theme 4: Future challenges, action, and governance

Participants discussed obstacles to maintaining rich biodiversity and the future of High Nature Value farmlands.

Workshop: “What are the major obstacles to maintaining biodiversity in the future? How can we overcome them?”

Survey: “Who can contribute to improving biodiversity, and how important is the involvement of different stakeholders?”

This theme also addressed: Governance challenges; Structural lock-ins limiting change; The role of trust and social cohesion in enabling collective action; Measures for stakeholder mobilization and empowerment.

Cross-cutting themes: Across all discussions, particular attention was paid to: The cultural and economic values of nature; The role of tourism and biocultural heritage; Perceived power relations among actors; Individual and collective responsibility for conservation.

Overall, the workshops created a space for reflective dialogue, enabling participants to articulate concerns, express hope, and propose pathways to sustain biodiversity in their local communities.

3. Case Study Contextualization

3.1 Multidimensional Presentation²⁵

Geographical location. The Romania team's study area is Saschiz (part of the Saxon villages). Saschiz is situated in the Hârtibaci Plateau, Romania's second-largest protected area, after the Danube Delta Biosphere Reserve. It is located in the center of the country, in the southern part of Transylvania, bordered by the Târnava Mare River to the north and the Olt River to the south.

Demographic characterization. Saschiz has a population of approximately 1,965 inhabitants, predominantly Romanian (82.29%), followed by minorities such as Roma (8.96%), Germans (3.05%), and Hungarians (2.09%). Another 3.31% of the population has not declared their ethnicity. Demographically, the commune faces an aging population (64%) and depopulation, driven by the migration of younger people to urban areas in search of better economic opportunities. This trend negatively impacts the availability of labor for agricultural and biodiversity conservation activities. The religious structure of the population is determined by its ethnic composition and has undergone significant changes over the last 50 years. At the most recent census, most of the population identified as Orthodox Christians (over 88% of the total population, compared to 46.5% in 1900). In addition, there are Reformed Christians (1.2%) and Pentecostal/Evangelical Christians (1.7%). The number of the latter group increased from 1 in 2002 to 34 in 2012, while the number of Roman Catholics decreased from 22 to 6. In the case of the commune of Saschiz, a high percentage of the population is "dependent", either on other individuals, the state, private organizations, or various other economic circumstances, representing 50% of the inactive population. This significant portion of the total population represents a real potential labor force, provided the necessary measures are taken to utilize it for the economic development of the commune.

Cultural characterization. Saschiz is recognized for its rich cultural heritage, including a fortified Gothic church and traditional Saxon architecture. Local traditions, such as manual haymaking and communal grazing, have been integral to the community's life for centuries. However, modernization and economic changes have led to the decline of these practices, threatening the local cultural identity. Cultural events, such as the Rhubarb Festival, are recent initiatives that promote the region's uniqueness and attract tourists interested in the combination of nature and heritage.

Economic characterization. The lack of favorable economic measures for the commune's development is reflected in the evolution of the unemployment rate. During the interval between the last two censuses, the unemployment rate in the commune of Saschiz decreased due to national economic growth. However, after 2011 (when there were approximately 100 unemployed individuals in Saschiz), the unemployment rate experienced a significant increase due to the generalized economic crisis, reaching approximately 150 unemployed individuals in 2014. To address this situation, it is necessary to diversify economic activities, which would offer better-paying jobs than those in the agricultural sector. The economy of Saschiz is predominantly agrarian, relying on subsistence farming and animal husbandry. Most households depend on their own gardens and small-scale agricultural production. Recently, the commune has experienced economic diversification through the development of ecotourism, which emphasizes the valorization of natural and cultural heritage. Projects such as establishing cycling trails and promoting local products (e.g., rhubarb) support sustainable economic development. Nevertheless,

²⁵ Data for this chapter (e.g., figures, descriptive indicators) were extracted from the following official documents:

***, 2023. Annex. Update of the General Urban Plan and Local Urbanism Regulations for the commune of Saschiz, Mureș County. Available at: <https://sgg.gov.ro/1/wp-content/uploads/2023/03/Anexa-Partea-1.pdf>.

***, 2022. Annex, Volume I, available at:

https://sgglegis.gov.ro/legislativ/docs/2022/12/4x_8zkhmrswybd0gn13f.pdf

challenges such as limited access to funding, insufficient subsidies, and excessive bureaucracy persist, hindering locals' ability to capitalize on available resources.

Environmental characterization. Saschiz is part of the Natura 2000 network, situated in an area of high biodiversity, which includes semi-natural meadows and forests. The administrative territory of the commune is included in the special avifauna protection area ROSPA0099 Podișul Hârtibaciului, covering 52% of the administrative territory (according to Government Decision no. 1284/2007 regarding the designation of protected areas). These habitats support a diverse range of protected species, including wildlife and rare plant species. Agricultural traditions, such as manual haymaking and extensive grazing, have contributed to the maintenance of high-value natural landscapes. However, the abandonment of farming lands and changes in land use represent significant threats to biodiversity. Saschiz also serves as an example of integrating conservation practices into economic development through ecotourism projects promoting sustainable tourism and the conservation of natural heritage.

Still, there are risks that may arise for the Natura 2000 sites that include areas within the territory of Saschiz commune are as follows: Deforestation: Clear-cutting and forestry operations resulting in large-scale tree felling; selective cutting of old trees or specific species; Uncontrolled tourism; Forestry activities and tree cutting during the nesting period of endangered species; Hunting during nesting periods: Disturbance and noise caused by hunters; hunting in the nesting areas of endangered species; poaching; practicing extreme sports; destruction of nests, eggs, or chicks; disturbance of birds during nesting; trapping birds; removal of chicks for illegal trade; Afforestation with non-native species (e.g., acacia, tree of heaven, ash); Afforestation of natural or semi-natural areas, such as hay meadows; Uncontrolled proliferation of invasive species; industrialization and urban expansion; Electrocution and collision on power lines; Intensification of agriculture; Changes in semi-natural habitats (e.g., hay meadows, pastures) due to the cessation of agricultural activities such as mowing or grazing; Mowing during the nesting period; mowing too early.

3.2 Key Actors and their Impact on Worldviews

The RO case study features a complex network of social and ecological actors interacting within the socio-ecological system. These actors include human stakeholders from diverse economic, political, and civil society groups (they participated in the workshops based on a contract that we signed with the LAG. They committed to organizing these meetings in the study region), as well as the more-than-human ecological elements such as flora and fauna.

More in detail, the workshops brought together a diverse range of professional categories, ensuring a holistic approach to addressing socio-ecological challenges. Participants included farmers, retirees, and representatives from public administration, such as urban planning specialists, city hall officials, and a deputy mayor. Forestry professionals were well-represented, with foresters, forestry office representatives, and the head of the Forestry Department from Sighișoara in attendance. Academia and education were also represented by a master's student, an anthropologist, and a biologist with a PhD. NGO representatives from organizations such as ADEPT Transilvania and MET contributed to the conservation and sustainability expertise. At the same time, tourism professionals, including a destination manager for Colinele Transilvaniei, the manager of a Local Action Group (GAL), and the camping owner, highlighted eco-tourism opportunities. Additionally, cultural and community voices were represented by a GAL representative, homemakers, and a priest's spouse with a background in biology. This diverse group reflects the multifaceted nature of the socio-ecological system in the RO case study.

Participants across the workshops associate “nature”²⁶ with essential elements like water, forests, and meadows, as well as a source of cultural and emotional value. A Saschiz participant stated, **“For me, nature means water. Without water, everything stops, both for us and the animals”**. In Mălâncrav, nature is described through its tangible resources and recreational adaptations: **“Recreational ponds have emerged in recent years, and they’ve become gathering places for the community”**. In Soard, one participant emphasized the aesthetic and therapeutic qualities of natural pastures, saying, **“On a pasture, there is no color left by God that you won’t see there. It’s like therapy to stay in such a place”**. Nature was also framed in terms of specific species and the richness of ecosystems. In Saschiz, a participant highlighted the importance of local flora and fauna, such as **“Rușcuța de primăvară [spring adonis], deer, wild boar, and many birds that bring life to the area”**. In Soard, traditional farming practices were praised for supporting biodiversity, with one participant stating, **“Where you see cows grazing, you’ll see wildflowers, birds, and even rabbits”**.

Ecological degradation. The workshops consistently identified human practices, climate impacts, and land abandonment as key drivers of ecological degradation. A Soard participant remarked on climate effects: **“The ground dries up, even after it rains, there are cracks in the soil, and the grass doesn’t grow as it used to”**. Overgrazing emerged as a concern in Saschiz, where a participant noted, **“The sheep are left unsupervised, and they destroy the vegetation by eating everything, even the roots”**. In Mălâncrav, land abandonment was described as a major issue: **“If people stop mowing and grazing, shrubs take over, and we lose the beautiful meadows”**.

Ecological restoration and regeneration. Restoration efforts are linked to balancing traditional practices with modern conservation needs. In Saschiz, a participant suggested a blend of approaches: **“Selective mowing and grazing need to be planned. It’s not just about cutting the grass; it’s about cutting it the right way”**. In Soard, natural regeneration was emphasized, with one participant stating, **“Forests recover on their own when we stop cutting everything. Fallen trees become homes for insects and birds”**. In Mălâncrav, the restoration of abandoned orchards was viewed as a vital community project: **“Bringing back the orchards will help the landscape and give people something to work with”**.

Local framing of biodiversity challenges. The biodiversity challenge is framed around the tension between economic survival and conservation. Key narratives include:

- i. **Sustaining traditional practices.** In Soard, the role of traditional land use was repeatedly emphasized: **“When people mow by hand, they leave some flowers for the bees and don’t harm the birds”**. Conversely, mechanization was seen as both necessary and harmful, as expressed in Saschiz: **“People have to use machines now; it’s faster, but it doesn’t leave anything behind for the soil”**.
- ii. **Overgrazing and land management:** In Saschiz, a participant criticized the lack of control in sheep grazing: **“Shepherds don’t manage their flocks like they used to, and the land suffers because of it”**.
- iii. **Economic pressures and migration:** Economic instability drives land abandonment, as noted in Mălâncrav: **“Young people leave because they don’t see a future here. That’s why the fields are left empty”**.

Differing perspectives and narratives. The workshops revealed contrasting views depending on the stakeholder group:

²⁶ This question about how stakeholders understand nature was covered by Theme 1. Co-defining “biodiversity” from our workshop script (Annex 1 in Reti et al. 2025). Through this exercise, participants had the opportunity to express their understanding of what “biodiversity” means to them and co-define conceptualizations of biodiversity. We used “nature” because it is culturally closer to the local community than the more abstract “biodiversity”. Similarly, the term “ecosystem” will be avoided for the same reason (Peterson et al., 2018).

Farmers and residents: Farmers emphasize balancing productivity with conservation. A Saschiz farmer expressed this dilemma: **“We need to feed our families, but we also want to leave the land healthy for our children.”**

NGOs: prioritize the protection of habitats and species, often advocating for stricter regulations. In Soard, a conservationist stated, **“Without rules to limit grazing and fertilizers, the steppe grasslands won’t recover”**.

Local authorities: Authorities focus on finding compromises between economic development and biodiversity. A Mălâncrav official noted: **“We need solutions that keep people here but also keep the landscape intact. Tourism might help”**.

The local framing of biodiversity challenges reflects a rich interplay of ecological, economic, and cultural factors. While all stakeholders recognize the importance of nature and biodiversity, their priorities differ based on their roles and experiences. Farmers focus on balancing livelihoods with sustainability, NGOs emphasize habitat protection, and authorities aim for integrated solutions.

3.3 Biodiversity Loss Factors

Our case study focuses on High Nature Value (farming)=agricultural areas dominated by semi-natural vegetation that support high biodiversity, including habitats and species of national and international conservation concern. HNVf are affected by overgrazing, particularly of sheep, and the decline/ abandonment of traditional land management techniques. High Nature Value Farmlands (HNVF) are situated in rural areas where conventional farming is the main economic activity and a key factor in nature conservation. They are characterized by natural and semi-natural vegetation (grasslands), including natural structural elements (such as field margins, hedgerows, stonewalls, patches of woodland or scrub, and small rivers) and patches of arable land and orchards. Since the area's biodiversity is dependent on traditional land use methods, changing land use will result in the degradation of biodiversity and the loss of many threatened species of flora and fauna.

Our project area is represented by the farming landscapes of eight neighboring communes and the villages within their administrative units, as presented in the project description. The area covered by the project is one of the most studied areas from an ecological and social-ecological perspective from Central and Eastern Europe. The publications raised within the project “Sustainable landscapes in Central Romania” (led by Prof. Joern Fischer, Leuphana University and where Tibor Hartel was a postdoctoral researcher) from 2011 to 2018, can be seen on this website: <https://peisajesustenable.wordpress.com/>. The region was formally studied after the end of the above project by another project of Leuphana University, see some selected papers in this link: <https://leveragepoints.org/materials/papers/>) and the project “Transylvanian wood-pastures” (led by Tibor Hartel, with publications available here: <https://transylvanian-wood-pastures.eu/en/publications/>).

The environmentally friendly, often traditional farming system maintained exceptional biodiversity in these landscapes, from many rare plants, butterflies, amphibians, birds, and large carnivores (Dorresteijn et al., 2014; Hartel et al., 2010; Hartel et al., 2013; Loos et al., 2014; Loos et al., 2015; Roelling et al., 2024; Valkó et al., 2016). Even more, the farming practices and the legacy of the centuries extended communal land management (of the pastures and forests) together maintained ancient landscape elements such as wood-pastures and coppice forests (Hartel et al., 2013; Moga et al. 2016) as well as ecologically optimal conditions (i.e., habitats, structural gradients in vegetation complexity, landscape structural features) and a substantial natural capital (Dorresteijn et al., 2010). Notably, natural capital was identified as one of the strongest forms of capital assets for the target region, the other forms of capital (e.g., human, social, technological, financial) being eroded by the geopolitical instabilities of the recent past (Hartel et al., 2016; Mikulcak et al., 2015). While the Traditional Ecological Knowledge underpinning land

use and farming practices is still rich, most farmers' socio-cultural and economic aspirations do not support the long-term persistence of TEK and related practices. Notably, the TEK and traditional life forms are increasingly associated with a lack of opportunities, entitlements, and poverty, leading to a situation described by Hartel et al. (2013) as "the TEK conundrum". Nevertheless, multiple alternative futures can plausibly be attained by the different settlements of the study region, the significant uncertainties driving the future being the national and supranational policies relevant for shaping the local economies (i.e., toward "green" or towards the "conventional") and at the local scale, the capacity of the local communities to capitalize on whatever opportunities emerges (for further details see Hanspach et al., 2014).

Table 8 - Presents the list of ecosystem types involved, along with the main degradative processes (ongoing and to be halted) or regenerative processes (ongoing and planned). Types of biodiversity changes in the RO case study

Ecosystem type	Degradative processes to be stopped	Regenerative processes (to be fostered and expanded)
Grasslands (pastures, hay meadows)	Overgrazing by sheep is driven by CAP incentives and the significant international demand for meat (e.g., in Arabic countries), which affects both pastures and hay meadows. Abandonment of hay meadows and/or their conversion into pastures. Removing scattered trees and shrubs from pastures is an emerging, ecologically unmeasurable activity, but from a future perspective, it is worrying. Reduction of the livestock types used for grazing and pasture types. Economically profitable modern cattle breeds have been established. Drought affects the wetlands on the pasture, which are exacerbated by drainage ditches (both past and present). Water resources for livestock are drying in several pastures. Grazing and extreme heat in interaction represent a vast and novel harshness that farmers also recognize. Land abandonment over the past three decades, especially in more remote villages, can hurt certain biodiversity elements (e.g., grassland and related species), but can benefit others (e.g., brown bears). The establishment of electric fences, especially since 2015, has become visible. Currently, approximately 25% of the 130 wood-pastures surveyed in 2022-2023 have electric fences, while a subset of 50 wood-pastures from the same sample, surveyed from 2011 to 2012, had no electric fence. The reasons for fence establishment, according to farmers, are (i) the lack of good shepherds, (ii) the availability of relatively cheap fences in the market, (iii) the increasing activity of large carnivores on pastures, and (iv) Governmental support for fence installation. Predictably, fencing the landscapes will initiate a new regime shift that cascades throughout the entire social-ecological system.	The still good condition of the natural capital allows regenerative processes to be identified in virtually every village. The scattered trees and shrubs serve as ecological regeneration nuclei, helping to maintain a climate-resilient farming system. The still healthy soils allow new capitalization opportunities, e.g., on carbon markets and bio products. The rich diversity at the marginal parts of every managed pasture allows capitalizing on new opportunities to reconcile production and nature conservation. The existing wetlands allow opportunities to recognize and protect them. The scenic beauty of the pastures can be capitalized for their maintenance, e.g., via local tourism and brands.

	The start of adopting large machinery for land leveling and tree stump removal (approximately 5% of the pastures at this moment), but before 2015, such a phenomenon was not observed.	
Forests	The overall state of the forests in the project area is still good. No imminent threat can be enumerated.	Forests possess every key feature that contributes to high natural and cultural values, including old trees, dead trees, hollowed-out trees, high tree diversity, and an ecologically and biologically healthy age distribution. This applies to each of the settlements covered by our current project.
Crop fields	They represent a minor proportion of the targeted area (i.e., less than 10%). The small agricultural parcels and the geomorphological contexts result in no imminent threat from intensification. However, aspirations towards modern intensification are present at the level of farmers (see also those described in the pastures above).	Maintaining still uncompacted and agrochemical-free soils, along with traditional farming practices, are key regenerative elements for these.
Landscape scenery	Expanding infrastructure, modern structures, and buildings into ancient farming landscapes is a growing concern.	Traditional landscape features are present at every settlement within the project area. A clever landscape design can, therefore, maintain them. However, weak institutions, a lack of robust formal knowledge, and corrupt intent undermine such a landscape design (even if it were realized, i.e., in the form of a document, the authorities would most likely not formally adopt it for implementation).
Large carnivores, notably the brown bear	Healthy populations also show increasing trends. The increasing presence of roaming individuals around human settlements increases human-carnivore conflicts. The situation escalated after 2016.	Land abandonment (and the subsequent scrub encroachment) and the villages' depopulation are essential hypotheses for the expansion of bears towards people.
Invasive plant species (non-autochthonous)	The abandonment of fields led to the rapid establishment of <i>Solidago canadensis</i> in former arable lands. Furthermore, the <i>Robinia pseudoacacia</i> , established in the past century, can also represent local challenges for nature conservation.	Maintaining healthy native ecosystems and unfragmented native vegetation covers is a key ecological means to control the spread of exotic plants.

While the natural capital still bears the legacies of traditional forms of land use and land tenure, the diversity of human-nature connections is rapidly changing in the project region (Balázsi et al., 2019; Fischer et al., 2022; Hartel et al., 2020; Horcea-Milcu et al., 2017). According to our current understanding, social-ecological system changes are primarily driven by the social system subcomponent (along the axis of values, ownership, practices, and aspirations). In contrast, the ecological subcomponent shows some time lags of decades.

In the following section, we summarize the key factors contributing to biodiversity loss. This subsection highlights a critical juncture for biodiversity conservation in High-Nature-Value Farmlands. Addressing direct drivers such as overgrazing, land abandonment, and invasive species is essential. Simultaneously, tackling indirect socio-cultural, political, and institutional drivers is crucial to creating sustainable futures. Strengthening local governance, aligning policy incentives with conservation goals, and fostering socio-

economic systems that value TEK and biodiversity are key to reversing biodiversity loss and ensuring long-term ecological resilience.

Short-term trends: Despite the persistence of traditional ecological knowledge (TEK), socio-cultural and economic aspirations are increasingly undermining traditional practices, thereby accelerating biodiversity decline.

Long-term trends: The stability of biodiversity is threatened by the abandonment of traditional practices, overgrazing, and land-use changes driven by modernization. The gradual erosion of TEK and related communal practices compounds the challenges of biodiversity conservation.

Biodiversity challenges in the RO Case Study. The primary difficulties affecting biodiversity in the study area are:

1. Direct drivers: Overgrazing, mainly by sheep, leading to habitat degradation; Land abandonment, reducing human stewardship of biodiversity-rich landscapes; Infrastructure expansion and land-use intensification; Invasive plant species outcompeting native flora.
2. Indirect drivers: Socio-cultural changes, including the perception of TEK as outdated and tied to poverty; Political and institutional factors, such as CAP incentives that promote practices harmful to biodiversity; Economic pressures driving farmers toward intensive, modern agriculture; Weak governance and institutional support for traditional landscape management; Identity-related factors: Loss of community stewardship: Communal land management, once central to the region's identity, has declined, eroding collective responsibility for biodiversity.

Historical and mechanistic dynamics

Historical context: Biodiversity in this region has been sustained by centuries of traditional land use and communal management. However, geopolitical instability and modern economic pressures have eroded these practices over the last decades.

Mechanisms of change: Socioeconomic pressures push farmers toward modern, intensive agricultural systems; policy frameworks often fail to align incentives with biodiversity conservation; and time lags in ecological responses mean that the impacts of current land-use changes may not be fully realized for decades.

The perceived biodiversity loss factors (the most voiced causes) by workshop participants are illustrated in Table 9.

Table 9 - Perceived biodiversity loss factors: insights from the workshops

Community name	Factors of biodiversity loss and associated quotes
APOLD	1 Use of chemicals in agriculture <i>"Strictly referring to what is happening here in Apold, we could say that chemicals are being used in agriculture more than in previous years, and this is happening everywhere."</i> Mechanization of agriculture and the disappearance of traditional farmers <i>"Mechanization of agriculture".</i>
BIERTAN	1. Burning of vegetation and waste <i>"Burning of vegetation"</i> 2. Use of chemicals in agriculture <i>"And if it's possible without pesticides... I think nothing is done in the garden without pesticides anymore."</i>

	Mechanization of agriculture and land abandonment <i>"Mechanized work"; "Nobody mows with a scythe anymore".</i>
BOIU	1 Global climate changes felt at the local level <i>"Climate changes".</i> 2 Change in the way people use resources <i>"The way people use resources has changed; they no longer rely on natural ones but intervene artificially, whether we are talking about cleaning products or treatment solutions for various things. Our input has changed... we don't make homemade soap anymore".</i> 3 Mentality – Perception of agriculture <i>"It has multiple facets, but first, education is not done correctly; it leans more towards the economic side. "The focus is on immediate profit." "In school, we don't have an education focused on protecting our future. That's one thing; another is the family. There's no family education anymore. Families think about what's best for their children: I don't want agriculture." "They don't want it, but that's where their food comes from" "Agriculture is hard work."</i>
MALANCRAV	Irresponsible drilling and lack of rainwater collection <i>"The problem is that drilling is done irresponsibly, and rainwater is not collected. This is an issue because, in the long run, we will run out of water if we continue to consume without developing alternative solutions. Everyone complains that there is less and less water, but no one wants to do anything about it."</i>
SASCHIZ	Intensive farming and lack of crop rotation <i>"Corn everywhere. And, in my opinion, it's a bit exaggerated. I see it with my father-in-law, for 20 years on the same plot, he has planted only corn, corn, corn."</i> Declining water levels due to drought and lack of healthy maintenance <i>"They haven't taken care of them." "And they haven't bothered to clean them... but the level has dropped, even in the wells. You know, it's a drought problem."</i> Human-bear conflict <i>"Well, I say it's worth it, at least from a tourism perspective. In Germany, there are only two bears in the entire country. The bear always has multiple sides (...) Often, conflicts among people about bears are more intense than the conflicts themselves. People argue and become more tense (...) I always say that if you don't provoke the bear, it won't attack you. That's clear." "Some people here say that the bears in this area are smaller than the big bears in other regions, and that's why they aren't as scared. Is that true? Have you seen bears around here?"</i>

Cross-analysis of biodiversity loss causes: Local perceptions vs. scientific findings

This analysis compares the local perspectives on biodiversity loss with the factors identified in the scientific literature, highlighting commonalities, discrepancies, and additional insights. This cross-analysis highlights the convergence of scientific research and local knowledge on key drivers of biodiversity loss, including land abandonment, intensive farming, climate change, and water scarcity. However, it also reveals gaps – scientific studies emphasize overgrazing and TEK loss, while communities focus more on immediate agricultural shifts, economic pressures, and human-wildlife conflicts. We also have to

consider the non-generalizability of the workshop findings to the entire geographical area. The results reflect the specific perspectives and experiences of the participants involved and may not fully capture the diversity of environmental and socio-economic conditions across the broader region.

I. Overlapping causes: Agreement between scientific literature and local perceptions

Both scientific studies and local communities recognize several major causes of biodiversity decline. These include:

a) Land abandonment:

Scientific perspective: Land abandonment reduces human stewardship over High Nature Value Farmlands, leading to habitat degradation.

Local perspective: This is noted in Biertan and Soard, where mechanization and urban migration contribute to the abandonment of fields and subsequent changes in vegetation, including the encroachment of shrubs.

b) Intensive farming practices and chemical use:

Scientific perspective: Agricultural intensification, including monocultures and pesticide use, diminishes biodiversity.

Local perspective: Apold and Biertan report increased pesticide use, with concerns that “nothing grows in gardens without pesticides anymore”. Saschiz highlights monoculture farming, particularly excessive corn cultivation.

c) Water scarcity and resource exploitation:

Scientific perspective: Overextraction of water resources, combined with climate change, threatens biodiversity.

Local perspective: Malancrav highlights irresponsible groundwater extraction and a lack of rainwater collection, while Soard and Saschiz discuss declining wellwater levels resulting from drought and inadequate maintenance.

d) Climate change impacts:

Scientific perspective: Climate shifts contribute to biodiversity loss by altering habitats and species distributions.

Local perspective: Boiu and Soard highlight the visible effects of climate change, with drier conditions impacting species such as ash trees.

e) Weak governance and policy misalignment:

Scientific perspective: Agricultural policies (e.g., CAP incentives) often promote harmful practices rather than conservation efforts.

Local perspective: While not explicitly framed as a policy issue, locals in Boiu mention how economic pressures and lack of education shift priorities away from sustainable agriculture.

II. Differences in perception: Where science and local knowledge diverge

While there are substantial areas of alignment, some differences emerge between scientific findings and community views:

i) Traditional Ecological Knowledge (TEK) and community stewardship

Scientific perspective: The decline of TEK and communal land management is a key driver of biodiversity loss.

Local perspective: This is less explicitly acknowledged. However, Boiu touches on the erosion of agricultural traditions, where farming is increasingly seen as undesirable work rather than a valued practice.

ii) Overgrazing and habitat degradation

Scientific perspective: Overgrazing, mainly by sheep, leads to biodiversity loss.

Local perspective: This issue is not explicitly mentioned, suggesting that overgrazing is not perceived as a primary local problem despite its documented ecological effects.

iii) Invasive species

Scientific perspective: Invasive plants threaten native biodiversity by outcompeting local flora.

Local perspective: The lack of significant mention of invasive species indicates either a lack of awareness or a lower immediate concern in the studied communities.

iv) Human-wildlife conflict

Scientific perspective: This factor is not emphasized in the literature as a primary driver of biodiversity.

Local perspective: Saschiz highlights human-bear conflicts, which may impact local perceptions of wildlife conservation efforts.

v) Additional causes identified by local communities

The following drivers of biodiversity loss appear in local accounts but are not strongly emphasized in the cited scientific literature.

Burning of vegetation and waste: This practice, as mentioned in Biertan, contributes to habitat destruction and soil degradation.

Mentality and agricultural perceptions: In Boiu, concerns are raised about the negative perception of agriculture, where younger generations are discouraged from farming. While indirectly related, this cultural shift can influence land abandonment and agricultural intensification.

Economic pressures and profit-driven farming: Locals in Boiu emphasize how financial constraints push farmers towards intensive, unsustainable agriculture, aligning with but adding nuance to the scientific view on economic drivers.

3.4 Culture-Based Dynamics

The diversity of values and knowledge systems in the communities studied shapes relationships with biodiversity and the ownership of nature-based solutions. Local beliefs, social attitudes, and hybrid forms of knowledge, including traditional ecological knowledge (TEK), expert knowledge, and experiential insights, provide a framework for understanding interactions between society and nature.

Diversity of values and knowledge systems: In the studied communities, values such as relational, instrumental, and intrinsic play distinct roles in shaping human-nature relations:

1) Relational values: Nature is deeply embedded in cultural and familial traditions. For example, in Mălâncrav, one participant shared, "Grandpa used to go by carriage to bring hay from the pastures for the animals, and those lands were essential for the households" (Participant_Mălâncrav). This statement highlights the relational value of nature as an integral part of daily life and family identity. Similarly, in Saschiz, participants highlighted the cultural significance of rhubarb festivals, which link local agricultural practices with communal celebrations.

2) Instrumental values: Many community members view nature as a livelihood and economic opportunity source. For example, the grasslands are valued for their economic utility: "Pastures are the basis of animal nutrition. Everything we produce we use"

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(Participant_Saschiz). Similarly, water resources are considered essential for both agricultural and domestic use, reflecting an instrumental view of nature as a vital resource for survival.

3) Intrinsic values: Participants also deeply appreciated nature's inherent beauty and uniqueness. For instance, in Saschiz, one participant mentioned, "The ancient oaks are part of our identity. If they were gone, we would lose part of what defines us as a place." (Participant_Saschiz). This highlights the intrinsic value of natural features as symbols of local identity and heritage.

Divergence and conflict of values

Different actors within the community often hold divergent values, which can lead to potential conflicts.

Traditional vs. modern practices: Traditional knowledge holders prioritize sustainable practices, such as crop rotation and manual haymaking, which are often abandoned by younger generations in favor of mechanized farming. As one participant in Saschiz noted, "You can't find people who know how to sew traditionally anymore." (Participant_Saschiz). This divergence reflects generational shifts in priorities and practices.

Economic vs. environmental goals: Conflicts arise between those who value nature's economic potential and those advocating for conservation. For example, the expansion of agricultural land often comes at the expense of biodiversity, with one participant observing, "Thorns are expanding due to human non-intervention" (Participant_Saschiz).

Transformation of human-nature relations

Human-nature relations in the region have undergone significant transformations due to modernization, economic pressures, and changing cultural attitudes. As participants noted, traditional practices, such as communal grazing and haymaking, have diminished: "In the past, everyone went to clean the pasture. Now everyone waits for someone else to do it." (Participant_Saschiz).

Additionally, tourism and external influences have reshaped local perceptions of the natural environment. In Mălâncrav, tourism initiatives, such as thematic picnics in orchards, have revitalized interest in local biodiversity, blending economic and cultural values. However, this shift also introduces new tensions, as traditional knowledge and practices risk being overshadowed by modern economic incentives.

The interplay of relational, instrumental, and intrinsic values, alongside traditional and expert knowledge, defines the complexity of human-nature relations in these communities. While this diversity enriches the social-ecological system, it also creates challenges in balancing competing priorities and navigating cultural transformations.

Addressing these dynamics requires fostering dialogue among stakeholders, preserving TEK, and integrating modern solutions that respect nature's intrinsic and relational values. As summarized in Table 10, several barriers and opportunities emerge in relation to these cultural changes, emphasizing the need to foster dialogue among stakeholders, preserve TEK, and integrate modern solutions that respect nature's intrinsic and relational values.

Table 10 - Barriers and/or opportunities you identify in the field regarding cultural changes

Cultural change	Barriers represented by the cultural change	Opportunities to address the ongoing cultural changes locally

Lower appreciation for nature-friendly practices, rediscovery of TEK, and rural lifestyle as a healthy way of living	Economic unprofitability, lack of financial viability. Cultural refutation of this lifestyle, including the behavioral or cultural exclusion of those who aim to practice it, especially in settlements where the modern and urban culture is not yet established.	Increasing NGO activity in the region and diversifying NGO interest (spanning from nature, through built heritage to local skills and knowledge types, and fostering local products). Increasingly, farmers feel change is needed, a sentiment shared by most remaining settlements. The increasing demand for knowledge, best practices, and support for adaptation can represent a significant opportunity for cultural transformation in this area.
Cultural transmission of TEK	The main barrier is that the young generations have different cultural and economic aspirations—a lack of ecological embeddedness.	The existing TEK can be better capitalized through NGO's.
Cultural dilution	It challenged the social system's capacity to form a shared vision and develop holistic development strategies. It is also a barrier to the transmission of TEK.	Increased mindfulness about key local identity elements and the development of a set of shared norms and principles to guide the behavior of the outsider people established in the village. These identity elements can be revived from the local memory.
Policy	The current policy conflicts with several landscape features, which compromise the high natural and cultural values of the cultural landscapes in the project area.	Policy weakness could, at certain levels, be buffered by a strong local community and everyday decisions on what to maintain and what not.
Corrupt intentionality (especially in remote settlements)	It can create a rigidity-trap-like situation, eroding human-nature connections and connections between people. A key barrier to the development of a whole community-based ecotourism initiative. Corrupt intent typically results in many local losers	Eliciting local innovation and fostering a sense of agency and entitlement within the local community can help mitigate the risk of corruption. Strengthening trust between people and their interest in understanding and addressing local problems can be a practical

	and few winners after ecotouristic activities.	complementary approach to addressing corruption. Innovation nuclei and know-how to capitalize on local strengths exist in the project region.
Eroded social capital (increased individualism, lack of trust between the people)	Barrier to adopting local initiatives for sustainability.	Increase and diversify the cultural events in the settlements, ensuring that they are accessible to the entire community. With this, people have more opportunities to meet, exchange, and regain trust (communicated by a local Roma person).
Lack of reliable information	This is especially true in more remote settlements.	Expanding the coverage of the local NGOs and bringing scientific and other debates and workshops to the more remote settlements as well. Diversify local institution-academia partnerships for knowledge transfer, inspiration, and knowledge co-production (e.g., as in our case).

3.5 Identity-Based Dynamics

Gender. Women's involvement in biodiversity efforts is often constrained by traditional gender roles, which limit their participation in broader land management activities. However, women play a vital role in household-level conservation through gardening and small-scale farming. For example, participants noted that most women continue to maintain their gardens, which are integral to local food security: "(...) if we have a proportion of 5-10% who no longer garden, all the rest of the women work their gardens" (Participant_Mălâncrav). Generational divides challenge the transmission of traditional ecological knowledge (TEK). Older generations emphasize the value of haymaking and sustainable land management practices, while younger individuals often prioritize modern economic aspirations. A participant captured this shift: "In the past, everyone went to clean the pasture. It was a common action. Now, everyone waits for someone else to do it." (Participant_Saschiz).

Age. Generational differences have a significant impact on human-nature relationships and biodiversity practices. Older generations with traditional ecological knowledge (TEK) often emphasize the importance of sustainable land use and communal practices. For example, a participant remarked: "In the past, we used to go with a hoe to clear the brambles from the pastures, but now no one is interested." (Participant_Mălâncrav). These practices were critical for maintaining biodiversity through communal grazing and traditional haymaking. However, the decline of these practices due to modernization and economic pressures has contributed to biodiversity loss, as invasive species encroach on abandoned lands. Younger generations prioritize economic opportunities over traditional practices, influenced by urbanization and modern lifestyles. This shift was noted in Saschiz: "Children, if educated to engage and appreciate nature, will continue this connection. But right now, there is no

longer any interest in the old practices.” (Participant_Saschiz). The erosion of TEK and generational disconnects challenge the continuation of sustainable biodiversity practices.

Ethnicity. Ethnic minorities, particularly the Roma population, face systemic exclusion from decision-making processes and resource allocation. Their marginalization limits their contributions to biodiversity conservation despite their dependence on natural resources for subsistence. A participant highlighted this disparity: “Roma people are not included in large projects, and this makes them feel ignored” (Participant_Saschiz). This exclusion reduces their contributions to and benefits from conservation efforts despite their dependence on natural resources for subsistence.

Class. Socioeconomic disparities create significant barriers to biodiversity conservation. Wealthier landowners have greater access to subsidies and resources, enabling them to implement modern agricultural practices. In contrast, small-scale farmers struggle to maintain their lands, as noted by a participant in Saschiz: “Subsidies are paid late when they are no longer needed. Small farmers are already overwhelmed by problems” (Participant_Saschiz). These inequalities contribute to land abandonment and biodiversity degradation, particularly in marginalized areas. The economic status of individuals influences their connection to biodiversity, as small-scale and subsistence farmers often face challenges in maintaining their land due to external pressures and emigration. As one participant observed, “The youth have left, they work in other people’s fields, and others are here in their place (...) Nothing will be real anymore from what is here in 20 years” (Participant_Apold). This highlights the vulnerability of those who rely directly on the land for their livelihood.

Religion and local traditions. Religious and cultural traditions influence community perceptions of nature and biodiversity. For example, in Saschiz, a participant described how traditional religious events fostered a sense of connection with nature: “To keep the traditions, like the hikes organized by the church, when we all went to the forest, then pray and thank for what nature gives us” (Participant_Saschiz). These practices underline the intrinsic and relational values of nature within the community but are increasingly rare due to modernization.

Key impacts of identity-based dynamics. *Exclusion of marginalized groups:* Systemic barriers prevent minorities and low-income individuals from fully participating in biodiversity conservation, limiting the inclusivity and effectiveness of initiatives. *Erosion of traditional practices:* The generational shift away from TEK undermines sustainable land management, contributing to biodiversity loss. *Gendered roles in biodiversity stewardship:* Women’s contributions to household-level conservation remain undervalued, while structural barriers prevent their broader involvement in decision-making.

3.6 Political/Institutional Dynamics

Please describe the political barriers and institutional lock-ins that hinder positive biodiversity change. These barriers may include rigid policies, lack of political will, inadequate governance structures, or vested interests that prioritize short-term economic gains over long-term environmental sustainability. Additionally, institutional inertia, in which established practices and structures resist necessary change, can prevent the adoption of more effective biodiversity management strategies.

Rigid policies and a lack of flexibility. Policies often fail to align with local realities, creating obstacles for community-based biodiversity efforts. A participant highlighted the issue of rigid regulations: “European legislation could help more in areas with high biodiversity, but often the rules do not apply to our local realities” (Participant_Saschiz). Such policies often fail to consider the area’s unique ecological and social dynamics, thereby limiting their effectiveness and leading to community frustration.

Insufficient political will and governance fragmentation. The lack of coordinated governance structures and inadequate political actions will exacerbate these challenges. Participants described the absence of proactive leadership and clear strategies for

addressing local biodiversity issues: "Large farmers have been using the same farming methods for years. Current policies do not incentivize them to rotate crops or protect the soil." (Participant_Saschiz). This reflects a governance gap in which policy frameworks fail to incentivize sustainable practices, leaving critical biodiversity measures unaddressed.

Institutional inertia. Institutional resistance to change is a key barrier to effective biodiversity management. Established structures and bureaucratic inefficiencies hinder the adoption of innovative solutions. For instance, delays in subsidy payments were cited as a significant aspect: "Subsidies are paid late, when they are no longer needed" (Participant_Saschiz). This delay disproportionately affects small farmers, discouraging their participation in conservation programs and contributing to further land degradation. The lack of economic incentives for sustainable practices reinforced stagnation. As another individual put it: "In agriculture, everything is costly! Fuel, machinery, and you end up not being able to keep up." (Participant_Apold). Without financial support, communities struggle to implement necessary changes, leaving them trapped in an unsustainable cycle that hinders progress on biodiversity. Moreover, we observed that institutional inertia often manifested through resistance to change, as established structures and practices prevented the adoption of improved biodiversity management strategies. A strong example is the reluctance to abandon traditional yet outdated methods in favor of more sustainable alternatives. One participant noted: "We no longer want to use the wooden hoe because we don't like it anymore" (Participant_Apold), reflecting how modernization displaced traditional agricultural techniques, sometimes at the cost of ecological balance. The generational disconnect further exacerbated institutional inertia, where younger generations showed curiosity but lacked commitment to continuing sustainable practices. This was evident in the statement: "There is an interest in learning how things were done in the past, but not an interest in carrying them forward, right? So, it's more of a romanticized idea" (Participant_Apold). This highlights the challenge of integrating traditional ecological knowledge into modern conservation frameworks.

Short-term economic priorities. Vested interests often prioritize immediate economic gains over long-term environmental sustainability. A participant emphasized the impact of subsidies on land use: "If it weren't for these subsidies from APIA, all the fields would be forested." (Participant_Saschiz). While subsidies can provide essential support, their misalignment with conservation goals can foster overgrazing and monocropping, thereby degrading biodiversity.

Additional challenges in policy implementation. A further complication arises from the lack of integration between local, national, and EU policies, leading to inconsistent enforcement and gaps in biodiversity protection. For instance, participants highlighted that specific measures designed to promote conservation often fail due to weak oversight: "The rules are there, but who checks them? Everyone tries to get around the law" (Participant_Saschiz). This lack of accountability undermines conservation efforts and fosters mistrust among local stakeholders who feel that their efforts are unsupported or undervalued.

Political and institutional dynamics in the study area create significant barriers to biodiversity conservation. Rigid policies, governance fragmentation, institutional inertia, and short-term economic priorities undermine efforts to implement sustainable biodiversity strategies.

4. Transformative Biodiversity Innovations

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4.1 Analysis of Inclusion/Exclusion Mechanisms

Exclusionary practices that marginalize perspectives often influence biodiversity discussions and decision-making processes. These exclusionary practices are shaped by embodied values, social attitudes, flows of knowledge, and economic structures that prioritize epistemologies over others. By excluding diverse perspectives, particularly those of local communities, biodiversity policies risk being ineffective and disconnected from the realities on the ground.

Embodied values and social attitudes play a significant role in determining who participates in biodiversity governance. Historically, scientific knowledge produced in academic institutions was privileged over traditional ecological knowledge (TEK), systematically excluding local communities. As one participant in the workshop noted, "When I think about nature (...), it's a place where I don't see anything cultivated, just meadows or forests, without any kind of crops" (Participant_Biertan). This highlights the disconnect between academic ecological studies and the lived experiences of local communities. Despite their extensive knowledge of local ecosystems, many traditional land users find their insights undervalued in policymaking.

Additionally, there is a perception that local rural people's ways of knowing are outdated and unsuitable for modern conservation efforts. This perception reinforces the exclusion of communities that have co-evolved with their environments over centuries "If we have biodiversity, it means that we have been quite sustainable so far" (Participant_Biertan). This perspective highlights the depth of traditional knowledge, yet conservation efforts often impose externally designed frameworks that fail to incorporate these localized understandings. A participant from Biertan emphasized how exclusion is frequently unintentional but still present: "We cannot promote tourism at all if what we promote is not embraced by the community. Because it will not be sustainable, it will just be a trend, and that is why everything we discuss is important" (Participant_Biertan). This highlights the importance of local voices in conservation planning for long-term success.

Furthermore, local perceptions of nature are deeply embedded in cultural identity. In Saschiz, a participant emphasized the connection between water and heritage: "For me now, it means water. Water as a resource for food, drinking water, household water, water for animals" (Participant_Saschiz). This demonstrates how communities perceive nature not as an abstract ecological concept but as an integral part of their daily survival and culture.

Flows of knowledge and marginalization. Knowledge production and dissemination are also political processes. Scientific research is often conducted in ways that exclude or fail to engage with local perspectives. When biodiversity policies are formulated without meaningful consultation, they risk alienating those who have the most at stake. Often, policies are imposed without consideration of local contexts, resulting in confusion and resistance among the affected populations. In many cases, decision-makers assume that scientific assessments alone provide an objective basis for policy, overlooking the experiences of those who interact with the environment on a daily basis. Access to information is often unevenly distributed. Rural communities frequently lack the necessary resources to participate in decision-making, leaving them vulnerable to exclusion. One participant noted: "Local communities are not well informed about legislation and do not comply with it. Everyone is minding their own business" (Participant_Biertan). This lack of inclusion reinforces power imbalances, as only those with the means and knowledge to navigate bureaucratic systems can influence policies. Moreover, as one participant from Saschiz pointed out, the decline in traditional knowledge directly impacts the management of natural resources: "Thirty years ago, we used to bathe in the valley, but now there's barely any water flowing" (Participant_Saschiz). This illustrates how ecological degradation is a consequence of environmental factors and the sidelining of traditional management practices. Another voice from Biertan shared concerns about the decline of traditional

ecological knowledge: "I remember when I moved [...], I was super impressed by all the biodiversity, by the flora [...]" (Participant_Biertan). This highlights how knowledge is lost when communities are excluded from biodiversity governance.

Economic practices and systemic exclusion: Economic structures reinforce exclusion in biodiversity discussions. Many local communities rely on subsistence agriculture, small-scale farming, or pastoralism – practices that are often marginalized in broader economic policies. "Small farmers... They have the most to lose. First, they have nowhere to sell their products because of our policies... I saw on TV just now that those who grew tomatoes are throwing them away, they can't even sell them for 80 bani" (Participant_Biertan). This reflects how economic marginalization leads to both financial insecurity and political disenfranchisement. Economic incentives and funding mechanisms also favor large-scale conservation initiatives that prioritize tourism or industrialized resource management over community-based solutions. This contributes to the displacement of traditional livelihoods and disrupts existing relationships between humans and nature. This demonstrates how external economic pressures reshape rural landscapes in ways that disadvantage those most reliant on the land. When traditional livelihoods are not considered in biodiversity policies, rural communities struggle to balance conservation requirements with their economic survival. A participant from Saschiz explained how industrialized farming practices are replacing traditional crop rotation systems, which affects soil health: "For twenty years, my father-in-law has only planted corn on the same plot" (Participant_Saschiz). This demonstrates how modern agricultural practices, often encouraged by economic policies, undermine the ecological knowledge embedded in traditional farming techniques.

Power dynamics in biodiversity decision-making: Power imbalances are embedded in biodiversity governance. Government agencies, NGOs, and academic institutions often dominate conservation narratives, bypassing local voices. When policies are formulated without input from those directly affected, they risk alienating communities and getting resistance rather than cooperation. Additionally, conservation initiatives prioritize scientific assessments over local experience, reinforcing an epistemological hierarchy marginalizing TEK. This creates a dynamic in which local communities are expected to conform to external conservation models rather than co-developing solutions that align with their lived realities. As one participant noted, the role of local knowledge is often ignored despite its long history of effectiveness: "Our pastures used to be properly maintained, but now no one takes care of them" (Participant_Saschiz). This erosion of local land management practices highlights the consequences of exclusionary governance.

Inclusive mechanisms

Inclusive mechanisms for biodiversity conservation: Various mechanisms can be implemented to foster inclusion and empower marginalized groups to counteract these exclusionary practices.

a) Strengthening participatory governance

One of the most effective ways to promote inclusion is through participatory governance. This involves engaging local communities in decision-making processes. Community-led conservation initiatives and co-management agreements can help bridge the gap between scientific and local knowledge. This is also reflected in the implemented interview guide, where we used "nature" instead of "biodiversity", as per the local community's position. This highlights the need for conservation discourse to be adapted to local understandings of nature, ensuring inclusivity.

b) Recognizing and valuing traditional knowledge

Policies should formally recognize and integrate traditional ecological knowledge as a legitimate form of expertise. This can be achieved through legal frameworks that protect local land rights, funding for community-led research, and platforms for knowledge exchange. One participant in Saschiz discussed how traditional knowledge, especially

related to water management, has been overlooked: “In our area, it was, you know, it was very important, being a Saxon area, that almost all houses, all households had a well in the yard.” (Participant_Saschiz). Biodiversity governance can benefit from centuries of accumulated wisdom by restoring and incorporating such traditional ecological practices.

c) Supporting sustainable local livelihoods

Ensuring that biodiversity policies align with the economic needs of local communities is important for their success. Many rural populations rely on traditional agricultural practices that should be recognized and supported within conservation frameworks. One participant from Saschiz emphasized the importance of sustainable land use: “Mowing is a bit mechanized [...] a lot now, because no one mows traditionally anymore [...]” (Participant_Saschiz). This shift from traditional practices highlights the need for conservation programs to support the continuation of sustainable land management techniques.

d) Creating platforms for community engagement

Inclusive conservation requires spaces where local voices can be heard and actively participate in decision-making. As another participant in Saschiz pointed out, knowledge-sharing is a crucial part of conservation efforts: “Elderberry, for example, at grandma’s cellar, local elderberry...” (Participant_Saschiz). This illustrates how local ecological knowledge is embedded in daily life and should be preserved as an integral part of conservation strategies.

By embracing local perspectives and prioritizing inclusive mechanisms, biodiversity governance can become more effective, equitable, and sustainable in the long run.

4.2 Niche Innovators and Key Players

Biodiversity conservation within the case study areas of Malancrav, Boiu, and Saschiz is driven by a variety of niche innovators and key players who can contribute to transformative change. These include traditional knowledge holders, community members engaged in sustainable practices, conservation-oriented organizations, and individuals maintaining traditional ecological relationships with the landscape.

Traditional knowledge holders and local experts

Traditional knowledge holders are one of the most valuable yet often overlooked groups driving biodiversity conservation. In Malancrav, older community members hold extensive knowledge about local flora and fauna, including medicinal plants and sustainable land management. One participant recounted: “When I got married in the ’80s, in Malancrav, there was Lele Dobriță, I know she knew, as there were two or three Roma families. And there were the elders who knew all kinds of... and my mother-in-law, being a vegetarian, would bring her mushrooms of all colors, but she never got sick. She knew the place, the timing, and everything” (Participant_Malancrav). This highlights the role of traditional foragers in maintaining biodiversity through careful selection and sustainable harvesting of forest resources. Similarly, in Boiu, local knowledge about natural cycles and the use of organic materials remains deeply ingrained in community practices. “In the local pharmacopeia, I believe around 10-15 plants are regularly collected. From the wild flora, people also cultivate aromatic or condiment plants, which also have medicinal values” (Participant_Boiu). These individuals play an important role in maintaining knowledge continuity about medicinal plants and sustainable harvesting methods. Their expertise ensures that plant populations are not overharvested, directly contributing to biodiversity preservation.

Small-scale farmers and pastoralists

Traditional agricultural and pastoralist practices are crucial in maintaining biodiversity, particularly in areas where intensive monoculture has not yet become the dominant practice. In Saschiz, rotational grazing and small-scale farming remain prevalent, as one

participant explained: "Pastures should be maintained by those receiving subsidies, as almost all pastures are allocated to farmers. In the past, when there weren't large farmers and big herds, everyone had a small flock or two or three sheep. Just enough to have a lamb for Easter [...]" (Participant_Saschiz). These practices help sustain soil health, promote biodiversity, and prevent overgrazing. Some small farmers also practice intercropping and rotation to maintain soil fertility and increase yield diversity. "My father-in-law has planted corn on the same plot for twenty years. This isn't sustainable, and we should return to rotational farming like our grandparents did" (Participant_Saschiz). This suggests that while some traditional farming methods are being phased out, a strong knowledge base and advocacy for their revival remain.

Local conservation enthusiasts and citizen scientists

Citizens, scientists and individuals dedicated to monitoring biodiversity play a crucial role in environmental protection. In Saschiz, one participant shared their experience of observing biodiversity changes: "I was looking at my phone. This was a researcher saying that the coolest beech forest is here. And we have important beech forests. And they are beautiful, as he was also saying they are beautiful" (Participant_Saschiz). This interest in local biodiversity, combined with the use of technological tools, supports conservation efforts by documenting changes in forest composition and species presence. Community members also observe changes in animal populations: "There are more deer every year. I think they are doing well here" (Participant_Saschiz). Such firsthand knowledge can complement scientific studies and improve conservation strategies.

The Influence of niche innovators and key players

Despite their contributions, many niche innovators face challenges in gaining formal recognition for their knowledge and efforts. Traditional knowledge holders are often marginalized in official conservation discussions. "I was telling them today at the workshop about what a tragedy it was when the mushroom collectors passed away. In one year, both were gone. And with them, the knowledge was lost." (Participant_Saschiz). The loss of local biodiversity experts leads to gaps in sustainable harvesting practices and knowledge transmission. In some cases, small farmers are also voiceless due to policies favoring large-scale agricultural enterprises. A participant from Boiu explained: "All the forests in the area are either recently planted, especially coniferous forests on Țopa and here on the hill behind, or forests under exploitation - traditional system, but through the forestry office, which requires partial exploitation, so no clear-cutting" (Participant_Boiu). While intended for conservation, these policies sometimes overlook the role of local farming systems in preserving biodiversity.

Expanding the recognition of local knowledge: To ensure sustainable conservation efforts, bridging the gap between traditional knowledge and formal conservation science is necessary. "It is important to have someone who knows what to collect and whom people trust" (Participant_Malancrav). Recognizing and integrating this knowledge into official conservation frameworks can lead to more effective and locally accepted biodiversity protection strategies.

Involvement of Niche Innovators

Efforts have been made to integrate niche innovators into biodiversity conservation through knowledge-sharing initiatives, collaborative projects, and participatory conservation programs.

Community engagement and knowledge exchange: One way of fostering biodiversity conservation is through active knowledge exchange. As one participant in Saschiz explained: "In the past, there were many more - they used to call the buffalo 'balanele', which is quite ironic. And now there are only a few left" (Participant_Saschiz). This suggests that even as traditional knowledge and livestock practices decline, efforts to sustain them can reinforce conservation. Additionally, community members in Saschiz discussed how traditional knowledge regarding water management has been largely forgotten: "Thirty years ago, we used to bathe in the valley, but now there's barely any water flowing"

(Participant_Saschiz). This loss of traditional ecological awareness highlights the importance of documenting and preserving such knowledge.

Collaborative conservation initiatives: In Boiu, initiatives to protect biodiversity include structured management of forest resources and controlled exploitation: "Timber exploitation. All the forests in the area are either recently planted, especially conifers on Țopa and here on the hill behind, or forests under exploitation - traditional system, but through the forestry office" (Participant_Boiu). These community-involved projects help ensure that conservation efforts are balanced with economic needs.

Formalizing traditional knowledge: In Malancrav, discussions are underway to integrate local expertise into conservation. As one participant noted, "It is important to have someone who knows what to collect and in whom people trust" (Participant_Malancrav). This suggests a potential pathway for formalizing local ecological knowledge within broader conservation frameworks.

Expanding the role of technology in conservation: Digital technology and social media platforms offer opportunities for niche innovators to document and share their knowledge. Mobile applications for identifying plant species, recording wildlife sightings, and mapping ecological changes provide community members with the tools to participate actively in conservation efforts. For example, in Saschiz, individuals who monitor biodiversity and share their findings contribute valuable insights into local ecological trends.

Encouraging community-based ecotourism: Ecotourism presents an opportunity to integrate local knowledge holders into conservation-based economic models. Tourists are often drawn to authentic cultural and natural experiences, incentivizing communities to preserve traditional practices and natural landscapes. In Saschiz, a participant highlighted the importance of local tourism: "We have an area for promenades there. Everyone goes to see the bear. In the evening, the bear comes out, and people take pictures" (Participant_Saschiz). This demonstrates how the presence of wildlife can support ecotourism, benefiting both conservation and local livelihoods.

The biodiversity conservation landscape in Malancrav, Boiu, and Saschiz is shaped by numerous key players, including traditional knowledge holders, citizen scientists, and small-scale farmers. While these individuals and groups play a crucial role in maintaining ecological balance, they often face marginalization and exclusion. Recognizing and integrating their expertise into formal conservation efforts is essential for creating inclusive and sustainable biodiversity policies. Expanding community-based conservation approaches and fostering economic incentives that align with ecological sustainability can further strengthen biodiversity protection in these regions.

4.3 Scalable Bottom-Up Innovations for Transformative Change

Identification of existing innovations

APOLD village

Bottom-up innovations for biodiversity conservation often emerge from local knowledge, traditional practices, and community-led initiatives. The workshop in Apold revealed various innovative approaches that support biodiversity at the local level, distinguishing them from conventional top-down policies.

One significant bottom-up innovation is the identification and conservation of native species, such as the Albăstrelul Transilvan (Latin name: *Pseudophilotes bavius hungaricus*, Figure 12). This butterfly species has also been preserved through local ecological efforts. This initiative represents a transformative approach as it recognizes the value of native species in fostering biodiversity and attracting eco-tourism: "... o să vină mulți turiști să îl vadă (fluturele)." (Participant_Apold)



Figure 13 - Albăstrelul transilvan Source: EuropaFM, 2024

Another notable initiative is the protection of ancient trees such as secular oaks (*stejarii seculari*). These trees are considered more than just natural resources; they hold identity and intrinsic value for the community: "Secularii, pentru noi... nu merita costurile ca să îl tai, pentru că... ce faci cu el? El e un monument al naturii. Te bucuri de el"/ "Secular trees, for us... it wasn't worth the cost to cut it down, because... what do you do with it? It's a monument of nature. You enjoy it." (Participant_Apold) working for Romsilva). This perspective reflects a shift from economic exploitation to conservation-driven thinking.

BIERTAN village

Biodiversity conservation efforts in Biertan are deeply rooted in the community's traditional knowledge and local practices, which differentiate them from conventional business-as-usual policies. These bottom-up innovations focus on sustainable land use, the protection of native species, and traditional ecological practices that have been preserved over time.

A significant innovation highlighted in the discussion is the conservation of traditional vineyards and terraces, which are essential in maintaining local biodiversity: "Dealul acesta unde a fost vița de vie a fost foarte important. Acuma nefiind exploatate, și-au mai pierdut... dar în continuare au o importanță din punct de vedere al esteticii"/ "This hill where the vines were was very important. Now that they are not exploited, they have lost some of their... but they still have an importance from an aesthetic point of view"/ "(Participant_Biertan). Although not actively cultivated on the same scale as before, these terraces continue to contribute to landscape biodiversity and serve as historical and ecological landmarks.

Protecting water sources such as the Biertan River is another innovative effort. The community recognizes the river's declining water levels and its ecological importance: "Are un debit foarte scăzut cel puțin... comparativ cu acum 20 de ani chiar... Semnificativ de mic."/ It has a very low flow rate, at least... compared to 20 years ago even... Significantly low." (Participant_Biertan). This awareness has led to community discussions on ways to protect and possibly restore the water body's ecosystem.

Another transformative practice is the traditional maintenance of grasslands and meadows, which supports high biodiversity. Community members emphasize their importance: "Tot ce ține de câmpii, de unde se cultivă porumb, fânețe, pajiștile." / Everything related to the fields, where corn is grown, hayfields, meadows" (Participant_Biertan).

BOIU village

In Boiu, several bottom-up innovations promote biodiversity at the local level, differentiating them from conventional business-as-usual policies. These innovations rely on traditional knowledge, sustainable land use, and ecological practices that have been preserved over generations.

One notable innovation is the local use of construction materials derived from natural resources. As a participant noted, "Aici s-a folosit întotdeauna piatra de construcție locală". / "Local building stone has always been used here." (Participant_Boiu). This practice ensures that the local environment is not excessively altered by imported materials, preserving the ecological balance.

Another key innovation is the careful management of forest resources: "Pădurea e o resursă foarte importantă și gestionată cu multă atenție de localnici". / "The forest is a very important resource and is managed with great care by the locals." (Participant_Boiu). This approach contrasts with mainstream logging practices that prioritize profit over sustainability.

Additionally, using organic fertilizers such as manure has been an integral part of traditional agriculture: "Și bălegarul că noi l-am folosit." / "And the manure that we used" (Participant_Boiu). This practice naturally enriches soil quality, reducing dependency on synthetic fertilizers that can hurt biodiversity.

A unique biodiversity-supporting feature in Boiu is the community's relationship with local stork populations: "Că oamenii le iubesc. Deja sunt repere pentru noi, la cuibul la stația de autobuz, deci mai mult de atât [...]" / "Because people love them. They are already landmarks for us, at the nest at the bus station, so more than that [...]" (Participant_Boiu). Storks are not just birds, but also symbols of local ecological health, demonstrating how biodiversity is intricately intertwined with community identity.

MALNCRAV village

In Mălâncrav, several bottom-up innovations have emerged to promote biodiversity at the local level, setting them apart from conventional business-as-usual policies. These innovations are deeply rooted in traditional practices, community knowledge, and sustainable land use, making them transformative.

One such innovation is the revival of traditional orchards: "Livada pot să zic că valoare de identitate. Avem și sărbătoarea mărului". / "I can say that the orchard has an identity value. We also have the apple festival." (Participant_Malancrav). This event, centered around the apple orchards, reflects how agriculture and biodiversity coexist while fostering local identity and economy.

Another key initiative is the creation of small ponds (heleștei in Ro language), which were initially developed for practical reasons but have since become essential biodiversity hotspots: "Acum 20 de ani era unul singur în partea de sus a satului". / "20 years ago, there was one alone at the top of the village". (Participant_Malancrav). Over time, these small water bodies have expanded, benefiting local wildlife and community members who use them for recreation, irrigation, and livestock watering.

SASCHIZ village

Several bottom-up innovations have been identified in Saschiz that promote biodiversity at the local level. These innovations are rooted in traditional land-use practices, water conservation, and the sustainable management of forests and meadows.

One notable innovation is the importance of water conservation. Community members emphasized: "Apa ca și resursă pentru hrană, apă de băut, apă menajeră, apă de adăpat

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animale." / "Water as a resource for food, drinking water, household water, water for watering animals." Water shortages have become a pressing issue, with some participants recalling: "Noi acum 30 de ani făceam baie în vale, dar acum nu mai putem că aproape nu mai curge." / "30 years ago, we used to bathe in the valley, but now we can't because it almost doesn't flow anymore". (Participant_Saschiz). This has led to efforts to restore traditional water sources such as wells and fountains.

Another significant innovation is the revival of traditional meadow management. Participants stressed the value of pajiști (meadows) and păduri (forests): "Pajiștile ar fi. Pădurea e foarte importantă." / "The meadows would be. The forest is very important". (Participant_Saschiz). Traditional haymaking (cosit) and rotational grazing are still practiced, although increasingly mechanized: "Acuma...Cositul e un pic mecanizat [...] foarte mult acuma, că nu mai prea cosește nimeni tradițional." / "Now [...] Mowing is a bit mechanized [...] a lot now, because no one really mows traditionally anymore." (Participant_Saschiz). This nature-positive approach differs from mainstream intensive agriculture, prioritizing yield over biodiversity.

Additionally, biodiversity-friendly farming practices remain a key component of local agriculture. Some community members lament the overuse of monocultures: "Peste tot porumb. Și, după părerea mea, un pic exagerat." / "Corn everywhere. And, in my opinion, a bit overdone." (Participant_Saschiz). Others highlight the importance of crop rotation: "Păi așa am învățat la școală...La școală așa am învățat că rotația culturilor e bună." / "Well, that's what I learned at school...That's what I learned at school that crop rotation is good" (Participant_Saschiz)

Another innovation lies in wildlife protection and ecotourism, particularly on deer, wild boars, and large carnivores. While conflicts with wildlife exist, some community members acknowledge the touristic appeal of seeing bears in their natural habitat: "Toată lumea merge să vadă ursul. Seara iese ursul, fac poze". / "Everyone goes to see the bear. In the evening, the bear comes out, and they take pictures" (Participant_Saschiz).

SOARD village

In Soard, various bottom-up innovations have been implemented to sustain biodiversity at the local level. These practices are rooted in traditional knowledge, sustainable land use, and natural resource management, differing from conventional business-as-usual approaches.

One such innovation is recognizing and conserving natural water sources: "Apa e un element destul de important pentru noi". / "Water is a pretty important element for us". (Participant_Soard). Traditional wells and small water bodies have been preserved, and their importance is well understood: "Sunt bălți din astea mici temporare pe pășune, joacă un rol important pentru menținerea bivolistilor și a vacilor." / "There are these little temporary ponds in the pastures, that are important for buffalo and cows' existence" (Participant_Soard).

Another important innovation is the conservation of pasturelands and their integration with traditional farming practices. Participants noted that some pastures are naturally rewilding due to abandonment: "Aici chiar vedem pe deal o pășune care probabil în primii 15 ani de abandon și împădurire nu mai revine la starea aia de pășune inițială" / "Here we see a pasture on the hill that probably in the first 15 years of abandonment and afforestation will not return to its original pasture state" (Participant_Soard). This highlights the importance of actively maintaining these habitats to sustain biodiversity.

Additionally, sustainable forestry practices have been increasingly recognized: "Regenerarea naturală, normal, cum să nu. E un proces al naturii." / "Natural regeneration, normal, of course. It's a process of nature" (Participant_Soard). This stands in contrast to mainstream forestry approaches, which often rely on intensive extraction without allowing time for regeneration.

A significant biodiversity-supporting practice is the protection of mature and dead trees as habitats: "Păi în mare majoritate, deci sunt habitatele marginale - arborii pentru

biodiversitate și arborii morți.”/ “Well, for the most part, so it’s the marginal habitats - the biodiversity trees and the dead trees.” (Participant_Soard) Instead of removing them for timber, community members recognize their value for local wildlife.

Evaluating transformative potential and equity in access

APOLD village

These innovations demonstrate a nature-positive approach by integrating biodiversity conservation with cultural and ecological resilience. The conservation of species like Albăstrelul Transilvan and the protection of secular oaks illustrate a deeper recognition of biodiversity as an integral part of community identity rather than just a resource for exploitation. However, access to these innovations remains inequitable, especially for marginalized groups such as small-scale farmers and ethnic minorities. The transcript highlights concerns that some community members are unable to leverage biodiversity-friendly practices due to economic constraints: “Nu au unde să își vândă produsele în primul rând, că în politica noastră [...]” [They have nowhere to sell their products in the first place, given our policies [...]] (Participant_Apold).

Additionally, biodiversity innovations should integrate cultural and knowledge diversity. The workshop participants noted that certain traditional practices, such as medicinal plant use, have been undervalued: “Ce mai poate da valoare de identitate la plante sunt cunoștințele locale care folosesc aceste plante.” [The local knowledge that uses these plants gives them their identity value.] Preserving these traditional ecological knowledge systems ensures that bottom-up innovations remain inclusive and effective.

BIERTAN village

These community-led innovations have strong transformative potential because they integrate biodiversity conservation with cultural heritage and traditional land-use knowledge. They differ from mainstream conservation efforts, which often rely on rigid policies that may not consider local socio-economic contexts. The community acknowledges that its biodiversity has been preserved precisely because traditional land-use practices have not been abandoned: “Dacă avem biodiversitatea, înseamnă că am fost destul de sustenabili până acum.” [“If we have biodiversity, it means that we have been quite sustainable so far.”] (Participant_Biertan)

However, access to these innovations is not always equitable. Some community members face economic constraints that make it challenging for them to engage in biodiversity-friendly practices. As one participant noted: “Nu mai au animale oamenii, ce mai sunt fermieri?” [People no longer have animals, so what kind of farmers are there?] (Participant_Biertan). The decline in traditional farming and pasture maintenance is linked to the migration of younger generations to urban areas, resulting in a decrease in the number of active land stewards. Despite this, biodiversity efforts remain closely tied to cultural and knowledge diversity. The community values both historical and ecological aspects of its landscapes: “Pentru că multă lume vine și întreabă ‘Wow, dar ce-i cu dealurile acestea?’” [Because many people come and ask, “Wow, what’s up with these hills?”] (Participant_Biertan). Recognizing local landscapes as heritage sites suggests that conservation efforts are closely tied to cultural identity and rural livelihoods.

BOIU village

These biodiversity innovations hold strong transformative potential because they prioritize coexistence with nature rather than exploitation. Unlike industrialized agriculture, which often prioritizes yield over ecological stability, Boiu’s traditional farming practices maintain biodiversity: “Tot ce ține de câmpii, de unde se cultivă porumb, fânețe, pajiștile.” [Everything about the fields, where corn, hay, and meadows are cultivated.] (Participant_Boiu).

However, access to these practices is not always equitable. Some community members face barriers due to economic challenges or regulatory constraints. For instance, traditional livestock grazing has been restricted by legal changes: “Ni s-a spus că nu au ce căuta animalele pe drum județean. E interzis prin lege.” [We were told that animals have no

business on the county road. It's prohibited by law.] (Participant_Boiu). This demonstrates a clash between traditional sustainable practices and modern regulations. Additionally, the integration of biodiversity conservation with cultural traditions is evident in events like the folkloric festivals and seasonal celebrations: "Serbările, sânzienele, sărbătoarea culesului..." [The celebrations, the Sânzienele, the harvest festival...] (Participant_Boiu). These festivals highlight how biodiversity-friendly practices can align with cultural heritage, strengthening ecological and social resilience.

MALANCRAV village

These community-led innovations hold strong transformative potential by integrating sustainability with cultural and ecological resilience. Unlike top-down conservation efforts, these practices are shaped by local knowledge and traditions. The revival of orchards, for example, preserves traditional agricultural landscapes while promoting biodiversity. However, access to these innovations is not always equitable. Economic barriers and modern land use regulations limit some community members from engaging in sustainable practices. For example, traditional grazing is restricted by new policies: "Ni s-a spus că nu au ce căuta animalele pe drum județean. E interzis prin lege." [We were told that animals are not allowed on the county road. It's prohibited by law.] (Participant_Malancrav). This presents challenges to maintaining traditional biodiversity-friendly farming practices.

Furthermore, these biodiversity innovations are closely integrated with cultural traditions. For example, seasonal celebrations and folklore events reinforce the importance of nature: "Serbările, sânzienele, sărbătoarea culesului..." [The celebrations, the Sânzienele, the harvest festival...] (Participant_Malancrav).

This demonstrates that conservation efforts in Mălâncrav are focused on protecting species and preserving both cultural identity and local ecological knowledge.

SASCHIZ village

These biodiversity-friendly innovations have strong transformative potential as they integrate sustainability with cultural heritage and rural traditions. Unlike industrial agriculture or large-scale forestry, these local practices foster long-term environmental resilience. However, access to these innovations is not always equitable. Some community members struggle due to economic challenges and modern regulations restricting traditional practices. These limitations challenge the viability of small-scale farmers in adopting biodiversity-friendly methods. These innovations are also deeply integrated with cultural traditions and local knowledge systems. Events such as "sărbătoarea rabarbarului" (The Rhubarb Festival) and other community-driven celebrations highlight how biodiversity is recognized and celebrated as part of local identity.

SOARD village

These biodiversity friendly innovations have strong transformative potential because they integrate environmental conservation with traditional land-use practices. Unlike intensive agriculture or deforestation, these community-led practices help maintain long-term ecological stability. One challenge is land ownership disputes, which sometimes hinder conservation efforts. A local example of such a conflict is: "Pentru o baltă s-au certat o viață întreagă și... Pai a cui e. Nu era a lui nimeni, nici a lui ăsta, nici a lui ăla. El vrea să fie a lui, ăla a lui, și au murit amândoi și balta a rămas aici." [They argued over a pond for a lifetime, and... Well, whose is it? It belonged to nobody, neither to this one nor to that one. One wanted it to be his, the other wanted it to be his, and both died, and the pond remained here.] (Participant_Soard). Cultural and traditional practices remain deeply intertwined with biodiversity conservation. Seasonal celebrations, like "carnaval al sânzienelor" [the carnival of the Sânzienele], reinforce local identity while promoting nature appreciation.

Social networks and stakeholders in biodiversity innovations

APOLD village

Biodiversity conservation in Apold is shaped by a web of relationships among farmers, researchers, conservationists, and community members. Local farmers play a central role, adopting biodiversity-friendly agricultural practices often supported through agri-environmental schemes such as APIA: "APIA are și programul de agromediu... te ajută cu niște bani – domnule, nu coseșc până în data de 15..." [APIA also has the agromedium program... it helps you with some money – sir, I don't harvest until the 15th...]. Researchers and environmentalists contribute scientific expertise, as illustrated by one initiative introducing the Albăstrelul Transilvan: "Dom' profesor a adus șase exemplare și le-a pus pe movile." [The professor brought six specimens and placed them on the mounds.]

Community members, meanwhile, sustain biodiversity through everyday land stewardship and traditional ecological knowledge. Yet, social change has weakened this continuity: "Tineretul e plecat, muncesc pe ogoarele altora..." [The youth are gone; they work on someone else's fields...]. Public authorities influence conservation through regulation but often face implementation challenges. As one participant noted, "Comunitățile locale nu prea sunt informate de legislație și nu prea respectă." [Local communities are not very informed about the legislation and do not really comply.]

The relationships among these actors determine how information and resources circulate. Limited collaboration between policymakers and practitioners often results in ineffective implementation and local frustration: "Noi aici încercăm 3 fluturi să-i salvăm și 4 capre negre. Nu le va merge." [Here we try to save three butterflies and four black goats. It won't work out.]

BIERTAN village

In Biertan, biodiversity conservation relies on interactions between community members, farmers, researchers, and policymakers. Farmers and landowners manage the fields and pastures that form the ecological backbone of the area, while researchers document and support traditional conservation methods. Elders preserve local ecological knowledge, recalling times when "Bătrânii chiar respectau natura. Nu săpau, nu interveneau." [The elders truly respected nature. They did not dig, nor did they intervene.]

Public officials and policymakers shape the regulatory framework but often remain disconnected from local realities. Tourism and cultural organizations have emerged as new actors, promoting eco-tourism and linking heritage conservation with biodiversity goals. Despite strong local commitment, institutional support is inconsistent, and gaps in communication persist: "Comunitățile locale nu prea sunt informate de legislație și nu prea respectă." This disconnection highlights the need for stronger coordination between local actors and decision-makers to sustain and scale up conservation practices.

BOIU village

In Boiu, biodiversity conservation depends on collaboration among farmers, shepherds, foresters, local officials, and environmental advocates. Farmers and shepherds maintain traditional land use and grazing systems that support biodiversity, while foresters and woodworkers engage in sustainable resource management. Community elders act as custodians of ecological memory, but their influence is waning as younger generations move away. Public authorities are responsible for implementing environmental regulations, which sometimes create unintended obstacles to traditional practices. Tourism and cultural advocates promote eco-tourism, though development pressures are increasing: "Oamenii se duc și își fac cabanele lângă pădure." [People go and build their cabins near the forest.]

Overall, information and resource exchange among stakeholders remains limited. Bureaucratic constraints often restrict rather than enable biodiversity-friendly practices, forcing villagers to navigate complex legal barriers despite their ecological commitment.

MĂLÂNCRAV village

In Mălâncrav, conservation efforts are anchored in a dynamic network of farmers, shepherds, foresters, elders, public authorities, and tourism actors. Farmers and foresters maintain practices that reflect long-standing traditions of sustainable land use, while elders

pass on knowledge about ecological rhythms and land management. However, state regulations sometimes conflict with these local practices, constraining innovation.

Community engagement remains strong, yet bureaucratic barriers disrupt traditional systems, as reflected in the remark: “Nu mai au animale oamenii.” [People no longer have animals.] Such challenges underscore the need for policy adjustments that align formal conservation frameworks with community-based approaches.

SASCHIZ village

In Saschiz, biodiversity conservation is the result of the interaction among community members, local authorities, environmental organizations, and economic actors. Farmers and shepherds sustain pastures through haymaking and grazing, while elders preserve ecological knowledge related to plant collection and water management. Public authorities regulate land use but sometimes impose measures that contradict traditional conservation practices. Ecotourism and cultural initiatives foster awareness of local biodiversity, yet institutional support remains inconsistent.

As one participant observed, “Comunitățile locale nu prea sunt informate de legislație și nu prea respectă.” [Local communities are not very informed about the legislation and do not really comply.] The statement reflects a broader need to strengthen collaboration and communication between policymakers and local communities, thereby reconciling policy goals with the lived realities of rural communities.

ȘOARD village

Biodiversity conservation in Șoard depends on cooperation among farmers, shepherds, elders, public authorities, and conservationists. Farmers and shepherds shape local biodiversity through their land management practices, while elders transmit knowledge of sustainable practices, such as rotational grazing. Public authorities and forestry officials play regulatory roles, yet these often conflict with traditional land uses. Despite high local awareness, the lack of adequate compensation for conservation discourages participation: “Acum sunt destul de receptivi... Ca aici nu apare nici o compensare încă dată pentru acei arbori.” [Now they are quite receptive... but there is still no compensation yet for those trees.]

These tensions highlight the broader challenge of aligning community engagement with policy mechanisms that can effectively sustain biodiversity in practice.

Diachronic analysis: Change over time

Biodiversity conservation is an evolving process shaped by social, economic, and environmental factors. This diachronic analysis examines changes in participation, involvement, conflicts, and challenges in biodiversity conservation across Apold, Biertan, Boiu, Mălâncrav, Saschiz, and Șoard. By assessing past practices, current constraints, and future potential, we identify key trends affecting the sustainability of biodiversity efforts.

Participation & involvement

Historical (traditional practices): Historically, biodiversity conservation was deeply ingrained within these communities. Traditional land management techniques, such as sustainable grazing, organic farming, and resource sharing, have balanced human activity and ecological stability. Elders followed nature-friendly practices: “Bătrânii chiar respectau natura. Nu săpau, nu interveneau [...]” [The elders truly respected nature. They did not dig, nor did they intervene [...]]. Similar sentiments were echoed in Biertan, Boiu, and Saschiz, where local communities viewed land stewardship as a responsibility rather than an economic asset.

Present (modern constraints and transitions): Economic pressures, urban migration, and modernization have led to a decline in traditional biodiversity conservation practices. Many younger residents have left rural areas, resulting in reduced engagement in farming and

conservation. As one participant in Biertan noted: "Cine a putut a plecat... nu a mai fost interes." [Whoever could, left... there was no more interest.] Similarly, Apold has witnessed decreased participation due to economic hardships: "Noi nu mai avem zăpadă. Seceta nu a început vara..." [We no longer have snow. The drought didn't start in the summer...]. Government regulations and economic policies have also reshaped engagement. In Boiu and Mălâncrav, traditional livestock grazing practices have been restricted due to road safety laws: "Dacă tot n-avem drumuri... Au zis că nu mai scot ciurda că e drum de importanță județeană." [If we don't have roads... They said they won't let out the cattle anymore because it's a county-important road] (Participant_Boiu). Despite their long-standing cultural and economic significance, these restrictions limit community members' ability to maintain biodiversity-friendly land use.

Future (potential outlook and revival opportunities): Despite the challenges, many participants express hope for a revival of biodiversity-friendly practices. The growth of eco-tourism, sustainable development initiatives, and cultural revival efforts is seen as an opportunity to reintegrate conservation into local economies. Participants acknowledge that infrastructural improvements could open doors to conservation-related tourism: "Cu drumul asfaltat, deschide drumul turismului..." [The paved road opens the way for tourism...] (Participant_Apold). A similar perspective is seen in Biertan, where there is hope for increasing conservation awareness: "Cu timpul o să conștientizăm tot mai mult chestiile astea, sper cel puțin." [I hope that, over time, we will become more aware of these things.] (Participant_Biertan). However, stronger policy support and community engagement strategies are necessary for these initiatives to succeed.

Conflicts & challenges in biodiversity conservation

1. Large carnivore management: A central point of contention across all villages is the increase in large carnivore populations, particularly bears and wild boars. Farmers experience economic losses due to livestock predation and crop destruction, with limited governmental support: "Da, ursul mi-a stricat... acum o lună... 4 oi, fără despăgubiri." [Yes, the bear killed... last month... 4 sheep, without compensation.]; "Aseară au trecut 2 urși." [Two bears passed through last night.]; "Acum și mistreții și căprioarele, se plâng lumea de ele!" [Now, both wild boars and deer... people are complaining about them!]. While some community members recognize the ecological benefits of these species, others argue that they pose an economic and safety threat, creating a need for balanced conservation strategies.

2. Agricultural land abandonment vs. Conservation: Rural depopulation has resulted in abandoned agricultural land, leading to negative and positive ecological consequences. Some participants see rewilding as beneficial for biodiversity, while others worry about the loss of productive farmland: "Pășunea devine pădure, ăsta nu e tocmai un lucru rău." [The pasture turns into a forest; that's not necessarily bad.]; "Expansiunea arbuștilor după abandon." [Shrub expansion after abandonment]. This conflict highlights the need for land-use policies that balance conservation goals with sustainable agricultural practices.

3. Urbanization and declining engagement: Youth migration to urban areas is losing traditional ecological knowledge and reduced participation in biodiversity conservation: "Satele sunt întregi care nu mai există." [Entire villages no longer exist.]; "Odată ajunși în comunități, nu mai au desfacere cum aveau mai demult." [Once they arrive in the community, they no longer have the market access they used to have.] Developing policies to attract and retain younger generations and make conservation-related employment viable is crucial for sustaining long-term biodiversity efforts.

4. Policy and bureaucratic obstacles: Government regulations, while aimed at conservation, sometimes restrict traditional practices that have historically supported biodiversity: "Exploatarea lemnului se face prin ocolul silvic... fără tăieri la ras." [Timber exploitation is done through the forestry district... without clear-cutting.]; "O baltă s-au certat o viață întreagă și... ăsta vrea să fie a lui, ăla vrea să fie a lui." [They fought over a pond for a lifetime... One wants it to be his, the other wants it to be his.] (Participant_Șoard).

Balancing regulatory frameworks with local realities will be essential to fostering sustainable conservation practices. Biodiversity conservation across these villages has undergone significant transformations. While traditional practices once ensured sustainability, modern constraints have led to a decline in engagement. However, the growing awareness of environmental issues and the potential for eco-tourism present opportunities for revitalization. Addressing conflicts related to large carnivores, land abandonment, youth migration, and regulatory barriers will require collaborative efforts between policymakers and local communities.

Cross-Villages analysis

Across the six villages, several recurring themes emerge regarding the relationship between biodiversity, land management, and community identity.

Declining engagement in traditional practices is a widespread issue. Migration has reduced the number of younger residents in Biertan, Saschiz, and Mălâncrav, resulting in fewer stewards of traditional agricultural and land management techniques. In response, some communities, particularly Apold, Saschiz, and Mălâncrav, are turning to eco-tourism to revitalize local economies and revalue traditional knowledge within a contemporary context.

Tensions between wildlife conservation and farming further complicate local livelihoods. In Boiu, Saschiz, and Mălâncrav, recurrent damage from bears and wild boars generates frustration among farmers and challenges collaboration with conservationists. Conversely, in Apold and Biertan, conservation focuses on less conflict-prone species such as pollinators and birds, where initiatives to protect butterflies and storks are better aligned with community interests and agricultural practices.

Regulatory barriers also shape how these villages manage their natural resources. Farmers in Mălâncrav, Boiu, and Șoard report restrictions on traditional grazing, which limits their ability to maintain pastures sustainably. Meanwhile, Biertan and Apold highlight the difficulties caused by unclear biodiversity regulations, illustrating the persistent disconnect between local needs and higher-level governance structures.

Approaches to forestry and pasture management vary considerably. Șoard and Saschiz have prioritized sustainable forestry practices, including tree conservation and meadow restoration. In contrast, Apold, Biertan, and Mălâncrav emphasize preserving historical land-use patterns, such as orchards and vineyards, as a strategy to maintain biodiversity while sustaining local heritage.

Finally, local identity and cultural heritage remain closely tied to biodiversity across these communities. In Apold and Biertan, conservation of pollinator species has become a symbol of community pride and ecological responsibility. Mălâncrav and Saschiz, on the other hand, connect biodiversity preservation with seasonal festivals and traditional practices, ensuring that environmental stewardship is embedded within the social and cultural fabric of village life. For guidance on navigating changes, see Table 11:

Table 11 - Characteristics of those who successfully or unsuccessfully navigate natural changes

Profile of those who can more easily navigate challenges resulting from natural changes	Profile of those who struggle to navigate change
Large agricultural entrepreneurs (although they also already experience drought);	Small farmers – in cases where they do not collaborate;
People who move from the village to the city and have financial resources;	Small businesses that rely on nature's functionality – for example, drought and lack of water affecting tourism;
Solar energy investors;	

Informed individuals;	Local communities with a high proportion of elderly individuals;
Communities where people collaborate and are open to experimentation;	Lack of information, lack of knowledge;
Communities that include formal institutions, the church, and NGOs that collaborate and form a shared vision for the community, valuing nature and taking a proactive approach to new challenges.	Local communities where trust among people is lacking;
	Local communities lack innovation, collaboration, and a shared vision that reactively approaches natural changes.

4.4 Initial Mapping of Interventions

a) Community-led festivals and gastronomy supporting biodiversity

One intervention in the Saschiz area is the revival of local food heritage through community festivals. The Rhubarb Festival in Saschiz, organized by the Women's Neighborhood Association (Vecinătatea Femeilor) of Saschiz, is an example. For over a decade, local women have transformed a traditional Saxon culinary practice (cooking with rhubarb) into an annual celebration that attracts visitors and supports biodiversity-friendly farming. The festival, now drawing over 1,000 tourists each year, features rhubarb soups, pizzas, jams, and syrups made from locally grown produce, as well as craft stalls and cooking workshops for all ages. By creating demand for rhubarb and other traditional crops, the event incentivizes villagers to maintain home gardens and orchards instead of abandoning them. It thus links cultural gastronomy with conservation: success is achieved informally through growing attendance and the pride of local producers, as well as formally through the creation of new market outlets for biodiversity-based products (an online shop now sells Saschiz rhubarb goodies nationwide). Participation is highly inclusive (local housewives, farmers, and artisans), and they co-create the festival. The Saschiz Town Hall and NGOs, such as ADEPT, have supported these festivals as partners, demonstrating a collaborative governance model. This grassroots initiative challenges conventional top-down rural development by proving that small-scale, place-based food heritage can drive sustainable tourism and livelihood. Indeed, the number of tourists to Saschiz doubled between 2011 and 2016 (from 6,000 to over 12,000) after such community-led events took off (further information at <https://mytransylvanianvillage.wordpress.com/>), suggesting that conserving HNV farmland through celebrating its products is a viable intervention strategy.

b) Reviving traditional land use and crafts as innovative interventions

Several interventions in the Saschiz region aim to revive traditional land uses and crafts as a means of restoring biodiversity and promoting community welfare. In the nearby village of Mălâncrav, for instance, a historic Saxon apple orchard (dating to the 15th century) was rescued from abandonment and transformed into Romania's first certified organic orchard. With support from the Mihai Eminescu Trust (MET), the entire 108-hectare orchard, with over 215 plant species and 100 bird species, was replanted with fruit varieties and managed with ecological methods. A small juice factory now produces about 20,000 liters of organic apple juice annually, sold in hotels and markets, and the orchard provides permanent and seasonal jobs for villagers. Notably, a nursery for old Transylvanian fruit tree varieties was established on-site to preserve genetic diversity and supply local farmers with saplings. This intervention builds on a niche innovation, traditional extensive orcharding, translating it into a modern social enterprise. Its success is measured both in biodiversity terms (dozens of wild plant and mammal species thrive in the orchard) and socio-economic terms (local employment and a revenue stream that makes conservation financially sustainable (further information at <https://www.mihaieminescutrust.ro/>)). It also consciously involves the multi-ethnic community (Romanians, Saxons, Roma) in the stewardship of their natural heritage, illustrating inclusive practices. Back in Saschiz itself, the revival of Saxon pottery traditions is another socially embedded innovation. Saschiz

was famed for its cobalt-blue pottery centuries ago, but the craft had nearly vanished. In 2015, Fundatia ADEPT (a local NGO) established a Pottery Training Center. Young people from across the Saxon villages were trained in ceramic skills to re-launch traditional pottery production. Today, pottery workshops not only produce beautiful traditional wares for sale but also serves an educational purpose: tourists and local schoolchildren can participate in hands-on pottery workshops, learning about the cultural heritage of the area. By blending craft revival with experiential tourism and youth vocational training, this initiative challenges the conventional view that heritage crafts are relics; instead, it positions them as drivers of rural innovation. The ADEPT foundation explicitly targets disadvantaged groups for employment in such projects, indicating a social inclusion angle (for example, training and hiring unemployed local youth or members of the Roma community in the ceramics workshop). The project's impact is evident both informally, in the renewed interest among local youth in their heritage, and formally, through the creation of new jobs and a tourist attraction, with the pottery center becoming a must-visit site for those touring the UNESCO-listed Saxon villages.

c) Participatory conservation, education, and inclusive governance

A hallmark of the Saschiz region's interventions is the participatory and inclusive approach to environmental management. Rather than relying on top-down enforcement, NGOs and community groups have promoted co-management of resources. For example, the village of Viscri (a neighboring locality) has a large wood-pasture with ancient oak trees, which has been maintained through a community-managed grazing system. Traditional rules and collective decision-making by villagers (including shepherds from all ethnic groups) have kept this wood-pasture in excellent condition, with significant biodiversity value. This common wood-pasture remains well-preserved through traditional agricultural practices and hosts a rich species diversity – a living example of how participatory governance can outperform “business-as-usual” intensive agriculture in conservation outcomes. In Saschiz itself, communal grazing associations have been formed with guidance from NGOs, to organize pasture use in ways that prevent overgrazing and reward local herders for sustaining the flora-rich meadows. Indeed, by 2010, ADEPT had facilitated the establishment of six grazing associations and conducted workshops with over 250 farmers to promote agro-ecological practices. One tangible result was a dramatic increase in uptake of agri-environment schemes: six times more farmers enrolled in biodiversity-friendly farming subsidy programs in the Saschiz area compared to nearby communes without such outreach. This is a formal success indicator that demonstrates how participatory advisory interventions can translate niche sustainable practices (such as rotational grazing and late hay mowing) into broader adoption. Local farming communities also participate in knowledge-sharing workshops on topics such as adding value to farm products and sustainable forest management, often led by or in partnership with ADEPT. Such workshops have led to the formation of new producer groups (e.g., a “Saxon Village Preserves” Slow Food network for traditional jam-makers) and even initiatives for community forestry certification, in which villages pursue FSC sustainable forest certification together. These examples underscore a shift towards inclusive governance: farmers, including smallholders and marginalized small producers, are actively involved in designing and implementing interventions, rather than being passive recipients of external instructions.

Youth and children are not left out. Both the MET and ADEPT have run environmental education and cultural heritage programs to seed the next generation's interest in sustaining their landscape. Schoolchildren in the Târnava Mare area have been given butterfly and wildflower identification guides, as well as farmers' almanacs adapted for HNV grasslands. Summer camps and “learning centers” in villages like Mălâncrav engage local and Roma youth in crafts, active citizenship workshops, and nature exploration. These informal interventions build local capacity and pride, ensuring the longevity of the more formal projects. Success here is often assessed through community feedback, for instance, increasing attendance in village meetings and Local Action Group forums.

d) Sustainable tourism and “High Nature Value” enterprise

Another cluster of interventions translates the region's niche innovations into sustainable business models, particularly in the tourism sector. The Transylvanian Bike Trails are a noteworthy example: with external grants and local cooperation, over 100 km of mountain biking and hiking trails have been created linking eight Saxon villages and the medieval town of Sighișoara. These trails traverse wildflower meadows, oak woods, and village lanes, intentionally routing visitors through the most scenic natural and cultural spots. Every year, a "Transylvania Bike Trail Race" is held, drawing more than a thousand participants to experience these landscapes. The race (organized by a local sports club together with ADEPT) is explicitly aimed at raising awareness of the "unaltered beauty of the area" and demonstrating the potential of nature-based, low-impact tourism. It has also become an economic opportunity for local people: local bed-and-breakfasts fill up during the event, and many racers return later as regular agri-tourists. The trails themselves won a European Landscape Award for their integration of conservation with community benefits. Importantly, local villagers (including schoolchildren) use the trail network as well, and some have been trained as biking guides or hospitality providers, ensuring the benefits circulate locally. This social enterprise approach to tourism builds on the niche idea that HNV farmland can be more valuable as a tourist landscape than as an intensive monoculture. By investing in trails and events instead of large ski resorts or extractive industries, the Saschiz area has become a path that challenges mainstream rural tourism models. Success is measured in part by visitor numbers and media attention. Small family-run guesthouses, craft shops, and farm-to-table experiences have increased alongside these interventions. For example, some local entrepreneurs offer "Transylvanian brunches" and farm visits, blending sustainable tourism with agro-biodiversity education. One couple in Saschiz opened the "Tei Tea House" in a restored Saxon home, which doubles as a community hub for discussing new projects while serving herbal teas and syrups made from foraged linden flowers and elderflowers. Another family launched a farm produce "basket" delivery service (the "Peasant's Basket") via an EU-funded project, allowing urban consumers to order traditional pickles, cheeses and jams from Saschiz farms online. These initiatives demonstrate how traditional knowledge, whether for gathering wild herbs or creating pickling recipes, is being harnessed in new ways to give HNV farming an economic edge. One example is Pivnița Bunicii ("Grandmother's Cellar"), a jam and syrup enterprise in Saschiz started by a local Scotsman, Jim Turnbull. He built a fruit processing center that now works with hundreds of villagers (many from poor families who seasonally pick elderflowers and berries) and employs several full-time staff to produce award-winning traditional preserves. By branding them as "like grandma used to make", this initiative connects culturally embedded skills (foraging, jam-making) with modern food markets. It challenges the conventional agri-business supply chain by keeping value addition local and ecologically gentle (e.g., wild elderflower instead of intensive crops). As an ADEPT director, Turnbull also insisted on training locals in hygiene and hospitality, enabling them to host tourists and offer tastings, which represents a holistic approach that links environment, culture, and business. The success of such social enterprises is often informal but tangible: Pivnița Bunicii products are now sold internationally, and similar small businesses have sprouted in neighboring villages, indicating replication of the innovation.

The Saschiz community-led interventions provide how niche innovations can be scaled out or translated into mainstream practice. What began as local experiments (e.g., a farmers' market here, a heritage festival there) is now part of an integrated rural development approach. For instance, the Slow Food-inspired "Saxon Village Preserves" idea helped local women commercialize traditional jams, informing national policy discussions on short supply chains and Geographic Indication labels for local products. Likewise, the creation of grazing associations in Saschiz has been used as a case study by agricultural policymakers to promote commons-based pasture management in other regions. These interventions also underscore the importance of policy support: EU programs, such as Natura 2000 and agri-environment schemes, provided an enabling framework (e.g., paying farmers to maintain wildflower meadows), but it was the local actors' capacity to organize and innovate that ultimately determined success. The fact that six times more farmers joined eco-schemes in the Saschiz area than elsewhere suggests that policy mechanisms only reach their potential when coupled with local facilitation and trust-building.

Another lesson is the power of social innovation and inclusive governance in achieving conservation outcomes. Rather than treating biodiversity protection as a solely ecological or technical issue, the Saschiz case shows it is inherently social. Initiatives deliberately built on cultural heritage (Saxon customs, Roma knowledge of the land) tend to gain local legitimacy and endurance. In fact, Saschiz and surrounding communes demonstrate a model of inclusive conservation where women's groups, farmers, and even youth clubs are stakeholders in biodiversity management. Policies aiming to replicate such success should therefore invest in local capacity (e.g., training rural animators and supporting micro-grants for community enterprises) and in mechanisms for participation (such as Local Action Groups or participatory budgeting for conservation initiatives).

Ultimately, these interventions challenge the conventional distinction between "development" and "conservation." In Saschiz, there are two sides of the same coin. High Nature Value farmlands are sustained not by fencing people out, but by drawing people in through livelihood projects, festivals, and education. The LIFE "Metamorphosis" project (2023–2029), now underway in the region, exemplifies this merged approach. It aims to reintroduce three threatened butterfly species and restore 45 hectares of meadow habitat, while indirectly protecting over 1,000 hectares by improving local incomes and working with farmers as partners. In other words, ecological experiments are not happening in isolation; they are entwined with social enterprise and participatory management. The Saschiz case study suggests that truly innovative interventions for biodiversity are those that embrace cultural context, empower communities (including marginalized Roma), and break the "business-as-usual" silo of conservation. By supporting festivals, local museums and centers, workshops, and inclusive campaigns, the region is actively redefining what biodiversity governance looks like on the ground, providing valuable insights for policymakers and researchers alike as they analyze interventions across Europe.

4.5 Discussion

Exclusionary practices in biodiversity governance

Biodiversity conservation is often shaped by exclusionary mechanisms that marginalize local knowledge, limit participation, and reinforce power hierarchies. These mechanisms manifest in various forms, from privileging scientific expertise over TEK to economic structures that disenfranchise small-scale farmers and local communities. Understanding these exclusionary practices is crucial for creating inclusive and effective biodiversity policies.

The role of values and social attitudes

Biodiversity governance is influenced by the values and attitudes that shape what is considered legitimate environmental knowledge. Historically, scientific frameworks have been prioritized over indigenous and local knowledge systems, systematically excluding traditional ecological practices. For example, conservation efforts in many rural areas often overlook the intricate understanding that local communities have of their ecosystems. Participants from Biertan illustrate this gap in perspectives. One workshop participant noted, "When I think about nature (...), it's a place where I don't see anything cultivated, just meadows or forests, without any kind of crops". This perception reflects the dominant conservation narrative, which views nature as separate from human influence. However, many local land users emphasize that biodiversity is a direct outcome of centuries of sustainable land management. "If we have biodiversity, it means that we have been quite sustainable so far" (workshop participant). Such statements highlight how exclusionary social attitudes can undermine the contributions of local communities to biodiversity conservation.

Furthermore, cultural identity is deeply intertwined with environmental practices. In Saschiz, a participant emphasized, "For me now, it means water. Water as a resource for food, drinking water, household water, water for animals" (workshop participant). The prioritization of scientific conservation over local knowledge overlooks these deeply

ingrained relationships with nature, thereby limiting the effectiveness of policy interventions.

Flows of knowledge and marginalization

Scientific research and policy-making processes often exclude or fail to engage local perspectives, further reinforcing power imbalances. Policies are usually formulated without consulting the individuals who are most directly affected, leading to ineffective implementation and community resistance. Knowledge asymmetries are also evident in the uneven distribution of resources and access to information. Rural communities frequently lack the means to engage in decision-making due to limited financial resources, restricted access to policy discussions, and barriers in navigating bureaucratic structures.

One participant noted: "Local communities are not well informed about legislation and do not comply with it. Everyone is minding their own business". This sentiment reveals the disconnect between policymakers and local populations. Similarly, the loss of traditional knowledge accelerates ecological degradation. A participant also reflected, "Thirty years ago, we used to bathe in the valley, but now there's barely any water flowing" (Participant_Saschiz). This highlights how environmental changes are exacerbated by the exclusion of TEK in biodiversity governance.

Economic practices and systemic exclusion

Economic structures play a significant role in biodiversity governance, often reinforcing exclusionary dynamics. Many small-scale farmers and pastoralists have historically maintained biodiversity through traditional practices, yet they are usually marginalized in broader economic policies. One participant from Biertan stated, "Small farmers... They have the most to lose. Overall, they have nowhere to sell their products because of our policies...". This economic exclusion leads to financial instability and weakens local resilience against environmental change. Moreover, economic incentives tend to favor large-scale conservation initiatives that cater to industrialized resource management or tourism rather than community-based conservation models. This displacement of traditional livelihoods disrupts existing human-nature relationships, forcing communities to conform to externally imposed conservation models. Industrialized farming further exacerbates ecological degradation. As one participant observed, "For twenty years, my father-in-law has only planted corn on the same plot" (This monoculture practice, driven by economic policies, contrasts sharply with traditional land-use strategies that promote biodiversity).

Power dynamics in decision-making

Biodiversity governance is often dominated by government agencies, NGOs, and scientific institutions, without providing a voice for local communities. This top-down approach imposes external conservation frameworks without considering local realities and contexts. A participant expressed frustration: "Our pastures used to be properly maintained, but now no one takes care of them". This highlights how traditional land management practices are being eroded due to power imbalances in conservation decision-making.

Inclusive mechanisms for biodiversity conservation

To counteract exclusionary practices, inclusive mechanisms must be strengthened to integrate diverse knowledge systems, empower marginalized groups, and promote participatory governance.

- a) Strengthening participatory governance: Community-led conservation initiatives and co-management agreements are essential for fostering inclusion. These mechanisms help bridge the gap between scientific and local knowledge, ensuring that policies are co-created rather than imposed. One practical approach involves adapting conservation discourse to local understandings of nature. For instance, researchers substituted "biodiversity" with "nature" in interview guides to align with local perspectives. This simple linguistic shift facilitated more meaningful community engagement.

- b) Recognizing and valuing traditional knowledge: Policies should formally recognize TEK as a valid and valuable expertise. Legal frameworks can support this by protecting land rights, funding community-led research, and creating platforms for knowledge exchange. A participant emphasized the importance of traditional ecological knowledge, stating, "In our area, it was very important that almost all households had a well in the yard". Biodiversity governance can benefit from centuries of accumulated wisdom by restoring and incorporating such practices.
- c) Supporting sustainable local livelihoods: Ensuring that biodiversity policies align with the economic needs of local communities is essential for their long-term viability. Many rural populations rely on traditional farming techniques that should be recognized within conservation frameworks. A participant noted, "Mowing is a bit mechanized now... because no one mows traditionally anymore". Supporting sustainable land management techniques through financial incentives and policy recognition can help bridge this gap.
- d) Creating platforms for community engagement: Inclusive conservation requires spaces where local voices can be actively heard and involved in decision-making. Knowledge-sharing initiatives that integrate local perspectives into biodiversity governance foster a sense of ownership and long-term sustainability. A participant highlighted the cultural importance of local biodiversity knowledge: "Elderberry, for example, at grandma's cellar, local elderberry...". This demonstrates how biodiversity conservation must integrate both ecological and cultural dimensions to be effective.

The role of innovation and innovators

Innovation plays a crucial role in biodiversity conservation by introducing novel approaches that integrate traditional knowledge with modern sustainability strategies. Niche innovators, including local farmers, environmental activists, and citizen scientists, drive transformative changes by experimenting with new conservation techniques. Researchers

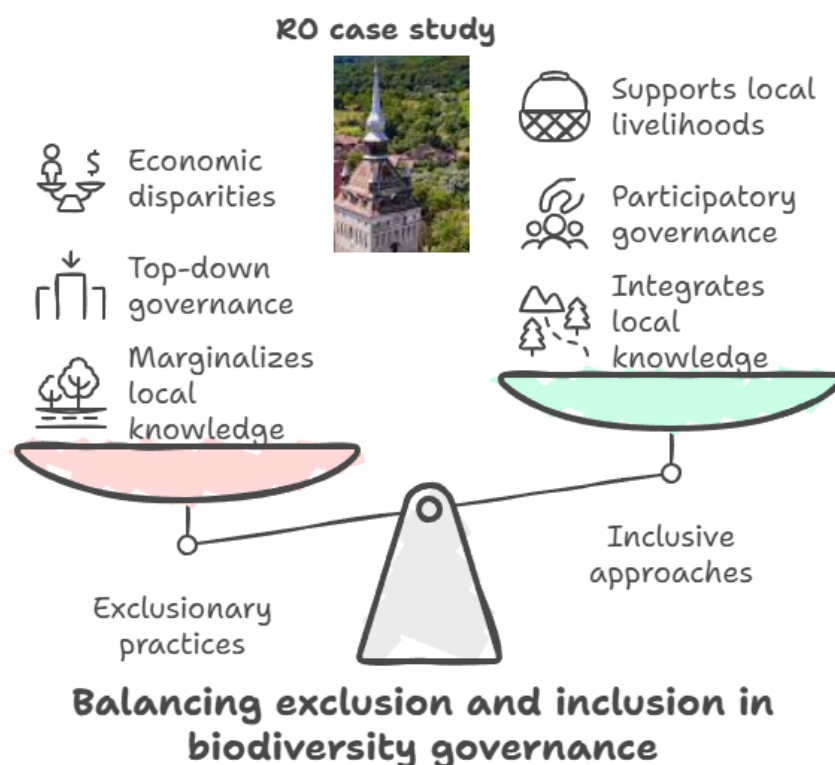


Figure 14 - Balancing exclusion and inclusion in biodiversity governance

introduced measures to protect the Albăstrelul Transilvan butterfly, engaging local farmers in habitat restoration. Similarly, community members have worked to preserve traditional vineyards, ensuring that these landscapes continue to support biodiversity. Recognizing and supporting these grassroots innovators is essential for fostering inclusive and sustainable biodiversity governance.

Exclusionary mechanisms in biodiversity governance marginalize traditional ecological knowledge, reinforce economic disparities, and limit participatory decision-making. However, inclusive approaches that recognize local knowledge and empower marginalized groups, fostering community-led conservation, can drive transformative change. By integrating traditional knowledge systems, supporting sustainable livelihoods, and strengthening participatory governance, biodiversity policies can become more equitable, effective, and resilient in the long term (Figure 13). Bridging the gap between scientific and local knowledge is essential to ensure that biodiversity conservation efforts are both socially just and ecologically sustainable.

5. Social Ecological System Analysis

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5.1 SES dynamics, interactions, and relations

SES impact on different actor groups

The territorial SES in the Romanian study case region impacts different actor groups in various ways, as SES influences access to land, resources, identity, and governance. Small-scale farmers are one of the most visibly impacted groups. Many of them still practice slow, traditional farming methods, such as haymaking and low-input livestock husbandry, which are integral to the area's biodiversity and landscape character. Their livelihoods are tied firmly to the ecological health of grasslands, forests, and water. However, changes in agricultural policy, land ownership, and youth migration have weakened material connections to the land. Farmers are now often farming to access subsidy programs rather than to meet the needs of their community, a phenomenon also observed by Fischer et al. (2012).

The older community members have a strong connection to the land, one that has been cultivated over decades of embodied experience with the environment, such as tending an orchard, harvesting herbs, or managing hay pastures, often alongside their family members. These relationships convey a profound connection that underpins both traditional ecological knowledge and cultural identity (Balázs et al., 2019). Older residents, as noted among interviewees in the Hartel et al. (2023) study, frequently spoke of the landscape as home, part of themselves, or even as sacred.

By contrast, younger people experience cognitive and affective disconnection. Their lesser material dependence on the land, as well as greater digitization and out-migration, have led to a decline in interest in local ecological and rural continuity. However, this disconnection is not irreversible - some returning youths connect with the land in new ways through tourism, food, or the practice of permaculture, often transforming tradition into hybrid innovation (for example, a tea house opened by a woman in one of the villages).

Marginalized communities, particularly Roma people, present and experience vulnerabilities as well. Frequently lacking official land rights or political representation, they rely on the informal use of natural resources, such as foraging, and are particularly vulnerable to environmental degradation and institutional neglect. Their interests are commonly excluded from conservation and land use planning, perpetuating systematic exclusion.

Other players, such as NGOs, scientists, and local authorities, play various roles in shaping the SES. NGOs and conservationists, often operating within institutional frameworks that prioritize measurable outcomes and biodiversity targets, tend to approach the SES from a technocratic or scientific perspective. While they are essential actors in channeling funding, promoting conservation, and legitimizing scientific knowledge, the broader institutional systems within which they operate can limit their deeper engagement with local values and experiential learning. Through activities like those organized by BioTraces, gaps between different ways of understanding nature can be bridged as they bring together diverse actors who might not otherwise have a space to collaborate or engage in dialogue.

The more-than-human agents, such as pollinators, wild plants, and protected animals, are also conditioned by the SES. Their health is closely entwined with traditional farming systems, which present the open, species-diverse spaces they need. When these systems change or break apart, habitat quality declines, and biodiversity loss consequently emerges (Signal and McCracken, 1996).

Overall, the SES is a complex web of interdependencies and vulnerabilities. When it changes under social, political, or economic pressures, it not only alters the landscape but also affects relationships, knowledge systems, and identities. Appreciation of these impacts across actor groups is necessary for constructing interventions that are both sustainable and equitable.

Decision-making processes and power relations between relevant actor groups

Decision-making regarding the SES in the RO study case occurs within a complex and often fragmented governance system, where institutions, traditional practices, and external policies overlap, interact, and frequently clash. Local officials, such as mayors and municipal councilors, are formally responsible for rural development and land-use decisions. However, their ability to actively support sustainable SES pathways is often limited by underfunding, limited ecological expertise, and reliance on broader national and EU policy frameworks that they do not directly control.

The Common Agricultural Policy is one of the most influential drivers of land-use decisions (Bignal and McCracken, 1996; Plieninger et al., 2015). Its structure tends to prioritize herd size and land ownership, which can unintentionally favor practices like overgrazing, monocultures, or subsidy-oriented production [6]. As a result, actors with larger landholdings and stronger administrative capacity (often external investors or agribusinesses) are more likely to shape land management decisions. This dynamic can marginalize traditional farmers and smallholders, despite their crucial role in maintaining High-Nature-Value farming systems.

Civil society actors, such as ADEPT, and cultural institutions, like Muzeul Etnografic al Transilvaniei (MET), play various but complementary roles in governance. While ADEPT performs the technical intermediary function, enabling biodiversity monitoring and providing support to farmers with conservation-friendly practices, MET helps in retaining and transmitting traditional knowledge, cultural values, and customs closely tied to High Nature Value farming. Their influence, even if it is very significant, is often limited by a lack of structural integration into formal governance processes.

Power asymmetries are reinforced through social and cultural structures. Older women, though principal custodians of traditional knowledge, are not involved in strategic decision-making. Formal planning processes are almost bereft of Roma communities because there is systemic discrimination, and institutional inclusion is weak. Participatory workshops with BIOTraCes and other initiatives demonstrate that decision-making is often perceived as being “done to” local people rather than “with” them.

Additionally, ecological actors, including species, habitats, and ecosystem processes, are significantly impacted by human decision-making. Despite the use of formal policies, such as the Natura 2000 network, to represent their interests in governance, designations are often made in a top-down manner (Roellig et al., 2018). While there is a legal obligation to consult with local communities and interested stakeholders when preparing plans for the management of Natura 2000, this is often poorly adhered to in practice. Many locals are unaware of the activity or choose not to participate, perhaps because they see little relevance or connection between the proposed conservation actions and their everyday realities and priorities. Consequently, the substance of these plans is largely unknown to many, and local input is not effectively incorporated. Hence, priorities for conservation may not align with local values or practices, and biodiversity relies on the performance of human institutions to express and respond to ecological needs. This generates a paradox: biodiversity-rich habitats rely upon traditional practice, while the actors who perpetuate them are excluded from decision-making. Meanwhile, species, habitats, and ecosystems are significantly impacted by these choices, as they lack direct presence or agency in decision-making structures. Although policies such as those for Natura 2000 are intended to meet their needs, the success of these frameworks relies on how effectively human institutions interpret, implement, and integrate them with local realities.

In summary, the governance of the SES is characterized by institutional fragmentation, unequal power relations, and limited communication between decision-makers and those most directly affected by their choices. Addressing this imbalance requires more than just institutional reform; it calls for epistemic justice, which involves recognizing and integrating diverse knowledge systems, cultural identities, and place-based relationships with nature into governance frameworks that are inclusive, grounded, and contextually relevant.

Types of knowledge informing decision-making and biodiversity framing

In the RO case study, various kinds of knowledge intersect to shape how biodiversity is understood, valued, and governed. Science- and policy-led framings are mostly dominant, and these are carried forward through EU conservation models such as Natura 2000. These are represented by ecological indicators, species checklists, and expert judgments to shape management priorities and designate protected sites. Whilst scientifically robust, these framings are often disconnected from local people's everyday experience.

Traditional Ecological Knowledge (TEK), rooted in generations of place-based practices, continues to play a significant role in shaping the perceptions of and responses to biodiversity shifts among local stakeholders. This includes practices like rotational grazing and seasonal mowing, as well as understanding the ecological importance of pastures and hay meadows. TEK has supported high levels of biodiversity long before the concept was recognized in formal policy. However, it is often overlooked in official governance structures or acknowledged only in a symbolic way rather than being meaningfully integrated into decision-making.

PAR methods employed throughout the BIOTraCes workshops demonstrated that locals perceive biodiversity not only in terms of the number of species or types of habitats but also through relational and emotional experiences. For example, participants described biodiversity not in abstract scientific terms, but through vivid sensory and emotional experiences, such as the visual beauty of flower-rich hayfields, the distinct taste of wild fruits gathered by hand, and the deep emotional resonance of working the land in rhythm with the seasons.

These interpretations, though less quantifiable, reflect deeply embedded values that motivate conservation-minded behavior. These insights from the workshops illustrate the contrast between local knowledge and dominant scientific framings, highlighting the need to integrate multiple ways of knowing into biodiversity governance.

Ultimately, the governance in the case study environment is presently biased towards institutional and specialized knowledge, with traditional and experiential knowledge still under-integrated. It's not just the challenge of translation between systems, but also the task of rebalancing authority and creating enabling conditions for truly co-producing knowledge.

Ecological functioning of the SES and direct drivers of biodiversity loss

The Sighișoara-Târnava Mare landscape is a historically co-evolved social-ecological system sustained through low-intensity, multifunctional agriculture. Traditional land-use activities, including the management of hay meadows, pastoral grazing, and crop rotation, have traditionally provided high biodiversity support through a mosaic structure of the landscape. These activities help support soil health, water retention, and habitat diversity, which are critical ecological processes essential for sustaining the system's resilience.

Ecologically, the SES comprises an active mix of orchards, pastures, spring-fed areas, forest patches, and meadows. These habitats are primarily High Nature Value farmland and are home to threatened plant and animal species, which are protected under national and EU conservation legislation. The health of the system relies on how seasonal patterns and spatial variety are maintained. For example, mowing late, grazing just enough, and avoiding overuse of chemicals are all crucial in conserving the rich natural capital.

Still, several direct drivers are now clearly undermining these ecological processes. The most significant ones include:

- 1 Overgrazing, which is partly promoted by CAP subsidies that reward numbers of livestock but lack adequate ecological guarantees, causes soil compaction, lowered plant diversity, and degradation of habitats.
- 2 Abandonment of the traditional farming practices, particularly in remote or unproductive regions, facilitates shrub encroachment and loss of open habitat specialists.

3 Intensification of agriculture, i.e., increase in monoculture crops (e.g., maize), application of chemical inputs, and mechanized land conversion, tends to disrupt the ecological balance.

4 The locals described climate impacts, such as extended droughts and changing precipitation patterns, as increasingly interfering with water availability and vegetation dynamics.

5 Infrastructure growth and fencing, particularly in forested environments, break up ecological corridors and restrict wildlife movement, further fragmenting the network.

Locals have noticed changes in the timing of flower blooms, the availability of water, and the presence of species, as well as the disappearance of others. These observations suggest a decline in the balance between human use and ecological recovery. Most notably, the loss of traditional practices impacts not just the continuity of culture but also undermines the subtle feedback relationships that sustain ecosystem function.

Understanding this SES thus requires both ecological indicators and local experiential knowledge. Results from the BIOTraCes workshops in Apold, Biertan, Boiu, Malancrav, Saschiz, and Soard further underlined perceived local ecological stressors and processes. Drying out of springs and shrub invasions were identified as direct consequences of unsustainable actions. The abandonment of traditional mowing and the decline of crop rotation were both highlighted as concerns for landscape biodiversity. In some areas, the spread of mechanized agriculture and the loss of traditional knowledge passed down between generations have weakened the local community's ability to manage the land in a way that maintains ecological balance.

Another profoundly felt driver is climate, particularly through drying and declining water tables, both of which affect vegetation cycles and grazing regimes. Local actors also pointed out that in many places, ecosystems are no longer protected and stabilized by traditional land-use practices, such as clearing springs, rotating grazing areas, or drying hay in stacks. These methods, once essential for maintaining balance in the landscape, are now disappearing due to labor shortages, limited economic incentives, and shifting attitudes toward farming and manual labor.

Thus, the SES's operation depends not just on ecological patterns but also on the continuity of low-intensity practices that co-evolved with the landscape. Without active maintenance, these practices and the biodiversity they support are vulnerable to irreversible loss. Re-establishing this equilibrium is imperative for stopping biodiversity loss and assuring long-term system vitality.

Values underpinning decision-making processes

The three value categories from our case study (relational, instrumental, and intrinsic) have a subtle but significant influence on the local community's interactions with land use decisions. These values do not directly influence formal policy, but they can influence people's responses to policies, including whether they trust them and whether they get involved (Tieskens et al. 2017). Local biodiversity has a profound impact on daily existence: wild fruits are sweeter, grassy fields are picturesque, and traditional cultivation practices are meaningful. These values stood out clearly during the workshops and reflect the kind of knowledge and motivation that most ecological indicators fail to capture.

Natura 2000 or CAP tend to emphasize scientific and economic concerns rather than relational and cultural values, which are underrepresented in these formal policies. Disconnection can lead to mistrust or conflict if locals perceive that their traditions are being marginalized. However, there are also positive indicators. Ecotourism, branding of local products, and community programs are areas where emotional and cultural values align with biodiversity objectives. These programs suggest that governance can incorporate more diverse values beyond those based on science. Local values need to be viewed not as secondary but as key in developing accepted and sustainable land-use decisions.

Political, cultural and institutional power dynamics



Sighișoara–Târnava Mare (Saschiz) SES governance is conditioned by intertwined sets of political, cultural, and institutional power relations that shape what kinds of knowledge and values are considered legitimate and whose voices prevail in decision-making.

Politically, the SES is regulated by a top-down model, mainly through the national implementation of EU policies, including the Common Agricultural Policy and Natura 2000. These institutions determine priorities and allocate resources based on ecological and economic indicators created at upper levels of governance. Local political stakeholders, including municipal councils and mayors, often lack environmental knowledge and tend to act more as administrators of outside policies rather than facilitators of place-based governance. Consequently, the valuable knowledge that local people possess is often not utilized or respected when decisions are made. Marginal populations, and particularly Roma communities, are politically invisible and excluded even from local processes. This political unevenness constricts the range of values and knowledge included in SES governance.

Culturally, SES has roots in balancing traditions that include manual haymaking, rotational grazing, and spring care, but are increasingly devalued. Agriculture in younger age groups is often perceived as burdensome or outdated, fueled by formal education systems and mainstream socio-economic ambitions that devalue rural livelihoods. The cultural disconnect has eroded the intergenerational transmission of ecological knowledge. On the other hand, people in the older generation have strong identity-based values and relational values regarding the landscape. Still, they are rarely recognized in mainstream narratives that often reinforce biodiversity as a technical or policy tool. As a result, local values and cultural knowledge systems are either marginalized or superficially incorporated into project reports yet not fully embedded in the structural contexts.

Institutionally, power is held by outside agencies, funding institutions, and intermediaries, such as NGOs. These actors play essential roles in mediating between the scientific and local worlds, but they do not alter the deeper power dynamics or who controls agendas and resources.

All these factors combine to shape a system of governance where scientific and institutional knowledge tends to dominate, while local, lived, and traditional perspectives are often overlooked or included only superficially. For governance to be fairer and more effective, it's not enough to involve more people; it's essential to respect and act on the value of different ways of knowing and connecting with the land.

Embedding the local SES in the high impact sector

Broader policies, particularly EU environmental and agricultural regulations, largely shape the way the Saschiz area is managed. These policies will determine the boundaries under which decisions are made locally, limiting the actual freedom local people and officials have.

Within such external systems, the loss of biodiversity is typically viewed as a scientific or technical issue, to be managed through tools, legislation, and economic incentives. While such an approach enables programs like Natura 2000 to be implemented, it often overlooks local cultural understandings of nature and sustainability. CAP rewards eligibility and compliance rather than ecological quality or local engagement. As a result, local governance usually follows external templates, limiting innovation and responsiveness to local values. Even where traditional approaches (like low-density grazing or maintaining hay meadows) are essential for nature, they are poorly funded unless they fit within the parameters of subsidy schemes. This mismatch can make people feel left out and discouraged.

Organizations such as NGOs and Local Action Groups (LAGs) are attempting to bridge the gap between local needs and broader policy goals. Yet, they continue to operate within the same top-down systems. For governance to truly improve, there needs to be a greater balance that reflects not just environmental data and targets, but also the cultural and social values in which people care for and relate to nature.

Economic structures' impact over the SES

Economic structures in our case study put both direct and subtle pressures upon land use and biodiversity. The most powerful economic driver is the CAP, which provides subsidies for land eligibility and herd size but disregards ecological value. This compels many farmers to adopt practices that rely on subsidies, such as overgrazing and the expansion of monocultures, despite their detrimental ecological consequences.

Market structures often fail to support small producers. Furthermore, across almost every workshop, the profile of those most adversely affected by environmental changes (specifically, changes in socioeconomic status) often corresponded to that of small-scale farmers. The area is rich in traditional knowledge and high-value products; yet many marginal producers encounter difficulties entering the macro-markets due to poor infrastructure, inadequate branding, and limited marketing channels. Therefore, their products remain underpriced in the economic system, making traditional land management practices financially nonviable.

Economic marginalization affects smallholders and marginalized communities most strongly, as they often lack access to capital and formal land titles and have inadequate financial support. The groups are more likely to rely on informal economies, face systematic exclusions, or disengage from a range of formal governance and conservation initiatives.

There are promising but still small-scale support measures linked to local production, such as ecotourism or HNV product branding. Without institutional support and further investment, however, their influence cannot hope to challenge the dominant economic situation.

Assessment of biodiversity challenge and related biodiversity trends in the high impact sector

Biodiversity in the Saschiz region is assessed through both formal institutional methods and local observations. Institutions and authorities adopt systematic approaches, such as habitat mapping, species monitoring, and remote sensing, primarily to implement European Union policies, including the Natura 2000 initiative. These methods are based on scientific indicators and thus often disconnect from the way biodiversity is experienced and interpreted locally.

Communities, according to workshop findings, monitor biodiversity through their lived experiences, including the observation of fewer pollinators, risks to flowering, and a lack of water. This knowledge is informal and specific to the places concerned.

Although the value of local knowledge is recognized, it rarely enters formal assessments. Consequently, many more people believe that the planning of biodiversity is somewhat detached from what they see. In practice, a more effective approach would be to integrate scientific data with local relationships, which are then used for an assessment that is both feasible and grounded in a social perspective.

Current enablers and barriers for transformative change

Workshops, participatory research, and institutional analyses have shown that the present socioeconomic status (SES) of the Saschiz region is both an enabler and a constraint towards transformative change. Key constraints:

1. Policy lock-ins of the CAP rewarding scale and intensity over biodiversity.
2. Weaknesses in marketing and capitalization of traditional products.
3. Reduction in the intergenerational transfer of traditional knowledge due to migration and cultural change.
4. Social and economic marginalization of the disadvantaged groups, in particular the Roma communities.
5. Fragmented governance with participation that often has no real influence.

Conversely, opportunities can act as levers for change:

1. The existence of Traditional Ecological Knowledge (TEK) and cultural values, at least among the elders.
2. A strong attachment to their landscape and a place-based identity.
3. Committed local NGOs, cultural institutions such as MET, and active academic partners.
4. Local interest in biocultural products and ecotourism, linking the economy with incentives for biodiversity protection.

Insights from the workshops suggested that many local actors are motivated by the relational and intrinsic values of nature, which can be harnessed through a supportive system. For example, small-scale farmers and rural households could take on active roles in biodiversity stewardship if they were supported not just through financial incentives but through approaches that strengthen their emotional and cultural connection to nature. Initiatives rooted in ecotourism or local product identity provide more durable and meaningful motivations than compliance-based subsidies alone [3].

To conclude, the SES has real transformational potential, but only if governance and economic systems change to enable bottom-up innovation, plural forms of knowledge, and socio-inclusivity. If the SES stays the same, opportunities will remain isolated, and systemic change is unlikely. Participatory research processes have enabled the connection of diverse research voices and perspectives, made common or shared values visible, and validated the importance of local knowledge. There remains social cohesion and landscape identity in many locations that may be tapped to capture existing motivations and community connections to the land. Existing practices, such as late mowing and low-intensity grazing, can support biodiversity and may be sustained and increased with the appropriate policy environment and economic incentives. Transformative change is highly likely to depend on the system's willingness to accept and incorporate diverse knowledge systems, redistribute power in decision-making, and develop interrelated policies that simultaneously support ecological, cultural, and economic resilience. If these changes do not occur, innovation will continue to be fragmented or, at the very least, insufficient in driving systemic change. However, the SES has the potential for biodiversity-sensitive and socially just transformation if the right structural barriers are tackled and local capacities are activated.

5.2 Vision: What alternative SES could be?

Based on the dynamics, power relations, and tensions articulated in the previous analysis, this vision further develops what a more just, resilient, and locally grounded Sustainable Energy System (SES) might look like in the Sighișoara-Târnava Mare region. Instead of following the trajectory implied by top-down policy, short-term economic gain, and a symbolic form of participation, this vision imagines a system of relations grounded in everyday interaction, awareness, and shared knowledge between people and the landscapes they inhabit and shape.

In this system of relations, biodiversity is not only a distinct element aimed to be 'protected'; it is the expression of identity, memory, and lived experience. Traditional practices such as rotational grazing, spring maintenance, preserving ancient, isolated trees on pastures, and manual haymaking are revived not just through compensation schemes but also because they are once again valued by the community, embedded in local economies (e.g., ecotourism, biocultural products), and integrated into education as well. For younger generations, they return or stay; they no longer view farming as an indicator of failure, but rather as a part of a meaningful way of life that combines love for nature, day-to-day creativity, and social cohesion. Many no longer desire to migrate to cities because they prefer the tranquil lifestyle of the village surrounded by beauty and history. Young people can stay involved and connected to nature through rewarding and community-driven work, thanks to employment options in the local economy, which include booming tourism sectors, vital local government organizations like Local Action

Groups (LAGs), and environmental NGOs. They are no longer viewed as foreigners in their own villages, feel empowered, and participate in decision-making. Some decide to join in small-scale farming associations, which help their communities become more resilient by combining traditional expertise with modern equipment. Youth are not only present in this vision but also play a key role in maintaining and redefining the SES's future.

Governance is transformed: participation is no longer symbolic but structural. Local actors not only respond to policies; they actively participate in their creation from the beginning. Platforms for making decisions are diverse and multilingual. Historical, emotional, and experiential types of information are discussed alongside scientific indicators. Natura 2000 evolves into a shared framework that can be interpreted locally, allowing for flexibility and adaptation rather than a checklist. Through constant presence and involvement with community-defined priorities, institutions gain trust by being open and accountable. Women, Roma, and youth are not only participants in governance spaces but also leaders within them. Locals collaborate to develop adaptive land-use regulations and biodiversity monitoring instruments, resulting in a governance structure that incorporates ecological knowledge and local experience.

This SES is no longer economically reliant on extractive models or on subsidies for compliance. Instead, networks of cooperation between farmers, conservationists, tour guides, educators, and craftspeople who jointly create value rooted in the landscape are what create economic resilience. Biodiversity-friendly practices are rewarded by markets not only because they are branded as "green", but also because they help communities and consumers reconnect with the sources of their food and customs. As regional income streams diversify, new opportunities emerge, including year-round cultural events and sustainable tourism, which draw tourists and generate steady employment. While digital connectivity and infrastructure help local businesses, media coverage and narratives raise awareness of the community and landscape. Carbon sequestration programs generate additional revenue by compensating for traditional practices such as crop rotation or maintaining isolated ancient trees on pasture. By creating and retaining value locally, local economies become increasingly circular, promoting the welfare of both ecosystems and people.

Ecosystem services, such as pollination, soil fertility, water regulation, and climate moderation, among others, are acknowledged as essential components of both ecological health and economic resilience. These services are actively preserved through community stewardship, sustainable practices, and context-specific policies tailored to the local environment rather than being taken for granted. Land users who maintain and improve these functions are directly rewarded by mechanisms such as payments for ecosystem services (PES). At the same time, practices such as small-scale farming and maintaining a mosaic landscape structure represent indirect outcomes. The SES adopts a more comprehensive and integrated view of value, recognizing that biodiversity conservation, food systems, human well-being, and climate action are all interconnected through the health and functionality of the ecosystems that sustain them. By allowing communities to share ownership of the protection and benefits of local nature, this reinterpretation also promotes a more democratic allocation of accountability and advantages.

Nature-positivity in this vision does not imply separating nature from people but rather acknowledging humans as integral parts of the environment. It represents a way of life in which human well-being and environmental regeneration are mutually reinforcing objectives rather than antagonistic ones. According to this viewpoint, nature is valued not only for its benefits and economic potential but also for its capacity to uphold relationships, meaning, and identity. Instead of focusing on control and extraction, it redefines prosperity through coexistence and harmony with natural boundaries. Secure access to land, intergenerational knowledge spaces, ecological monitoring conducted by locals, and support for cultural continuity are some of the conditions that local institutions provide for the new Sustainable Economic System (SES), which is founded on care and respect.

The balance of power is also rebalanced. With the help of specific inclusion mechanisms and cultural recognition, Roma voices are no longer marginalized and are now actively involved in local and regional governance processes. In addition to being valued, women's knowledge actively influences governance and land management choices and is frequently reflected in routine activities. To transition from a top-down to a community-driven SES model, local youth take on leadership roles in associations, advisory councils, and ecotourism projects. Institutions are now more accountable and transparent, and they are working with those who will be impacted to co-create solutions rather than relying on administrative hierarchies. There is a more equitable distribution of power among generations, genders, ethnic groups, and occupations.

The biodiversity challenge is no longer presented as a remote or exclusively technical problem in this vision. For communities that depend on the land for their livelihoods, identities, and futures, it becomes something that is deeply felt and constantly checked. In addition to being quantified through indicators, biodiversity is also observed, discussed, and cared for in everyday activities, such as through the cycles of farming, the celebration of seasonal abundance, and the collective responsibilities of stewardship. By using their emotional, historical, and experiential knowledge to inform their decisions, local actors actively co-define what thriving ecosystems look like. Built on place-based ethics and shared futures, transformation is a continuous collective practice rather than a one-time endeavor. Continuity and change coexist in this new SES, as new forms of sustainability and care are established alongside respect for traditional knowledge. Through this continuous process, the integrity of the local social-ecological fabric is restored, enabling communities to confidently, creatively, and resiliently envision and implement shared futures.

The “roots” of this changed SES are trust and cooperation, which are gradually restored through inclusive decision-making, shared accountability, and a reciprocal understanding of each actor's function within the system. This collective imagination was also captured in a visual representation (Figure 14), co-created from the insights gathered during the workshop. By reviving collective action, neighbors once again join forces, rebuilding a sense of community and mutual support. When individuals recognize that they can accomplish more as a team than they can individually, a collaborative culture develops.



Figure 15 - Community traits of a healthy Social-Ecological System (SES), based on workshop reflections

The “trunk” of this new system is traditional knowledge, which gives it strength and stability through customs and perspectives that have endured for centuries. Instead of being silent, this knowledge is now shared in mentoring circles, school gardens, workshops, and everyday land practices, where it is revived, reappreciated, and adapted. The system's “leaves” are community engagement, where everyone has a role and a place through peer-led environmental monitoring, seasonal festivals, and regular participatory forums. All of this is made possible by education and awareness, the “sun”, both in formal and informal settings, such as schools, where people connect, share stories, and reinterpret nature as a living, co-creating partner. Education becomes a source of energy that fosters a sense of purpose in all individuals.

Innovation is encouraged in this system, but not just in the form of technological advancement. Instead, it is based on action, directed by town halls, youth councils, and local leaders who thoughtfully and determinedly initiate solutions rather than waiting for them from above. Knowledge, values, and imagination are mobilized collectively in the SES, creating a new civic energy. Through shared responsibility and co-creation, damaged relationships between people and nature, between generations, and between institutions and citizens will be healed in this vision, which extends beyond simple resilience.

The SES transforms into a system of possibility, solidarity, and sustainability. It is a place where people feel like they belong, where nature is preserved out of love rather than duty, and where futures are shaped collectively rather than separately. This vision is the actual, cumulative outcome of deciding to stay, work together, adapt, and develop; it is not a utopia.

5.3 Discussion

As the analysis progressed, it became clear that the SES is shaped by somewhat unequal relationships between policy and practice, scientific and experiential knowledge, and among social groups. The dominance of CAP rationale and Natura 2000 bureaucratic processes has constrained the space for local agencies and marginalized key actors such as small-scale farmers, Roma communities, and elderly holders of traditional knowledge. At the same time, institutional fragmentation and symbolic participation have undermined the feedback loops on which adaptive governance relies. Governance is often reactive, externally led, and compliance-based, rather than being driven by co-learning or reciprocal accountability. And despite such constrained conditions, elements of transformation can be identified. Local actors possess rich ecological knowledge, strong affective attachments to land, and cultural practices with implicit pro-biodiversity values. The workshops revealed a shared desire for change, not through disruption but through reconnection.

A recurring theme is the discrepancy between dominant biodiversity framings and local knowledge practices. While institutional assessments rely on technical indicators, locals discuss biodiversity in terms of taste, beauty, rhythm, and intergenerational memory. Closing this knowledge gap requires more of these participatory moments; it requires a structural transformation in who decides value and how decisions are made. It requires a shift from a logic of inclusion as an invitation to that of inclusion as a foundation. The vision developed in the previous section is not just a product of abstraction. It is grounded in values, practices, and lived contradictions expressed by local actors within the BIOTraCes workshops. It resonates with an alternative system of relations where diversity of knowledge, affective belonging to place, and collective agency are central pillars. Rather than proposing top-down solutions, the vision suggests bottom-up pathways rooted in existing practices, such as “clacă” (a traditional form of communal labor or mutual help in rural communities), community seed exchanges, or local ecotourism endeavors. Importantly, this vision neither romanticizes tradition, but seeks to revive and reimagine it via intergenerational learning, inclusive governance, and plural economies. Youth are not passive bystanders but active actors, and marginalized voices, including Roma and women, are pulled into positions of influence and co-creation. The SES is a site not only for sustainability but for care, justice, and reimagined prosperity.

However, the vision is dependent on more than imagination. Structural barriers, such as stringent subsidy regimes, a lack of long-term funding, and extractive policy cycles, for example, must be addressed. The current system prioritizes technical compliance over relational and cultural dimensions. Without institutional flexibility and trust-building mechanisms, many of the proposals are in danger of being aspirational. From a methodological perspective, this analysis demonstrates the effectiveness of employing participatory and narrative approaches in unlocking local knowledge and reimagining futures. The BIOTraCes workshops not only mapped existing tensions, but also generated new imaginaries through dialogue, shared storytelling, and ethical reflection. These tools helped reveal the relational fractures within the SES, as well as the pathways through which they might be healed.

Sustainable transformation in high-biodiversity rural communities requires more than technical fixes. The SES of Saschiz is on the verge of transformation, but only if transformation is grounded in care, equity, and collective agency. On a more fundamental level, the SES vision also challenges prevailing assumptions about what transformation should look like. Policy and scientific interventions increasingly seek measurable outcomes, including conserved hectares, counted species, and sequestered carbon. Despite these metrics being important, they overshadow the emotional, ethical, and historical entanglements that support human-nature relationships in lived landscapes. The citizens of local communities do not view biodiversity as a checklist but rather as something interwoven with taste, memory, rhythm, and presence in everyday life. In this context, change begins not in targets but in relations.

Perhaps one of the most valuable lessons of the BIOTraCes process is that trust is essential. Trust among institutions and individuals, trust across generations, and trust between communities themselves. To rebuild that trust (undermined by top-down policies, loss of control, and social dissolution), there must be a regular presence, transparent processes, and a desire to listen and learn together. The eagerness of the participants to imagine other futures is evidence of a civic reservoir of potential energy present in the population, waiting to be tapped if only institutions will make space for it.

The workshops also revealed the importance of emotional and relational spaces. Activities like telling stories, drawing maps together, sharing meals, and working as a group weren't just methods for gathering information; they were also ways to build community. They became moments of healing. In these places, people regained voice, visibility, and care. These types of knowledge, though often intangible, are key to building longer-term resilience and co-ownership of sustainability transitions.

These reflections also point to the need for policy co-evolution. The kind of transformation described in this report cannot be achieved solely by local communities. It should also encompass the broader impact sector, including EU programs, national governments, NGOs, and donors, becoming more responsive to locally determined capacities and values. This includes embracing policy agility, co-designed funding initiatives, and measurement that incentivizes not only conformity but also relational care, cultural continuity, and co-produced knowledge.

Another critical element is the role of young people in sustaining cultural continuity. As the vision highlights, young people are not merely returning to their homes. They are remaking it. They are combining tradition and innovation, land husbandry and digital fluency, and local rootedness and global outlook. Investment in youth participation, mentorship programs, rural innovation hubs, and place-based education would ensure that change is not only imagined but also implemented with intergenerational strength.

Finally, this SES narrative extends beyond Transylvania. It addresses more abstract questions regarding the future of rural Europe. Can we develop policy models that are sensitive to complexity, conflict, and cultural nuances? Can we reorient governance away from fragmented project thinking and toward an integrated, relationship-centered, place-based approach to change?

6. Locally Tested Interventions

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6.1 Evaluation of strategies in action

The ongoing strategies and interventions implemented by LAG/GAL and the UBB team for biodiversity regeneration present various strengths and gaps. These are analyzed under three primary lenses: (1) transformative change potential, (2) the manageability of indirect drivers of biodiversity loss, and (3) enablers of replication and impact reduction attached to disruptors.

1) Transformative change potential: A key aspect discussed during the last workshop (March 12, 2025, hereinafter referred to as W7) was the necessity of transformative change rather than incremental adjustments. This last workshop was part of the broader sequence of qualitative engagements (six workshops) carried out throughout the case study. The insights shared during the online session build directly on earlier meetings held in Apold, Saschiz, Boiu, Biertan, Mălâncrav, and Șoard where participants first articulated local understandings of land-use pressures, biodiversity decline, and opportunities for change. Referencing these earlier workshops helps show that the reflections emerging in March 2025 do not stand alone but represent a cumulative learning process developed over multiple interactions with community members. This framing highlights how perspectives on transformative change have evolved across the complete set of workshops and field dialogues. Against this background, one participant emphasized that “Real transformative change requires greater momentum. If we don’t pick up the pace, it will be difficult to achieve the desired results” (P_W7 anonymized identifier for a participant in Workshop 7). The emphasis is on finding new methods and adapting to novel conditions while maintaining sustainable land use and biodiversity. One example of transformative change cited in the discussion was an effort to restore biodiversity on agricultural land: “When we took over the land, we faced problems... we bought habitat-specific seeds, we brought bales of hay from other areas to introduce native seeds, we practiced grazing according to certain rules” (P_W7). The visible transformation over 10-18 hectares signifies progress, but the time-intensive nature of such interventions raises concerns about scalability and long-term feasibility.

However, a significant barrier to transformative change is the lack of enforcement of existing regulations. As pointed out, “A concrete example of transformation would be the application of already existing legislation ... We have the tools, but they are not put into practice.” (P_W7) Without proper implementation of environmental policies, efforts at biodiversity regeneration remain fragmented and ineffective.

Moreover, cultural and behavioral change is necessary to ensure long-term transformation. The discussion highlighted that mindsets rooted in short-term profit maximization and economic survival must shift toward long-term ecological sustainability. “The individualistic mentality, focused exclusively on profit, on personal interest, has become the norm... Therefore, any form of collective management of natural resources becomes almost impossible.” (P_W7). Transformative change in biodiversity management thus requires both structural policy changes and a fundamental shift in societal values toward collective responsibility.

2) Manageability of indirect drivers of biodiversity loss

The indirect drivers of biodiversity loss – including economic constraints, land-use changes, and policy misalignment – were among the recurring themes in the discussion. Economic viability remains a core issue, with farmers struggling to balance sustainability with profitability: “Many continue to practice organic farming, even if they no longer have official certification. This shows that it can be done, and the world is starting to understand the benefits” (P_W7). This suggests that while local farmers are willing to adopt environmentally friendly practices, economic pressures often hinder their long-term adherence to these practices.

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Another significant challenge is the lack of incentives and support for environmentally sustainable practices. As one participant noted, “If someone wants to benefit from subsidies, they should prove that they have learned about the sustainable use of natural resources” (P_W7). This suggests a possible solution: integrating education and policy incentives to encourage best practices in sustainable agriculture.

Furthermore, the ongoing degradation of ecosystems due to land privatization and resource competition was highlighted: “There are already examples of people appropriating portions of the river stream and conflicts are already starting”. This highlights the pressing need for enhanced land management and governance structures that prevent resource monopolization and environmental degradation.

From the previous workshops in Apold and Saschiz, additional insights emerged. The significance of traditional agricultural landscapes as biodiversity reservoirs was emphasized: “The meadows would be. The forest is very important” (for biodiversity). However, these landscapes are threatened by overgrazing and changes in land use. This shift reduces habitat heterogeneity, impacting biodiversity.

3) Enablers for replication and impact reduction attached to disruptors

In June 2024, the societal partner (GAL Dealurile Târnavei) organized six on-site workshops in the villages of Apold, Saschiz, Boiu, Biertan, Mălâncrav, and Șoard, where residents discussed local understandings of nature, land-use change, and biodiversity vulnerabilities. An online deliberative workshop complemented these workshops in March 2025, revisiting earlier insights and deepening reflections on the need for transformative change. While the complete set of workshops informs the case study, Deliverable 2.4 places particular emphasis, but not exclusively, on participants from Saschiz and Apold, as these locations provided the most relevant perspectives for intervention testing. Together, these engagements form a continuous qualitative process that grounds our analysis in locally situated experiences and cumulative learning. Through these discussions, participants consistently highlighted not only the need for transformative change but also the practical conditions that either enable or hinder such change on the ground. Replication of successful biodiversity conservation initiatives is critical, but institutional and structural barriers often impede progress. One identified enabler is the formation of communities of practice, as one participant (March 2025 workshop) pointed out: “We need functional communities of practice. WhatsApp groups, for example, are very effective” (P_W7). These networks facilitate the sharing of knowledge and support between farmers, researchers, and policymakers, enhancing the overall impact of biodiversity regeneration efforts. Another factor contributing to replication potential is education and awareness-building. The importance of early education and hands-on learning experiences was emphasized: “Every school could have a pedagogical garden, where children can learn through practice” (P_W7). Additionally, initiatives like school greenhouses and environmental education projects in rural areas were highlighted as models for fostering environmental stewardship from a young age.

However, the risk of local disengagement remains a challenge. The lack of institutional responsiveness was highlighted: “If someone files a complaint about the destruction of protected land, there must be a prompt and effective response, not just a formality.” (P_W7). Without stronger accountability measures, the effectiveness of replication efforts is compromised.

Disruptors such as climate change and external economic pressures require multi-level governance approaches. The importance of water resources was a recurrent theme: “Water as a resource for food, drinking water, household water, animal watering water” (P_Saschiz). Participants in Saschiz expressed concerns over declining water availability: “30 years ago we used to bathe in the valley, but now we can’t do this anymore because it almost doesn’t flow anymore”. Without effective strategies to protect water resources, local ecosystems and agricultural sustainability remain at risk.

Moreover, wildlife conservation challenges were highlighted. The presence of large carnivores is both a conservation success and a source of conflict: “The bear, the wolf, the

jackal... It is very interesting, considering two edges" (explanation: the need for conservation-protection of people). While some view these species as integral to their identity and even as potential attractions for ecotourism, others struggle with livestock predation.

To address the identified gaps, several strategic recommendations emerged from the March 2025 workshop: Strengthening policy implementation: Enforcing existing environmental regulations to protect biodiversity-rich areas; Economic incentives for sustainable practices: Providing financial support to farmers who adopt environmentally friendly methods; Enhancing community engagement and education: Expanding educational programs and community-based knowledge-sharing platforms; Improving institutional accountability/performance: Ensuring that complaints and reports on environmental violations lead to concrete actions; Developing sustainable land-use strategies: Encouraging traditional, nature-friendly agricultural practices to prevent ecosystem degradation; Balancing economic development and nature preservation: Creating models for sustainable tourism and resource management; Leveraging technology for biodiversity monitoring: Using satellite imagery and remote sensing tools to track biodiversity changes in real-time.

6.2 Enablers and disruptors

Although the workshop discussions centered on local experiences, they unfolded within a broader governance landscape shaped by national and EU policies. Romania's Natura 2000 obligations, strategic planning regulations, and national biodiversity strategies provide the overarching framework for conservation (European Commission, 2020). At the EU level, instruments such as the Common Agricultural Policy (CAP) strongly influence farming practices, subsidies, and land-use incentives in the region, shaping both opportunities and constraints for biodiversity-friendly management (Pe'er et al., 2019). These frameworks can support agroecological practices and habitat restoration, but they may also reinforce intensification pressures or administrative burdens that rural communities struggle to navigate. Understanding how these multilevel policies interact with local strategies is therefore relevant for enabling transformative change, as community-led initiatives are most effective when aligned with broader governance structures.

1. The success: on a 10–18-hectare plot, a transformation is visible in both species' richness and ecosystem function after a few years of adaptive management (using local seed mixes, imported hay to introduce native seeds, rotational grazing, and fallow periods). When traditional practices collapse – due to legal restrictions, labor shortages, or poor profitability – the result is often habitat degradation through neglect. Overgrown pastures, the disappearance of livestock breeds (such as the buffalo in many villages), and the accompanying loss of open-land flora and fauna are examples of these failures. Any strategy for regeneration must envisage how to revitalize or substitute the functions of these fading traditional practices.

2. Community attitudes and cultural identity

The workshops underscore that biodiversity is as much a cultural and social phenomenon as an ecological one. Local attitudes towards nature can greatly enable or impede regenerative efforts. In these Transylvanian communities, many natural elements are deeply woven into cultural identity. For instance, the white storks that nest in villages have become beloved symbols of the countryside. In Boiu, several women enthusiastically recounted how "the people love them", celebrating the storks' return each spring. One resident was overjoyed when storks attempted to build a nest on her small house, saying, "I was so happy." Stork nests are even used as local landmarks (e.g., "the nest at the bus stop"). This cultural relationship translates into practical protection – villagers guard the nests and view the birds as part of the community. Such cultural pride in a species or landscape is a powerful enabler of regeneration, as it motivates grassroots conservation efforts. It makes biodiversity a source of local esteem rather than an external mandate.

Communities also find identity and economic opportunity in unique local biodiversity. In Apold, a rare carnivorous plant (*Drosera*) was discovered in a marsh, and the recent reintroduction of the “Albăstrelul Transilvan” blue butterfly became a topic of discussion. Locals immediately connected it with future ecotourism: “many tourists will come to see it”. This excitement shows how a well-communicated intervention can capture the public imagination.

3) Attunement and mismatch between local biodiversity agendas and economic interests

The relationship between biodiversity regeneration efforts and economic activities is complex, with both alignments and tensions. Many community members in the study areas express deep concern about the loss of biodiversity due to financial pressures, primarily stemming from agricultural practices and land-use changes. The dominance of monocultures directly conflicts with the need for diverse landscapes to sustain biodiversity. Economic viability remains a significant driver of decision-making at the local level. While some farmers maintain environmentally friendly practices, others prioritize short-term economic returns over long-term sustainability. One participant noted: “The individualistic mentality, focused exclusively on profit, on personal interest, has become the norm... Therefore, any form of collective management of natural resources becomes almost impossible”. This perspective highlights the fundamental mismatch between biodiversity-focused interventions and prevailing economic models.

However, there are also opportunities for alignment. In Apold, discussions revealed an interest in promoting traditional agricultural landscapes that support biodiversity, suggesting that policies promoting agroecology and sustainable grazing could serve as enablers for biodiversity net gain while preserving economic benefits for farmers. In Biertan, discussions emphasized the importance of natural water resources, with particular concern over declining water levels. The drying of rivers and streams due to climate change and land-use changes presents a significant challenge for balancing local biodiversity conservation efforts with agricultural demands. Similarly, in Soard, discussions revealed concerns regarding land-use change and habitat loss. A participant stated: “In the forest, for example, it rained for two weeks in a row. You’d think the soil is now full of water. But if you go into the forest a week later, the ground is cracked. So, there is a great need for water”. This highlights a critical issue: deforestation and improper land management exacerbate the effects of climate change, affecting both biodiversity and agricultural productivity. Further, in Mălâncrav, participants emphasized the growing challenge of balancing biodiversity conservation with economic pressures: “People call them ponds... (used for) fishing and swimming... But I think they also serve as a water source for animals”. While small artificial water bodies provide some relief for biodiversity, they also underscore the need for economic activities, such as livestock farming, to adopt sustainable water use strategies and prevent depletion.

Another economic factor affecting biodiversity is the increasing pressure for land privatization. In multiple case studies, concerns were raised about the monopolization of natural resources. As a participant pointed out in Soard: “Here, we can see a hillside pasture that, after the first 15 years of abandonment and forest encroachment, likely will never return to its original pasture state”. This suggests that while land abandonment may offer some short-term benefits for biodiversity, a lack of proper management can lead to unintended ecological consequences.

The tensions between economic interests and biodiversity regeneration are also evident in forest management. In Soard, participants noted the pressure from private owners to exploit forests for short-term gains: “Foresters are quite receptive, but they still must deal with landowners. Currently, there is no compensation for those trees, though I believe it will be introduced in the forestry code. From my perspective, this represents a loss of timber resources”. This demonstrates a key conflict: conservation efforts must be accompanied by financial or policy incentives to make biodiversity-friendly practices economically viable for landowners.

4) Replicability of enablers and broadening impact

Communities of practice have been identified as a key enabler for expanding biodiversity initiatives. A participant emphasized: “We need functional communities of practice. WhatsApp groups, for example, are very effective”. Such informal networks facilitate knowledge exchange and capacity building among farmers, conservationists, and policymakers. Education is another enabler with strong replicability potential. The importance of integrating environmental awareness into school curricula was highlighted: “Every school could have a pedagogical garden, where children can learn through practice”. By fostering an early appreciation for biodiversity, communities can cultivate a generation that is more inclined toward sustainable practices. Financial incentives and support mechanisms were also discussed as necessary enablers. One participant noted: “If someone wants to benefit from subsidies, they should prove that they have learned about the sustainable use of natural resources”. This approach could incentivize farmers to adopt biodiversity-friendly practices, ensuring long-term impact. In Mălâncrav, the role of natural elements in community identity was underlined: “... examples of nature’s elements that are relevant to the local community... Pastures, forests, rivers, orchards”. This suggests that leveraging local appreciation for natural landscapes could enhance biodiversity restoration initiatives.

5) Managing disruptors and reducing long-term impact

Several disruptors were identified in the workshops, ranging from climate change to land privatization and economic pressures. A recurrent theme was the decreasing availability of water resources, which threatens both agriculture and biodiversity conservation. As noted in Saschiz: “30 years ago, we used to bathe in the valley, but now we can’t because it almost doesn’t flow anymore”. Addressing such environmental changes requires integrated water management strategies that align with local biodiversity goals. Large carnivores, such as bears and wolves, represent another disruptor. While they are an essential part of the ecosystem, their presence often leads to conflicts with local communities. One participant described the dilemma: “The bear, the wolf, the jackal... It is very interesting, considering two edges”. This suggests that while large predators are valued as part of regional biodiversity, their increasing numbers create tensions with farmers and herders. Land management conflicts also pose challenges. The privatization of key natural resources has led to disputes: “There are already examples of people appropriating portions of the river stream and conflicts are already starting”. Such conflicts hinder biodiversity conservation efforts and necessitate stronger governance mechanisms.

In Soard, climate change impacts were also noted, particularly regarding soil degradation: “Well, now the rain has changed a lot, the rains of 40, 50 years ago were smaller and soaked the soil, and now they are more violent and run off, washing the soil”. This suggests that land erosion resulting from shifting rainfall patterns poses a significant challenge to biodiversity.

6.3 Failed and successful practices

Across these diverse but interlinked cases (from the six villages), a clear picture emerges: biodiversity regeneration thrives when human and natural systems are tended together, but falters when either side is neglected. The successful practices – whether it’s the return of a rare butterfly, the persistence of buffalo grazing, organic farming, or the celebration of an orchard – all share a common thread: they combine ecological restoration with local social benefits and cultural meaning. Such interventions are locally led or at least locally embraced, and they often require patience. As one practitioner noted, “Our impact is slow. We see it over time, over many years.”

Yet, when that impact does come, it tends to be enduring, because it has grown from local roots. For example, the apple orchards of Mălâncrav have survived modern pressures in part because the community, with external support, has found new value in them – culturally (through festivals and identity), economically (through products and tourism), and ecologically (as habitat for pollinators). Likewise, Apold’s newfound “blue jewel” (the butterfly) is poised to become a long-term asset precisely because it was introduced hand

in hand with community awareness. On the other hand, the failed efforts and ongoing challenges underscore that good intentions alone are not enough. While many of these challenges arise from local socio-ecological dynamics, such as shifting land-use practices, declining traditional knowledge, and changing community motivations, they are also shaped by broader structural forces. Market pressures that favor high-input agriculture, rural depopulation trends, and rigid regulatory frameworks often amplify local vulnerabilities and limit the scope of community-led interventions. Distinguishing between these scales helps clarify why specific barriers persist despite strong local commitment and underscores the need for effective solutions to integrate both community-level initiatives and supportive, wider policies.

Systemic challenges – such as youth migration, the breakdown of traditional knowledge transfer, unfavorable market conditions, or rigid regulations – can undermine regeneration projects if left unaddressed. We saw that when farmers cannot make a living or feel unsupported, they abandon practices vital for biodiversity. When a community's social fabric frays, nature is left without its stewards. In these Transylvanian villages, people likened fighting for sustainable practices to Don Quixote tilting at windmills: "when you try and try to change deeply rooted mentalities, at some point you get tired... You feel like the windmills are too many and too big". This vivid metaphor highlights that deeply rooted mindsets are a primary barrier, whether it is locals stuck to harmful habits (such as improper pesticide use) or authorities hindered by one-size-fits-all policies. The fatigue that changes agents feel is real, but the case studies also offer hope: even windmills can be harnessed if enough force is applied in the right direction.

While the workshops brought together a varied group of local actors, the perspectives of certain underrepresented groups were present only partially. Youth, many of whom have migrated, were largely absent from discussions, and their viewpoint on land use and future livelihoods remains underrepresented. Women were frequently present and contributed substantially; however, several participants noted that women's voices are still not consistently recognized in local decision-making structures. The situation of economically vulnerable households and some Roma families surfaced only through second-hand accounts, indicating gaps in direct representation. These patterns reflect wider social inequalities that also shape who participates in shaping environmental futures. Acknowledging such asymmetries is crucial for interpreting the evidence base and ensuring that biodiversity initiatives do not inadvertently perpetuate local exclusions.

In conclusion, the enabling factors for biodiversity regeneration in these territories include strong community engagement, respect for traditional practices combined with updated knowledge, cultural pride in natural heritage, economic innovations that reward conservation, supportive networks, and responsive governance (when present). When these factors align, small projects can snowball into long-lasting positive change. Conversely, the limiting factors – social disintegration, cultural apathy or fear, economic inequities, and inflexible or absent policies – are influential and often interlocking. A well-documented lesson from the Transylvanian experience is that tackling these limiting factors requires an integrated approach: ecological goals must be paired with social and economic solutions. As one participant insightfully noted, "human life and nature cannot be seen separately." The most successful practices created win-win situations for people and ecosystems. By learning from both successes and failures – the orchard that blossoms and the pasture that vanished – practitioners and policymakers can better craft strategies that regenerate biodiversity in a way that local communities can sustain. The future of these landscapes depends not only on conserving nature but also on restoring the human communities and practices that care for nature. The integrative narrative from these case studies is ultimately one of cautious optimism: with knowledge, cooperation, and perseverance, the challenges of the windmills can be turned into engines of ecological and social renewal.

1. Traditional land management: Gains and losses

Many of the villages focus on traditional land-use practices, such as grazing, hay meadow management, and small-scale farming, which have a significant impact on biodiversity. In

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several communities, reviving or maintaining historic grazing regimes has proven beneficial. For example, participants observed that pastures where hardy water buffalo still graze harbor exceptional biodiversity: “As a rule, wherever buffaloes are grazed, biodiversity increases... traditionally buffaloes were more”. Buffalo grazing creates varied vegetation structures, and sites with buffalo host very strictly protected species. In Malâncrav, locals reported that buffalo are indeed still present, suggesting that continuity of this practice has helped sustain rich pasture ecosystems. Recognizing this, we must help farmers keep buffalo – which means first understanding why they gave up buffalo and addressing those causes. This marks a promising intervention: supporting traditional herding as a modern conservation tool. Where such support exists, it can be considered a successful practice that enables biodiversity regeneration by connecting ecological goals with local husbandry traditions. However, traditional grazing has declined in many areas, often with adverse effects.

Several villages described the loss of communal herding systems due to regulatory and social changes. In Boiu, residents complained that the daily communal herd (locally “ciurda”) of cows no longer goes out, in part because animals were banned from using the main road: “we were told that animals have no business on the county road. It is prohibited by law”. This legal barrier forced remaining farmers to find back roads for their livestock, and such hurdles discourage the practice. Elsewhere, pasture abandonment is a serious issue. In Șoard, participants pointed to a hillside pasture that, after 15 years of being unused, had rapidly overgrown with scrub. Once woody growth passes a threshold, the land is even reclassified as forest. This illustrates a failed outcome: traditional grazing and mowing kept landscapes open and biodiverse for centuries, but when economic and demographic shifts led to abandonment, biodiversity tied to open habitats declined as thickets and eventually forests took over. In Biertan, older residents noted a similar decline in active land use. Terraced hills, once famed for their vineyards, have largely fallen out of cultivation; they still hold aesthetic and historic value, but much of their ecological and productive function has been lost. Thus, loss of traditional management is a recurring challenge in these territories. Crucially, the social dimension underpins these trends. In the workshops, people observed that fewer villagers engage in farming and herding today, especially among the young generation. “At the community level, the number of people who exploit the land has been reduced... there is no one young anymore. That is, whoever could has left... In most of the country, large farms have taken over”, one Biertan participant remarked. This quote captures the demographic and economic forces driving change: youth out-migrate, smallholders age or quit, and large commercial farms or absentee owners take over land in many regions. The departure of “ciobani adevărați” (true shepherds) is particularly acute – an expert surveying over a hundred wooded pastures could “in 2 years, I only found 5 real shepherds”. With skilled herders disappearing, the knowledge and labor needed to manage grazing for biodiversity also vanish. A participant from Apold highlighted that even when flocks remain, the economics are harsh: “The price for a liter of milk is 60 bani” (approximately 0.12 Euro), which undermines livestock viability. Market failures like this make traditional pastoralism economically unsustainable, explaining why many who “could” have indeed left to seek better livelihoods. Practically, where traditional land management persists or is revived with support, landscapes show resilience and biodiversity re-integrates all elements of nature into a “sort of mini cultural wilderness”

The introduction of planned grazing regimes and restoration seeding on formerly arable land is a notable aspect of the butterfly’s return, serving as a point of pride and a tourism draw. We can consider community support as a crucial ingredient for long-lasting success. Similarly, in Malâncrav the historic apple orchards are a source of identity. Villagers instituted Sărbătoarea Mărului (the Apple Festival) to celebrate their orchard heritage, which one local explicitly cited as an “identity value”. The festival is now the village’s annual celebration, linking cultural tradition with biodiversity. Such events not only reinforce local appreciation for biodiversity but also encourage practices that maintain it – for example, keeping the old orchards pruned and productive for the festival. While these cultural connections can enable conservation, their absence or erosion can hinder it. A recurring theme was the gap between generations and the loss of traditional ecological knowledge.

Older residents often possess valuable knowledge of the local environment, but as they pass away or as young people leave, this wisdom risks being lost. In Apold, participants suggested a project for pedagogical schools to interview village elders, precisely to capture and transmit such knowledge. The need for “a meeting between generations” was seen as very important. Without efforts like this, young people may grow up disconnected from the land. Indeed, some have noted that many youths show little interest in farming or forestry, having witnessed their parents' struggles. Where cultural continuity is disrupted, conservation projects can fail because there is no one to maintain the practices. As one man observed, in some areas from other parts of Romania, entire villages have been abandoned. “In Tulcea, a village was emptied, nobody left”. In such cases, even the best ecological plans on paper are of little value if there is no community to implement or benefit from them.

Another attitudinal challenge is striking a balance between fear and tolerance of wildlife. Traditionally, rural communities have known how to coexist with large carnivores, such as bears and wolves. One participant noted that Romania was recognized as “the most tolerant country towards bears,” and that experienced shepherds still accept predators as part of life, taking measures to protect their livestock. One participant remarked that those who have long lived with wolves “tolerate them and know what to do to minimize risks”. This traditional tolerance has enabled Romania to retain populations of species that have vanished elsewhere in Europe – a conservation success rooted in culture. However, tolerance is wearing thin in some communities as lifestyles change. Several villagers admitted, “We are afraid of bears now and no longer go into the forest to collect mushrooms”. Younger or newer residents lack the familiarity with wildlife that their forebears had, and some incidents amplified fear. This shift toward fear can hinder regeneration: it reduces people’s use of and presence in nature (affecting practices like foraging that tie them to the land), and it can spur calls to cull wildlife rather than protect them.

The case studies, therefore, highlight that maintaining a cultural acceptance of living alongside nature – whether it’s storks on one’s rooftop or bears in the woods – is vital. The workshops revealed that communities value open communication and education to strengthen positive attitudes. In Apold, after hearing that even “traditional” farm products can harbor pesticide residues if old practices are misapplied, locals agreed that better information is the answer. A cautionary example was voiced: “Eggs from lovely old ladies at the market had very high pesticide levels, because the poor souls didn’t realize the potato powder they used would contaminate the hens.” Locals have noted that many villagers believe a lack of money is the primary problem. Still, in reality, “everyone... needs information... A lot can be done without money. If they have the information, money is a tool, not an end in itself”. In other words, knowledge and initiative can achieve a great deal even with limited funding. This sentiment suggests that investing in human capital – including education, demonstration of good practices, and intergenerational learning – is a low-cost, high-impact strategy. Communities that have internalized this, fostering learning networks and pride in local nature, seem far better positioned to regenerate biodiversity than those waiting passively for outside funding or top-down instructions.

3) Economic and political factors: Barriers and enablers

While culture provides motivation, economic and political frameworks often determine feasibility. Across the workshops, systemic factors – including markets, policies, and institutions – emerged as either supports for regenerative efforts or as obstacles that frustrate them. On the enabling side, supportive policies and projects have made a difference in certain instances. One example is how scientific research influenced law. In Mălâncrav’s workshop, the moderator described how the concept of protecting “remarkable trees” was developed over 10 years, and eventually, “now it’s a law”. This shows that evidence-based advocacy can translate into concrete legal protections, providing a framework to preserve biodiversity (in this case, like ancient oaks or other veteran trees) beyond individual efforts.

The LAG (GAL) and NGOs also play a positive role. In Apold, the GAL repeatedly held meetings to inform residents about the value of their land – to discourage the sales to outside investors. One man noted “Luckily, not many ended up selling land here”. By anticipating threats (land grabs, loss of local control) and raising awareness, the GAL may have helped the community retain its land and the possibility to manage it sustainably. This is an example of a preventative intervention with long-lasting benefits: keeping land in the hands of local stewards is essential for any regenerative practice to take root. Economic support can also come from alternative income streams aligned with conservation. Tourism and branding local products are frequently mentioned hopes. The introduction of the rare butterfly is anticipated to draw visitors. At the same time, Malâncrav’s apple festival and traditional apple products (like juices or jams made from the old orchard) attract people to the village. Such biodiversity-based businesses or events give conservation a tangible value. Similarly, the growing interest in organic farming provides an economic incentive to farm in a manner that is friendly to wildlife. One participant gave an example: some farmers initially obtained organic certification for better market access, and “many continue ecological practices even after dropping the formal certification”. This suggests that once farmers experience the benefits (such as improved soil health, enhanced product quality, potential price premiums, or personal satisfaction), they often continue with greener practices. However, it also highlights a limitation: the cost of certification was too high for some, leading them to abandon the label even though they continued the practice.

In general, when policies (such as organic subsidies or agri-environment payments) or markets (like consumers paying more for organic products) are supportive, they enable regenerative agriculture. When they are lacking, it falls to the personal conviction of farmers to continue, as seen in this case. Many challenges documented in the workshops relate to economic disadvantages and policy gaps that hinder the implementation of conservation-oriented practices. An example is the low pricing of farm products (as with milk mentioned earlier), which makes it hard for traditional farmers to survive. No matter how much a community values its meadows or herds, if the farm economy is unprofitable, younger generations will not continue in that path. This is a systemic issue that requires higher-level policy intervention (e.g., fair pricing, subsidies, cooperative structures). Otherwise, local regenerative efforts may fail in the long run due to simple economic factors. Another systemic barrier is the existence of fragmented or counterproductive regulations. The case of the forbidden road grazing in Boiu is illustrative: a well-meaning traffic law ended up outlawing a sustainable practice, without providing an alternative.

Participants across communities have voiced concerns that legislation often treats humans and nature as separate entities, rather than promoting their coexistence. As one facilitator put it, “The two (people and nature) cannot be seen separately as, for example, the EU Habitat Directive does”. This suggests that some top-down conservation policies may be perceived as out of touch with local realities, which could potentially hinder their effectiveness. A more integrative policy approach, which supports traditional land uses like shepherding or haymaking as part of habitat management, would likely be more successful. In fact, Romania’s implementation of EU schemes has sometimes tried this – for instance, by paying HNV farm subsidies to shepherds – but the persistence of comments like the above means gaps remain between paper and practice. Another factor is the influx of external actors and new landowners. The discussions revealed mixed effects of this. On one hand, those “who worked in the West, then came back and bought cheap land” were often the ones with foresight and resources to invest. These individuals can be agents of positive change if they bring sustainable ideas or keep the land from being overly exploited. On the other hand, if land is bought by investors with purely speculative or industrial agriculture intentions, local biodiversity can suffer. Apold’s experience was relatively positive – few sold out, and those who did were often informed folks – but the very need for the GAL’s awareness campaign shows that market pressures to sell land are intense in rural Transylvania. This economic pressure is a limiting factor, as it can disrupt community cohesion and remove land from the traditional stewardship that has historically favored biodiversity. The presence of “neo-rural” newcomers (city people moving to villages) was also debated. Some saw them as “winners” because “they earn money in the city and come

invest it locally”, potentially boosting the rural economy. If these newcomers purchase and restore old houses, buy local food, or even start small enterprises, they could indirectly support biodiversity-friendly living. But others noted that many “don’t take part in village life, even if they enjoy the rural environment”. Thus, the social integration of new stakeholders is crucial when outsiders connect and collaborate with locals, as they can be an asset. When they remain detached, their presence alone does not regenerate the community or landscape. Finally, the mentioned enabler was the formation of collaborative networks and the establishment of trust. Participants stressed the value of exchanging experience and being “part of a network”. They acknowledged that current society is “very individualistic” and people are afraid to trust each other, but rebuilding trust and cooperation can spark new ideas and solutions.

In practical terms, this means farmer associations, community groups, or partnerships with NGOs can help pool resources and knowledge for conservation. For example, if farmers band together to market a product (such as meadow-raised beef or wildflower honey), they might overcome some economic barriers that each would face individually. The participants referred to this through references to GAL projects and knowledge-sharing meetings. Indeed, one local expert concluded that with the correct information and minimal training, people can achieve significant results. Peer examples of success (like seeing a neighbor profit from eco-tourism or organic cheese) create a demonstration effect that money can’t buy. Thus, a key enabling factor is fostering these networks and disseminating success stories among communities, turning isolated successes into broader movements.

6.4 Co-learning

The co-learning process between research partners and societal actors reveals both challenges and opportunities in biodiversity governance. While indirect drivers such as land abandonment, economic constraints, and policy inefficiencies pose significant obstacles, the workshops also identified powerful enablers, including community-driven knowledge exchange, intergenerational learning, and participatory governance approaches. To enhance clarity for readers unfamiliar with the empirical material, it is helpful to note that the qualitative component of the case study consisted of six deliberative workshops conducted in June 2024 across Apold, Saschiz, Boiu, Biertan, Mălâncrav, and Soard, followed by an additional online workshop in March 2025. Quotations from the first six workshops are coded using anonymized identifiers of the form “P_VillageName,” while contributions from the online event are referenced as “PW7,” indicating “Participant in Workshop 7.” This system ensures both transparency and confidentiality while allowing readers to trace insights across events. A detailed analysis of all workshops, along with the full interview transcripts, is openly accessible in one of the UBB team’s contributions (co-authored with the social Partner, the GAL): Reti et al. (2025). Drawing on these cumulative insights, the patterns that emerged across the workshops underline a consistent expectation for governance models that recognize local knowledge and respond to the lived realities of land users.

To create effective biodiversity governance, action plans must integrate local insights, provide economic incentives for sustainable practices, and strengthen participatory decision-making. By fostering genuine co-learning and responsiveness to societal needs, biodiversity strategies can move beyond theoretical frameworks to create tangible, lasting change on the ground.

The co-learning process described in the document was produced through an integrative analysis of discussions from all workshops and field observations documented in the provided files. The co-learning between researchers’ partners on indirect drivers of biodiversity loss was developed by reflecting on the patterns of disruption that emerged across the six villages. Research partners identified: The loss of traditional land management practices, such as the decline in manual hay mowing or buffalo grazing, which previously supported biodiversity; Economic constraints, such as the drop in milk prices,

which force farmers to shift toward unsustainable agricultural practices; and Land abandonment, leading to rapid ecosystem changes.

By analyzing these trends, research partners could identify enablers for biodiversity regeneration, including a) Community-driven knowledge-sharing mechanisms (e.g., WhatsApp groups); b) The role of local ecological knowledge in policy design; c) Recognition of systemic lock-ins, such as bureaucratic delays in conservation policy implementation.

The co-learning between the research partner and the GAL was produced through the exchange of knowledge between local communities and researchers. Many insights in biodiversity governance originate from place-based observations, such as: ► Water shortages in Saschiz, which serve as real-time indicators of environmental change; ► Economic struggles faced by farmers, reinforcing the need for financial incentives tied to conservation; ► Cultural identity and biodiversity, as seen in Saschiz, where the reintroduction of the Transylvanian Blue butterfly sparked local engagement. By engaging directly with GAL, the UBB team could move beyond theoretical aspects.

I. Co-learning on indirect drivers of biodiversity loss between researchers' partners

Patterns of disruption in biodiversity regeneration: One of the main insights from the workshops was the recognition that biodiversity loss is deeply intertwined with socio-economic shifts. In Mălâncrav, participants observed that traditional practices, such as manual hay mowing, have almost disappeared: "Nobody mows by hand anymore. That is, very few". Instead, mechanization and demographic changes have led to a decline in labor-intensive, yet biodiversity-friendly, land management practices.

Another major disruption pattern is land abandonment. In several case studies, community members highlighted that when pasture lands are no longer used, they quickly become overgrown, altering local ecosystems. In Șoard, a participant noted: "In the first 15 years of abandonment, the pasture became forested... It will never return to its original pasture state". This reflects a broader trend where abandonment leads to rapid ecological succession, often resulting in biodiversity loss.

In addition to land-use changes, economic constraints also serve as a significant indirect driver of biodiversity loss. In Mălâncrav, a participant shared concerns about declining profitability in traditional farming. Such low prices make it unsustainable for farmers to maintain traditional livestock-based landscapes, which have historically supported biodiversity.

Enablers and their potential for scaling up: While disruptions pose significant challenges, several enablers identified in these case studies present opportunities for upscaling biodiversity-friendly practices. A key enabler is community-driven knowledge sharing. One of the successful models discussed was the role of informal learning networks. By fostering direct communication among farmers, conservationists, and policymakers, such platforms can enable real-time problem-solving and support. Another enabler is the integration of traditional ecological knowledge into governance models. In Saschiz, a participant emphasized the value of intergenerational knowledge transfer, suggesting that younger generations should learn directly from elders before traditional expertise is lost. Without a deliberate effort to retain such knowledge, biodiversity-friendly practices may disappear.

Lock-ins that hinder biodiversity regeneration: Despite the existence of scalable enablers, several persistent obstacles act as lock-ins to biodiversity regeneration. Bureaucratic inefficiencies were frequently cited as a barrier. In Mavlankar, a participant described the slow policy response to environmental concerns: "10 years of working on remarkable trees... and now it's law". This demonstrates that while science can inform policy, the lag in implementation significantly weakens the impact of conservation efforts. Additionally, economic lock-ins continue to shape decision-making in ways that are detrimental to biodiversity. Market-driven agricultural intensification has led to the expansion of monoculture. The reliance on monoculture reduces habitat diversity, creating a biodiversity-poor landscape.

At the same time, these local patterns suggest broader, multi-level policy implications. The persistence of bureaucratic and economic lock-ins suggests that local actors cannot overcome these barriers without more substantial alignment between national CAP instruments, regional land-use planning, and local conservation goals. Strengthening cross-scale coordination, particularly between municipalities, LAG structures, and environmental authorities, could accelerate the uptake of regenerative practices that communities already recognize as necessary. Moreover, the insights from these workshops illustrate how local experiences can inform higher-level policy adjustments to reduce administrative burdens and improve incentive structures for biodiversity-friendly farming.

To strengthen the connection between these subsections I and II, it is important to highlight that the analysis of indirect drivers presented above operates at a structural and analytical level, examining how broad socio-economic and institutional mechanisms shape biodiversity outcomes. By contrast, the following subsection shifts to a local and operational level, focusing on how researchers and societal actors engage in concrete co-learning practices within specific communities. This bridging step illustrates how diagnosing systemic pressures (subsection I) lays the groundwork for the collaborative, practice-based interactions (subsection II) required to implement transformative change. In doing so, effective biodiversity governance depends on linking structural understanding with on-the-ground experimentation and shared learning.

II. Co-learning between research partners and societal sectors

Bridging the knowledge gap between researchers and communities: A key insight from the workshops was that successful biodiversity governance requires bidirectional learning – where researchers learn from local communities as much as they share their expertise. In Malâncrav, participants highlighted the need for scientific research to be made more accessible and actionable: “This science is translated into laws... but how far do these laws reach people?” The effectiveness of policy depends on whether local communities are equipped to implement it. Moreover, societal actors often hold crucial place-based knowledge that researchers might overlook. For instance, a participant from Saschiz pointed out: “30 years ago we used to bathe in the valley, but now we can't because it almost doesn't flow anymore”. Local observations like this can serve as critical early-warning indicators of ecological degradation, which researchers should incorporate into biodiversity assessments.

Action plan adjustments for inclusive biodiversity governance: To enhance biodiversity governance, action plans need to shift towards more participatory approaches. One major proposal emerging from the workshops is the need for economic incentives for biodiversity-friendly farming. As noted in Malâncrav, “If someone wants to benefit from subsidies, they should prove that they have learned about the sustainable use of natural resources”. Integrating educational components into financial support mechanisms can ensure that funding fosters long-term ecological and economic sustainability. Additionally, local governance structures should incorporate early-warning systems based on community knowledge. For example, in Șoard, where pasture abandonment was raised as a concern, a proactive monitoring system led by local stakeholders could help detect early signs of habitat degradation and inform timely intervention. Finally, biodiversity action plans should prioritize cultural continuity as a conservation strategy. In Saschiz, participants discussed the potential for ecotourism based on local biodiversity, referring to the recently reintroduced Transylvanian Blue butterfly. By linking biodiversity efforts to local identity and tourism, conservation becomes a source of economic resilience rather than a constraint.

6.5 Testing of interventions

Monitoring and evaluation in local events: The Local Action Group (GAL) Dealurile Târnavelor has implemented various initiatives over time to address biodiversity loss through monitoring and evaluation at local events. One of the primary ways GAL has tested interventions is through knowledge-sharing workshops that bring together farmers, researchers, and local stakeholders. To avoid confusion between institutional and

community levels of action, it is essential to note that GAL-led interventions are formally coordinated activities, such as workshop organization, project facilitation, and strategic planning. In contrast, community-driven initiatives emerge organically from local actors, based on their own practices, needs, and motivations. Clarifying this distinction helps illustrate how institutional support provides structure and resources, whereas community initiatives reflect bottom-up engagement and lived experience. In many cases, GAL interventions have served as catalysts that strengthen rather than replace locally initiated efforts. This dual dynamic shows how institutional guidance and community agency interact to shape biodiversity-related action.

In Saschiz, workshops have facilitated discussions on traditional land-use practices, agroecology, and biodiversity conservation. Participants assessed the success of past interventions and explored innovative approaches. A participant shared, "We tried to restore the valley with native plants, and in one season, we saw an increase in insect populations and bird species." This demonstrates that local conservation efforts are yielding tangible results and require continued support and refinement.

In addition, efforts in Mălâncrav demonstrated the transformative potential of targeted biodiversity regeneration strategies. A participant explained: "When we took over the land, we faced problems. We had arable land, but our goal was to preserve the pasture networks. We therefore explored various methods to restore biodiversity on arable land. We bought habitat-specific seeds, brought bales of hay from other areas to introduce native seeds, practiced grazing according to certain rules, and let the soil rest, according to a procedure established together with experts". Over approximately 10-18 hectares, these interventions resulted in visible improvements in both species diversity and ecosystem function. Importantly, these ecological gains also reflect the indirect drivers identified earlier in the analysis. By reactivating land that might otherwise be abandoned, demonstrating affordable practices that alleviate economic pressures, and partially compensating for gaps in policy enforcement, the interventions address the broader structural challenges shaping local land use. This connection indicates that restoration outcomes are not isolated events but rather emerge from a wider socio-economic and governance context.

Addressing root causes of biodiversity loss: To ensure a just transition, GAL has worked to address the root causes of biodiversity loss through practical, community-driven initiatives:

- a) Deforestation and land degradation: Conservation projects such as "Achiziționarea de echipamente pentru fabricarea brichetelor din resturi vegetale" ("Purchase of equipment for the manufacture of briquettes from vegetable waste") promote sustainable land use and waste management. By funding equipment that transforms plant waste into briquettes, GAL is helping to reduce deforestation and encourage responsible resource use (<https://tarnava-mare.ro/bune-practici/proiecte-finantate-prin-sdl-2014-2020/>);
- b) Agricultural intensification: GAL has promoted traditional and organic farming techniques, supporting projects such as "Diversificarea activității fermei Boian Global Business SRL", which encourages sustainable agriculture and biodiversity-friendly food production (<https://tarnava-mare.ro/bune-practici/proiecte-finantate-prin-sdl-2014-2020/>).
- c) Declining traditional knowledge: The cultural establishment in Daneș provides a venue for knowledge-sharing events and workshops that educate locals about sustainable farming, biodiversity conservation, and traditional ecological knowledge (<https://tarnava-mare.ro/bune-practici/proiecte-finantate-prin-sdl-2014-2020/>);
- d) Overexploitation of resources: GAL has implemented sustainable harvesting guidelines and supported projects such as "Modernizarea exploatației agricole Grădinile Mălâncrav SRL", which promotes biodiversity-friendly farming practices (<https://tarnava-mare.ro/bune-practici/proiecte-finantate-prin-sdl-2014-2020/>).

Strategic responses to lock-ins and barriers: Despite success, GAL has encountered several challenges:

- a) Regulatory constraints: Legal restrictions sometimes hinder traditional farming and grazing practices that support biodiversity conservation.

b) Economic challenges: Many small-scale farmers lack financial incentives to adopt biodiversity-friendly practices.

c) Knowledge gaps: There remains a disconnect between conservation policies and local ecological knowledge.

To address these challenges, GAL has implemented strategic responses:

Economic incentives for conservation: Eco-tourism initiatives, such as the “Înființare Pensiune Turistică Saschiz” project, have linked biodiversity conservation with local economic benefits; Educational outreach and training: The equipping of a cultural establishment in Daneș has created an educational hub for biodiversity awareness, organic farming, and conservation (<https://tarnava-mare.ro/bune-practici/proiecte-finantate-prin-sdl-2014-2020/>).

Moreover, GAL sought to bridge the gap between legislation and practical application. One challenge noted was the ineffective implementation of environmental policies: “A concrete example of transformation would be the implementation of existing legislation. For example, the effective implementation of the grasslands law and pastoral management, as well as the implementation of the Natura 2000 directives. We have the tools, but they are not being put into practice”. Ensuring that legal frameworks align with conservation needs is a critical step toward breaking systemic lock-ins.

Leveraging influence and systemic change: GAL strategically influences conservation policies and land management practices by:

1) Being part of participatory research methods to document and integrate traditional ecological knowledge into formal conservation strategies (e.g., Biotraces and the former initiatives).

2) Creating pilot projects to showcase the economic and environmental benefits of biodiversity conservation. A notable intervention in Saschiz involved the biodiversity-friendly certification program for local agricultural products, which incentivizes farmers to adopt sustainable practices while providing transparency for consumers. The success of this program has encouraged discussions on scaling similar models to other regions.

3) Collaborative thinking with researchers: Collaboration between researchers and societal partners has been essential in refining conservation strategies. Researchers contribute scientific methodologies for data collection and analysis, while societal partners provide local insights and contextual knowledge. A key takeaway from these collaborations is the importance of adaptive management. One researcher in the workshop noted, “Rather than imposing predefined solutions, we need to adapt interventions based on local feedback and environmental changes continuously”. This flexible approach has led to more effective and locally relevant conservation strategies.

6.6 Discussion

The biodiversity regeneration strategies implemented by the LAG/GAL and UBB team offer insights into conservation efforts at the local level. These initiatives address environmental concerns while navigating economic, social, and policy-related challenges. This discussion critically examines their transformative potential, the role of indirect drivers of biodiversity loss, key enablers for replication, and the broader socio-economic and environmental contexts shaping biodiversity conservation. Consequently, building on the indirect drivers and systemic lock-ins previously identified, such as policy misalignments, socio-economic pressures, and the erosion of traditional stewardship, this section links the discussion of transformative potential to these deeper structural constraints. By doing so, it emphasizes that proposed innovations cannot be understood in isolation but must be situated within the broader socio-ecological dynamics that shape local land-use decisions. This bridging perspective highlights how the institutional path dependencies continue to shape community practices and constrain options for transformative change. At the same time, it highlights how emerging enablers, such as strengthened local governance and

collaborative learning processes, can help unlock alternative trajectories. Together, these insights underscore the need for comprehensive strategies that address both surface-level challenges and the underlying mechanisms contributing to biodiversity loss.

Biodiversity conservation increasingly requires transformative change rather than incremental adjustments. The results of the workshops demonstrate promising approaches, but their success depends on whether these efforts can trigger broader systemic shifts. Actual transformative change, as we have seen, involves altering economic incentives, policy enforcement, and cultural values to promote long-term ecological sustainability.

A significant barrier to transformative change is the weak enforcement of environmental policies. While regulations exist to protect biodiversity, their implementation is often inconsistent. Without proper enforcement, conservation initiatives risk being fragmented and ineffective. Stronger governance mechanisms, combined with community engagement, can help bridge this gap. In evaluating the broader context, it's clear that multi-level governance support is needed. Local action can achieve a great deal, but supportive regional/national frameworks (policies, funding, property rights, etc.) significantly enhance its impact. Likewise, economic and social trends (migration, market changes) will influence how far a local biodiversity strategy can go. The interplay between top-down and bottom-up efforts emerges here: top-down efforts (government policies, EU regulations) set the enabling environment, while bottom-up efforts (community initiatives, LAG, local knowledge) ensure on-the-ground implementation and innovation. The UBB team's academic perspective, combined with the LAG's grassroots base, exemplifies bridging these levels – scientific evidence informing local practice, and local lessons feeding back into broader policy discussions.

Several indirect factors were identified as primarily contributing to biodiversity loss, including economic pressures, land-use changes, and policy misalignment. Addressing these challenges requires an integrated approach that considers both environmental and socio-economic factors. Farmers often struggle to strike a balance between sustainability and profitability. While some continue organic farming practices, others prioritize immediate financial stability, making it challenging to maintain biodiversity-friendly land-use practices. Providing financial incentives, such as subsidies for sustainable farming, can help offset economic constraints. Land privatization and resource monopolization pose further threats to biodiversity. Effective land management policies should prevent overexploitation and ensure equitable distribution of resources. The integration of conservation goals into agricultural and economic policies is crucial for long-term sustainability. Many biodiversity-rich areas are maintained through traditional farming and grazing practices. However, these landscapes face threats from modern agricultural expansion and overgrazing. Conservation strategies should support traditional land-use methods while incorporating sustainable management techniques to preserve habitat heterogeneity.

For biodiversity conservation efforts to be practical on a larger scale, successful initiatives must be replicable and resilient to disruptions such as climate change and economic instability. Climate change remains a significant disruptor of biodiversity. Strategies such as sustainable water management, habitat restoration, and agroecology can enhance ecosystem resilience. Additionally, economic diversification, such as promoting eco-tourism or organic farming, can reduce reliance on resource-intensive industries and provide alternative livelihoods for local communities. Local engagement plays a crucial role in conservation success. Functional communities of practice, such as farmer cooperatives and knowledge-sharing networks, facilitate the exchange of ideas and best practices. These groups help sustain biodiversity initiatives beyond the initial project scope. Environmental education programs, such as school gardens and rural training workshops, build awareness and encourage sustainable practices. Integrating biodiversity education into local curricula fosters long-term ecological stewardship. That is why transformative biodiversity management requires a shift in societal values. Many local economies prioritize short-term profit, making it challenging to implement conservation-friendly practices. Encouraging a

collective mindset that values long-term ecological health over immediate economic gain is essential. Educational initiatives and awareness campaigns can help drive this change.

Conservation efforts do not exist in isolation; they must be integrated with economic and social realities. Aligning biodiversity goals with sustainable development is crucial for long-term success. Biodiversity regeneration must coexist with economic growth. While monoculture farming and land privatization pose threats, sustainable land-use strategies can create a balance. Agroecological methods, such as crop rotation and regenerative grazing, can enhance both productivity and biodiversity conservation. Eco-tourism offers a chance to generate income while promoting environmental conservation. Responsible tourism initiatives can create financial incentives for local communities to protect natural landscapes. Similarly, sustainable resource management – such as responsible forestry and fisheries policies – ensures long-term ecological and economic stability. Strong governance structures are essential for biodiversity conservation. Participatory decision-making, where local stakeholders have a voice in policy and land-use planning, leads to more sustainable outcomes. Incentive programs, such as payments for ecosystem services and conservation grants, can further align economic interests with biodiversity goals.

Transformative change reminds us that isolated projects must connect to more profound societal shifts to truly reverse biodiversity loss. The indirect drivers highlight economic and policy contexts as both obstacles and targets for integration, underscoring that conservation success demands engaging with broader development agendas. The focus on enablers and disruptors highlights the importance of community empowerment, knowledge sharing, and resilience in scaling up positive outcomes and withstanding shocks, such as those posed by climate change. Ultimately, examining the broader socio-economic context reveals that conservation and human development need not be mutually exclusive, with effective governance, targeted incentives, and participatory approaches, they can be mutually reinforcing.

The LAG-UBB co-learning can be seen as a microcosm of global biodiversity efforts, as it faces the same need to balance human needs and ecological integrity, requires patience in changing mindsets, and demands persistence in the face of external pressures. Critically, this co-learning experience contributes to a growing understanding that effective biodiversity regeneration is as much a social challenge as an ecological one. The key themes explored are not just academic concepts; they manifest in day-to-day decisions – a farmer choosing integrated pest management, a town council debating land use, a youth group volunteering for tree planting. By expanding and refining the discussion around these themes, we appreciate that meaningful biodiversity/nature conservation requires transformational thinking, cross-sector collaboration, and a long-term commitment to harmonizing our socio-economic systems with the natural world. The partnership between LAG/GAL and the UBB team, therefore, is relevant not only for the local benefits it produces but also for the lessons and inspiration it offers to other communities striving for a more biodiverse future.

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UGOT Bottom-Up Forest Biodiversity

D2.5, Sweden

December 2025

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Funded by
the European Union

Summary

The debate on Swedish forestry is often described as a struggle between two camps: the forest industry that wants to cut more, and conservationists who want to protect more. But when you look closer, the picture becomes far more nuanced. Our study analysed small and medium-sized private forest owners in three different areas of southwestern Sweden: S  ve on the edge of Gothenburg, Istorp in a mixed farming landscape, and Ambj  rnarp in a more heavily forested area. Through 24 in-depth interviews and five workshops, we set out to understand how owners themselves think about biodiversity, what obstacles they face, and what opportunities exist for change.

One of our first observations was that the heated national debate often feels distant for many forest owners. If they do not actively follow forestry media or online discussions, the conflict between "production and protection" is not something they identify with. Instead, they highlight much more everyday, place-based concerns: wet soils where machines get stuck, storms that fell spruce, steep slopes that make harvesting difficult, or favourite paths for mushroom picking. Many also spoke of the forest in relation to family – as a place for recreation, an inheritance to pass on, or a source of pride. Income from the forest matters, but often to cover concrete needs: repairing the house, investing in the farm, or securing firewood. In S  ve, firewood and recreation was far more important than sawlogs, while land prices there were shaped strongly by pressure from the expanding city.

History and landscape also shape today's decisions. During the 20th century, Sweden shifted to a more uniform way of managing forests – clear-cutting followed by planting. That shift has left deep marks. Machines, road networks, training, advice, and sawmills are all adapted to this model. As a result, it has become the "default" option for many. At the same time, there is growing curiosity about alternatives: continuous-cover forestry, more deciduous trees, longer rotations. But owners hesitate, worried about costs, storm damage, conflicting information or whether the industry will accept "non-standard" timber. Existing structures – advice, markets, and certification rules – largely pull them back towards the familiar.

Nature itself also influences decisions. A capercaillie display ground can suddenly stop a planned harvest, wet soils make certain areas difficult to use, and old oaks become places owners are reluctant to disturb. Several forest owners valued their deciduous patches for birds and aesthetic variety. At the same time, some expressed irritation over "untidy" municipal forests with dead wood and windthrown trees – what ecologists see as crucial for biodiversity can for others look poorly managed. This reveals different cultural expectations of what a "well-kept forest" should be.

The three study areas also showed clear differences. In S  ve, urban expansion was the strongest force. New housing and logistics developments put pressure on land, and many owners felt uncertain about how municipal planning would affect them. In Istorp, the long, narrow forest strips that emerged during the 19th-century land reforms still shape management today. In Ambj  rnarp, a longer continuity of forest cover meets 20th-century spruce planting and today's market demands. Across all three areas, the past 150 years have brought dramatic changes – from more open pastures, varied forests and fields to today's dense conifer forests. What many now see as "natural forest" is, historically speaking, quite recent.

Questions of identity were more complex than we expected. Earlier research often points to gender or age as important differences in attitudes. What we found instead were differences in access to networks and opportunities to be heard. Women forest owners emphasized the value of women's networks, where they could share experiences in an otherwise male-dominated sector. Older owners often spoke about succession and how to pass on knowledge – and sometimes that transition was also used to try new ideas, such as more deciduous trees or more conservation-oriented plans.

Perhaps our findings can be summed up in one word: lock-in. The industry-based model of forestry continually reproduces itself through roads, machines, markets, and habits. That makes alternatives harder, even when there is interest. But we also saw cracks in the

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system: small trials with continuous-cover methods, owners asking for advice on alternatives, new economic alternatives, and dialogues where different local actors actually started talking to each other on forestry.

Private forest owners hold about half of Sweden's forests. They are not a uniform group, nor are they just pieces in a larger game. They are people balancing economy, tradition, care, and uncertainty in their decisions. If we approach these owners and try to make them realize how their own agency can be used to initiate further bottom-up initiatives, pathways can open toward forests that are both rich in species and workable for those who manage them. Our study shows that many owners are already interesting in pursuing change – as long as the right conditions are in place.

1. Case Study Introduction

1.1 Justification of the importance of the case study

The loss of forest biodiversity is a pressing environmental challenge in Sweden and Europe today. In Sweden, where clear-cutting has long been the dominant forestry model, calls for more biodiversity-friendly practices have intensified in recent years. About 50% of forest land in Sweden is privately owned, and owners of small and medium-sized forest properties play an important role in the preservation and development of forest biodiversity. This case study focuses on their perspectives, knowledge, capacities and goals with their forests, which are often overlooked in policy. By understanding how private forest owners relate to biodiversity and what support or changes they need, or what challenges they face when managing biodiversity, the case study contributes both nationally and to the broader European conversation on forest governance and environmental considerations.

1.2 Explanation of the focus of the case study

The Swedish case study explores how small and medium-sized private forest owners in southwestern Sweden perceive and approach biodiversity in forest management. It investigates how these views are shaped by their geographical location, social background, access to knowledge, and interactions with other actors such as forestry advisors, authorities, and industry. The study builds on qualitative methods, including semi-structured interviews, walk-along interviews, and workshops, in three different case study areas with differing characteristics: the urban-forest fringe of Säve (Hisingen), the mixed agricultural-forest landscape of Istorp, and the forest-dominated region of Ambjörnarp. These areas allow comparison between different ownership patterns, degrees of self-involvement in forestry, and forest types. The study further integrates historical and spatial perspectives to assess how current management options are conditioned by past land use and spatial configurations.

1.3 Research questions addressed by the case study

The core questions of the case study are:

- How do private forest owners perceive biodiversity and climate change in relation to their forest?
- How are these perceptions influenced by social and geographical contexts, and by the interests of external actors?
- What practical, institutional, and knowledge-based constraints do owners face in promoting biodiversity?
- What solutions or needs are formulated by the owners themselves to better engage with biodiversity concerns?
- Secondary questions include how biodiversity is understood conceptually by different owners, what role economic values play, how ownership location affects management capacity, and how historical path dependencies shape present-day practices.

1.4 Reading guide

The remainder of this deliverable report is structured as follows. Section 2 describes materials and method, Section 3 provides a context description for the three case study sites, followed by analysis of the transformative biodiversity innovation in section 4, SES analysis in Section 5, and locally tested interventions in Section 6.

2. Research methods and application of PAR

2.1 Role of Societal Partner

In this case study, it was decided early on that it was not possible to involve a societal partner organisation, since we wanted to capture the broad views of the private forest owners in our three case study areas. In Southern Sweden, many private forest owners are members of the forest owner organisation, Södra Skogsägarna. It is an economic association created in 1938 in order to enable private forest owners to organise an industrial production and improve profitability (Wiklund & Ivarsson, 1994). This organization remains in a similar function today, including owning several pulp mills and sawmills in both Sweden and Finland, and is an important industrial actor. Due to the industrial nature of this actor, and also the fact that not all forest owners in Southern Sweden are members of Södra, it was decided best to approach forest owners individually.

Throughout this project, we have viewed the private forest owners as our informal societal partners. Considering the limited practical knowledge that all team members in UGOT had about forestry, despite some earlier experience in forest owner research, we have learnt considerably from the forest owners that we have engaged with.

Our interactions with the forest owners started off with 24 individual interviews (7 online via teams and zoom, and 17 face-to-face interviews), starting in May 2024 and ending in October 2024. During these interviews, we also asked the forest owners explicitly for suggestions for our planned workshops which contributed to their design. The interviews conducted in autumn 2024 also included four walk-along interviews in the forest properties, which enabled the research team to gain a much fuller understanding of the individual forest properties and their conditions.

In March 2025, we organised four workshops in total with private forest owners. Three of these workshops were situated in the three case study areas and involved another selection of forest owners recruited through post. The fourth workshop was organised through contacting an association for female forest owners in southern Sweden called Dryaderna and was an attempt at exploring the conditions for female owners on a deeper level. These workshops were explicitly focused on drawing from the insights and ideas of the forest owners themselves, and while we provided the frame for the workshops through sets of thematic questions the discussions were on purpose left open-ended. This enabled us to more fully understand what issues that private forest owners themselves feel are the most important.

In summary, although no formal societal partner organisation was involved, private forest owners served as informal partners throughout the research process. Their input was instrumental in shaping both the design and content of the study, from early interviews to the organization of workshops. By engaging directly with a broad range of forest owners – including through walk-along interviews and targeted workshops – the research team gained valuable practical insights and a deeper understanding of the owners' perspectives, priorities, and everyday challenges.

The case study did not employ an explicit PAR approach, but inspiration was drawn from PAR approaches to extend the scope of the research beyond the ordinary comfort zones of the team involved. PAR was primarily conducted during the workshops and thus grew more relevant by the end of the case study. The decision not to adopt an explicit PAR approach was primarily due to the nature of the societal engagement in the case study. As there was no formal societal partner, but rather individual private forest owners, there was no clear action being implemented with which the research team could engage. While the case study identified several individual biodiversity initiatives, the aim was to obtain a broader understanding of both such initiatives and instances where forest owners were not engaged in biodiversity efforts. Consequently, the research team did not take an active role in any specific initiative.

The PAR methods employed and listed in D1.3 where one-to-one interviews, walkthrough in situ, focus group interviews and participatory workshops focused on initiating dialogue.

Table 12 - Participatory action research methods

PAR Method	No	Purpose
One-to-one interviews	24	To gain in-depth knowledge about how forest-owners reason around issues connected to biodiversity in connection to their own forests, identify potential barriers, knowledge pathways, path-dependencies and points of potential leverage
Walkthrough in Situ	4	The purpose of the walk-along interviews was to gain a deeper, situated understanding of the forest properties and the owners' management practices, by discussing them in the landscape where decisions are made and experienced
Focus group interviews	1	This interview was conducted with female forest owners connected to the organisation "Dryaderna" (date: 25-03-05, online) with the purpose to explore gender dynamics in forest ownership in closer detail.
Participatory workshops	4	These three workshops were conducted at each case study location (dates: Ambjörnarp 25-03-07, Istorp 25-03-14, Säve 25-03-21), with the main purpose to gather forest owners' perspectives in a collective setting, encourage dialogue between participants, and explore shared and divergent views on biodiversity and forest management in a more interactive and reflective format. A fourth workshop was also conducted together with regional actors and stakeholders. These workshops were also used to triangulate interview results.

2.3 Triangulation

A triangulation of research methods combining historical analysis, policy analysis, interviews, and participatory workshops was applied. Historical research included the analysis of written sources and historical maps from the 17th century onwards, with a particular focus on the period from 1800 to the present. This provided a long-term perspective on landscape change in the three studied areas and the different trajectories that the forests there have gone through. Policy analysis offered insight into the regulatory frameworks that shape forest owners' actions and constraints. One-to-one interviews and walk-along interviews enabled us to explore forest owners' views and practices in depth and in context. Finally, participatory workshops were used to collectively reflect on and discuss important issues that came up in the aforementioned analyses with a wider group of forest owners, also initiating communication between them in an arena outside of their usual forums of discussion.

These methods complemented each other by allowing us to understand both the structural conditions and the individual experiences that shape forest management. The combination of spatial, historical, and qualitative data allowed for a comprehensive analysis. The methods indicated in Deliverable 2.1 have not changed in substance, but policy analysis was mainly restricted to gaining a fuller overview of Swedish forest policies, rather than digging into details. Both interviews and workshops also managed to cover the most important policy issues.

3. Case Study Contextualization

3.1 Multidimensional Presentation

The case study involved three case study areas: the historical parish centres of the parishes of Säve, Istorp and Ambjörnarp. In the text below, the multidimensional presentation is sub-sectioned according to these three study areas, since the context varies between them.

Säve

The study area is located in northern Hisingen, just north of Gothenburg, mainly within the Gothenburg municipality. The landscape features flat agricultural land surrounded by forested hills – coniferous on higher ground and deciduous near valleys and settlements. The Göta River borders the area to the east, with the Nordre River flowing northwest toward the sea. The topography is shaped by glacial history, with broad clay plains, thin soils, and exposed bedrock, and parts of the area are landslide-prone due to stiff glacial clays (Larsson & Dury, 2022; Persson, 2009).

Historically a farming region, the area was covered by larger deciduous forests during the Late Iron Age and Middle Ages. Deforestation increased after the founding of Gothenburg in the 17th century and reached its peak in the 19th century (Lindner, 1935). In the 20th century, forest pressure declined as grazing ended and fuel sources shifted, allowing natural regrowth and some active reforestation with spruce. As of 2018, forest coverage in the area amounted to 44% (Naturvårdsverket, 2018).

Around 1,500 people lived in Säve parish in the early 1800s, growing to about 2,000 by the late 19th century (CEDAR, 2022). In the 1960s, the municipality bought farms for planned urban expansion, and many farmers became leaseholders (Wästfelt & Zhang, 2016). Residential development increased from the 1970s onward, especially near the Göta River, with the population reaching 10,500 by 1980 and 15,164 by 2024 (SCB, 2024). As of 2023, most residents work in manufacturing, commerce, professional services, education, or healthcare, while only 0.29% are in agriculture or forestry (SCB, 2023). Median income (395,256 SEK/year) and employment (84.4%) are slightly above national averages, as is the rate of post-secondary education (41.8%) (SCB, 2025).

Istorp

The landscape is characterized by agricultural valleys with streams and watercourses, surrounded by forested hills, where the forest in 2018 covered c. 55% of the area (Naturvårdsverket, 2018). These hills are relatively elevated in places and are mainly covered by planted coniferous forests, particularly spruce and pine. Historic farms – many of which also own the surrounding forest – are typically located at the base of the slopes leading down into the valleys. Near the settlements, especially in older pastures and meadows, patches of deciduous woodland are common. Geologically, the valleys are dominated by glacial clays, while the forested hills have moraine soils or thinner soil layers, and also include several peatlands (SGU, 2025).

Although the area is now heavily forested, it has a long history as an agricultural region focused primarily on livestock. The Viskan river valley was once marshy, with a shallow lake known as Veslängen. Wet meadows were used in the lowlands, while the uplands served as pastures and oak woods for pig grazing. The forested uplands – today the main forest area – were formerly a shared parish forest (*sockenskog*), where all valley farms had grazing rights. Early 18th-century maps describe this forest as sparse, dominated by heath, shrubs, and small trees. King Charles XV's forest map from 1849 refers to former extensive woodland near Istorp, by then heavily damaged by forest fires. The parish forest was divided during the 19th-century land reforms (*laga skifte*), with each farm receiving forest parcels in proportion to their share of the common. This resulted in a unique pattern of long, narrow forest lots stretching several kilometres from the farms into the woods.

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Forest fires were again reported in the late 19th and early 20th centuries, followed by large-scale conifer planting, shaping the forests seen today.

In the early 1800s, Istorp parish had about 1,000 inhabitants. The population grew significantly during the 19th century but gradually declined afterward. In recent decades, it has stabilized, with 509 residents in 1990 (CEDAR, 2022) and 494 in 2024 (SCB, 2024). In the surrounding rural areas (excluding the small town of Horred), around 10% of the workforce is employed in agriculture or forestry, 16% in construction, 18% in health and social care, about 11% in trade and repair services, and 11% in education (SCB, 2023). The median income is 325,248 SEK per year, below the national average of 371,500 SEK, and the share of residents with post-secondary education is 34.2%, also below the national average of 37% (SCB, 2025).

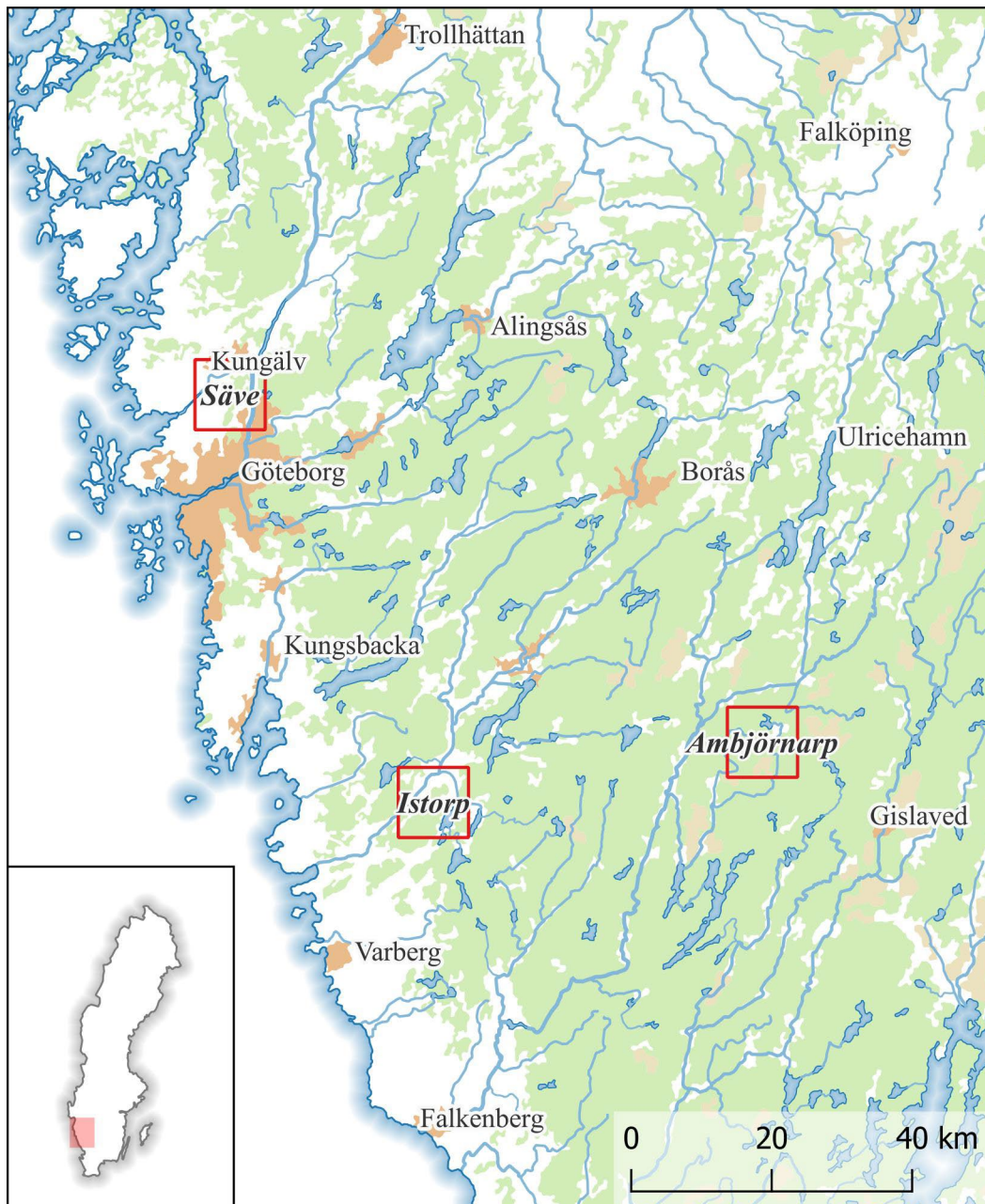


Figure 16 - Map showing the location of our three case study areas

Ambjörnarp

Located in the inland area of Tranemo Municipality, the landscape is predominantly forested (c. 73% in 2018: Naturvårdsverket, 2018) with scattered pockets of agricultural

land. The terrain is relatively elevated, with settlements often situated on higher ground and forests extending down the slopes. While the area is not characterized by dramatic topography, it is traversed by a former glacial meltwater river from the last Ice Age, primarily following a valley. The numerous lakes in the region are likely the result of kettle holes formed by retreating glaciers. Most of the area is covered by thin layers of glacial till. However, there is also a drumlin-like ridge of moraine that extends southwest from the village of Ambjörnarp (Hilddén, 2009). Along this ridge lie many historic farms, many of which still own substantial forest land today.

In contrast to the other study areas, the area around Ambjörnarp shows longer continuity in forest land. Maps from the late 17th century mention pine trees available for timber, building fences and firewood. King Charles XV's forest map from 1849 also mentions larger timber reserves in the area. During this time, bailiff reports describe the agriculture in the area as limited due to poor soils, and animal husbandry was primarily focused on self-sufficiency. However, by the end of the 19th century, logging seems to have accelerated, and available larger trees were scarce. Comparing maps from the late 19th century and today shows a remarkable decrease in open land and deciduous forests.

The population in the parish of Ambjörnarp was around 500 in the early 19th century and reached a peak with around 900 people by the early 20th century. After this, the population has fallen steadily but has stabilised roughly since the 1970s (CEDAR, 2022). Relatively stable 542 inhabitants in 2015, 570 in 2024 (SCB, 2024). In the area at large, around 8% is employed in agriculture and forestry, and most people work in manufacturing, health and care services, the building industry or education (SCB, 2023). Median income (339,157 SEK) is below the national average and the share of post-secondary education is almost 10% below the national average (SCB, 2025).

3.2 Key Actors and their Impact on Worldviews

The question of biodiversity in Swedish forestry is a highly debated issue at the national level in Sweden, illustrating competing interests around the value and purpose of Swedish forests. Forest industries advocate for productive forestry to ensure the supply of timber, which is often framed in the context of climate transition and the provision of renewable raw materials. On the other side are nature conservation organizations, such as the Swedish Society for Nature Conservation (SSNC), demanding larger areas of protected forests and the preservation of old-growth forests threatened by industrial expansion. Private forest owners tend to be represented primarily through membership organisations like the Federation of Swedish Farmers (LRF), since many private forest owners for historical reasons also own farmland, or regional forest owner associations (e.g. Södra, Mellanskog). These groups advocate for the preservation of private property rights, threatened by more extensive environmental regulations, and generally argue that biodiversity-related problems in privately owned forests are limited.

In our case study material, however, the heated national debate only emerges sporadically. It is primarily forest owners with greater engagement in forestry media or social platforms who explicitly mention the broader conflict. Most respondents position themselves between the polarized extremes of industry and conservation. Surprisingly many were unaware that a national debate even exists or had no insight into its content. The issue, in other words, appears distant from their everyday concerns.

Private Forest Owners

Private forest owners are a highly diverse group, and their views on biodiversity reflect this heterogeneity. Most respondents we have interviewed do not have forestry as their main occupation and often have educational or professional backgrounds in other sectors. A strong impression from the interviews is that their general backgrounds are more important for the individual understanding of biodiversity than forest ownership per say, although a large part of their views of the biodiversity concept is related to different kinds

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of species and ecological interactions (e.g. pollination). There are also some slight tendencies when it comes to differences between the three study areas. In Ambjörnarp, biodiversity tends to be viewed a bit more through the eyes of forestry, often connected to diversifying the tree species on a forest property (particularly more deciduous trees), to different kinds of species protection, older forests or interactions with the forest authorities. This was also reflected in the local workshop (Workshop in Ambjörnarp March 7, 2025). In Istorp, more forest owners tend to refer to definitions closer to a more scientific definition regarding variations in species and environments, but there are also many referring to area protections in forestry, preserving species and so on. In Istorp, the workshop revealed a general positive attitude among the participants to alternative forestry practices which are more biodiversity-friendly, yet at the same time concerns were raised regarding the involvement of EU in this regard, also reflecting parts of the national debate around private property rights (Workshop in Istorp March 14, 2025). The tendencies in Säve are similar to the tendencies in Istorp in this regard, although with a somewhat more developed reasoning around the concept of biodiversity, likely reflecting the more educated backgrounds of the forest owners there.

Private companies and forest-owner organisations

Among private companies, the approaches to biodiversity also vary. Near Ambjörnarp, *Sveaskog* – a state-owned forest company – owns large forest areas and officially states its ambition to improve and restore habitats for biodiversity (Sveaskog, 2024). However, Sveaskog has also been criticized for not following or adhering to their own environmental guidelines (DN, 2021). In Istorp, a local forest company called *Derome* owns a forest property, largely adopting a similar position as other forest companies with a focus on wood production as a means of enhancing environmental values (given the forests' carbon sink function and role in providing renewable building material) (Derome, 2025). In Säve, the areas attractiveness for housing and industry development is also reflected in the companies owning forests there. Skanska is one of these, one of Sweden's largest construction companies, which officially states that they try to integrate biodiversity, for example by improving the integration between built environment and green space (Skanska, 2025). Other dominant companies in Säve are so called *kommanditbolag* (limited partnership), which are smaller companies with a special type of organisation often lending them suitable for housing development. How these smaller companies work with integrating biodiversity in their plans remains unknown to use, since we haven't interacted with them.

Among membership organizations, *Södra Skogsägarna*, has made biodiversity one of its explicit goals. The organization argues that the structure of their members forest ownership – divided among many smaller private forest owners – by its very character leads to a more varied and diverse forest landscape (Södra Skogsägarna, 2025). Södra promotes certification systems and has sought, at least regionally, to cooperate with SSNC to avoid unnecessary conflict and increase understanding between these actors (Interview with 'Tommy', October 2024). They also offer a "nature conservation premium," which rewards members who voluntarily set aside land (up to 14% of their holdings) by paying more for their timber. Nonetheless, Södra owns its own forest industries and maintains the profitability of forestry as a key aim (Interview with 'Simon', May 2024), which depends on consistent timber supply (Interview with 'Andreas', September 2024). The organization's advisory services have been criticized for focusing mostly on promoting conventional clear-cutting practices, but since autumn 2024, Södra has introduced guidance in continuous-cover forestry in response to member demands (Interview with 'Stina', September 2024).

SSNC

The Swedish Society for Natur Conservation (SSNC) is a nationwide membership-based environmental NGO that promotes biodiversity and sustainable land use through policy

influence, public engagement and the work of its many local chapters. SSNC emphasizes the need to preserve nature and promote sustainable forestry practices within the limits of the ecological system. On a national level, the organization advocates for stronger legal tools to protect forests, and the implementation of alternative forestry practices that are more biodiversity-friendly through economic incentives and compensation.

Locally, SSNC is more engaged in different forms of activism, for example through conducting their own surveys and mapping of red-listed species and key habitats in order to challenge logging applications and raise public awareness. As already mentioned, in some areas collaboration between SSNC and forestry actors have been initiated in order to ease the tensions and increase understanding between these groups. As noted by one respondent, this type of interaction has reduced the polarization locally which is otherwise strongly associated with forestry debates (Interview with 'Tommy', October 2024).

Government actors

Government agencies such as the Swedish Forest Agency (*Skogsstyrelsen*) and the Swedish Environmental Protection Agency (*Naturvårdsverket*), and the County Administrative Boards (*Länsstyrelserna*) are responsible for implementing national strategies and legal frameworks, including for biodiversity, at various scales. These actors work with formal definitions of biodiversity, encompassing both species and habitats, and is also grounded in EU and national directives like the Habitats Directive and Sweden's Forest Act.

The Swedish Forest Agency plays a central role in offering educational courses and advisory services, including the development of forest management plans. It also receives and reviews logging applications and is responsible for ensuring that forest logging complies with environmental legislation. The Swedish Environmental Protection Agency is primarily responsible for shaping national conservation policy, identifying habitats for prioritization, and allocating funding for biodiversity initiatives such as the formation of nature reserves.

In our case study, Västra Götaland's county administrative board (CAB) is the most relevant since all three case study areas are within the borders of the county of Västra Götaland. This agency interprets and enforces national environmental regulations at the regional level. It carries out species and habitat surveys, monitor area protections and environmental action programs.

Municipalities

Municipalities in the studied areas vary in their relevance for this specific case. In Ambjörnarp and Istorp, which are located in the rural municipalities of Tranemo and Mark respectively, local governments have played only minor roles in forest ownership and forest policy. These areas are relatively peripheral to municipal centres and are not the objects of intense development pressures. Säve, in contrast, is part of the City of Gothenburg where the municipality owns significant areas of forest, much of which borders to privately owned forest land. This public forest is often criticized by local forest owners for being poorly managed, left 'messy' and neglected. Respondents in our interviews also express frustration that the city demands high management standards for privately owned land (often in more subtle rather than formal ways), particularly for recreational purposes, while not adhering to the same principles for their own forests. Urban development is a tangible concern in Säve, with several respondents discussing ongoing or planned parcelling of forest land for housing. Biodiversity considerations seem to be less prioritized than long-term urban development and serves more or less as a motivation for inactivity in land that is kept as a reserve for future development.

Non-human actants

Beyond the social and human sphere, there are various entities that also enact a certain type of agency in the three case study areas. Here, we prefer to use the term 'actant' for these entities rather than 'actor', where 'actant' signifies the relational type of agency that they exercise (Castree, 2002: 121; Latour, 2005: 54-55). The number of actants which are relevant in the present case are numerous, so here we primarily focus on a few that has been more prominently discussed in the material.

Among the biotic actants we have birds such as the *capercaillie* and specific types of *woodpeckers* whose presence can trigger conservation actions and restrict logging, since their habitats are useful indicators for high environmental values. The way that these actants develop and move their habitats thus has direct impacts on local forest owners and plays important roles in the Swedish forestry debates. In a recent case from Western Sweden, a forest owner was prohibited from logging due to the presence of a capercaillie display ground on his land, losing millions of SEK in revenues. At the same time, the capercaillie itself is not a threatened species in Sweden, and is allowed to be hunted (Tidningen Näringslivet, 2024). Several respondents mention capercaillie as a species of some concern, but also enjoyment. One respondent especially mentions a complex relationship with this actant:

J: *So there's plenty of capercaillie around, I see them no matter which direction I walk in the forest, they just flap up. It's the same when you drive up a forest road, there's always a capercaillie walking along the edge... And why is that all those capercaillie up there where there are clear-cuts everywhere, if they supposedly need old-growth forest to do their mating displays? I don't really buy that... I had a displaying male up here. So when I was up there cutting trees, he always came, you know. If you called out, he came. He didn't attack or anything, but he walked alongside while I was clearing wind-felled trees – he was just there, walking around. It was really nice having him around. He was there for about two years, then he disappeared...*

O: *But are you afraid someone might come and say, "Oh, there are lots of capercaillie here"?*

J: *Yeah, then I wouldn't be allowed to do clear-cutting, you know. They'd shut down several hundred hectares around here where logging would be forbidden. So no one can know that you have one of those spots, you know... If I can put it a bit bluntly, I mean, I want to have capercaillie – it's really nice when they're around, I don't want to wipe them out. They all have a role to play. So I want them here. The problem is, when you submit a logging notification to the Forest Agency, and they come out to check and see capercaillie, well then – you're not allowed to log it (Interview with 'Jens', September 2024).*

Trees can also serve as important actants in this case, and for more reasons than simply serving human purposes as raw material or objects to which other human values are attached, for recreational, aesthetic or other values. Trees interact profoundly with their local environments shaping conditions for and being affected by animals, mycorrhizal networks and local microclimates. The number of years necessary for a tree to grow is something that importantly conditions planning and management of forests for various purposes, and the relationship between different trees of different ages within a forest stand is something that acts as a possibility or restriction in the management conducted by forest owners. Many respondents describe emotions and feelings, not seldom connected to aesthetics, when it comes to deciduous forests and broad-leaf trees, and stronger negative feelings towards monocultures dominated by conifers. The aesthetic properties of deciduous trees are something that clearly affects how forest owners plan the use of their land spatially, with concentrations closer to settlements and places of recreation.

Also, prominent yet seldom thought of as *actants* (or actors) due to their abiotic character, is the influence that topography, soils and climate exert on human intentions and actions. These are not merely serving as passive backdrops constraining human activity but can instead be considered dynamic actants whose effects work on different time scales through physical processes. In this case study, the influence of topography, including its wider

effects on hydrological conditions, clearly interacts with forestry logistics to shape how forest owners plan the use of their forests through a type of spatial logics. Land which is more inaccessible to forestry machinery is often left unused or only used in limited ways, while more accessible land tends to be used for clearer productive purposes. In S ve, this was brought up in the local workshop as one of the conditions behind the limited use of the forest in the area (Local workshop in S ve, March 21, 2025). Wet areas, often low-lying ground in connections to depressions in the landscape, are places where forest owners and forestry workers exert caution when moving machinery, since both want to avoid too deep machine tracks in the forest, both for aesthetic, biodiversity and forest growth purposes. Different soils and topographies lend themselves better to some tree species above others, something called "site conditions" in forestry. These conditions can act against the wishes of the forest owners, especially in older forests planted during more monoculture-directed Swedish forestry regimes for a major part of the 20th century. Effects of this can be observed today, when spruce forests planted in place with drier site conditions are more sensitive to effects of droughts. This forces some forest owners to reconsider the tree composition in their forests and adapt their management more fully according to local conditions, especially in areas where those conditions are changing more rapidly due to current global warming trends.

3.3 Biodiversity Loss Factors

In this context, we interpret biodiversity loss as a continuous historical and geographical process whereby the variation in species and habitats decreases over time. In this section, we thus focus on describing biodiversity loss as a process which continuously evolves over space and time and has reached a certain point in the present. In the following sections (3.4, 3.5 and 3.6) we instead focus more on the present state, where processes of previous biodiversity loss serve as an important background, and potential implications and barriers for future improvement of biodiversity.

Below are listed the primary direct drivers of biodiversity loss for the present case study, and indirect drivers behind these are also described.

Reforestation (direct driver)

This is most prominent in S ve where the landscape previously at least since c. 1600-1900 was characterised by an open coastal landscape with bare rock and heathlands, and very limited forests. Similar tendencies in Istorp where the main forest area today part of larger heathlands in western Sweden was. Heathlands have decreased with 99.5% in Sweden the last 150 years, primarily due to plantation of forests, cultivation and spontaneous overgrowth partly caused by reduced grazing pressure (Larsson & Stenstr m, 2022). In Ambj rnarp, heathland was limited in the 19th century, but forest grazing had historically led to a more diverse and open landscape with notably more deciduous trees. Deforestation due to logging also accelerated here during this century. It is apparent that conifer forests has expanded significantly in Ambj rnarp throughout the 20th century, largely caused by plantation practices. Reforestation has largely led to a less diverse forest landscape than in the past. Today however, reforestation of open land is limited.

Indirect drivers of reforestation: The indirect drivers behind this reforestation process are largely connected to the Swedish industrialisation process, leading to an increasing demand for timber products. The government issued laws regarding replantation to secure the long-term supply of wood in the early 20th century. Also, industrialisation led to a prominent urbanisation and rise of wage labour, which in combination with agricultural mechanisation led to less people actively involved in agriculture. Technological advances in the 20th century also led to less demand for firewood. Agricultural modernisation in turn meant that most cattle now grazed on arable land (Morell, 2011) and forest grazing is nowadays a marginal practice in Swedish agriculture.

Even-aged silviculture (direct driver)

Since the early 20th century, even-aged silviculture has become the dominant forest management system in Sweden. This development replaced earlier forms of forest management such as selective cutting (*blädning*), which consisted of uneven-aged forest structures and supported higher biodiversity primarily due to longer continuity. Combined with historical forest grazing and firewood collection these older practices contributed to a more diverse forest landscape in the past. Even-aged silviculture instead introduced a system of clear-cutting followed by controlled regeneration, with homogeneous and even-aged stands considered to be more productive and more easily managed.

The shift to even-aged silviculture was gradual but intensified during the 20th century, becoming the standard in Swedish forestry. In the 1970s, forest policies and legislations aimed at securing growth and regeneration, making even-aged silviculture the legal framework for forest management. Since the Forestry Act from 1993, environmental considerations such as retention forestry have been integrated into the legislation, and private forest owners have gained more autonomy in their choice of management. However, even-aged silviculture still remains by far the most dominant management practice in Swedish forestry.



Figure 17 - Aerial photos showing the industrial development in Kålsärdalen on Hisingsåsen between 1956-2024

Respondents in both Ambjörnarp and Säve referred to earlier forest use practices involving selective logging, often with horses or small tractors. In both Ambjörnarp and Istorp, transitions toward more rationalised, industrial forestry are described – sometimes accompanied by critical narratives about the past, where older, mixed forests were dismissed as “poorly managed”. While the current management practices varies between the studied areas, both interviews and particularly the workshops revealed a significant interest in alternatives to even-aged silviculture among the private forest owners. However, it is only a marginal group working in practice with for example closer-to-nature

forest management, while most of the others continue to practice even-aged forestry on most of their forest properties.

Indirect drivers of even-aged silviculture: The transition is closely linked to the emergence of Sweden's pulp and paper industry in the early 20th century. This industry created a market for previously more unused parts of the forest, making clear-cutting more economically viable (Lundmark et al., 2013). The increasing industrialisation of forestry introduced standardisation and yield logics which still shapes Swedish forestry today. This is also reflected in the surrounding institutional environment – including forestry education, advisory services, and timber market structures – which continue to reinforce production-oriented practices.

Urban expansion (direct driver)

Urban expansion is only a significant direct driver in Säve. The area is located on the island of Hisingen, adjacent to central Gothenburg, where both housing and industrial areas have expanded into previously forested land and arable land during recent decades. One prominent example is the construction of a large logistics centre in Kålsared, which was built on forest land. The project was brought up in the local workshop in Säve, where forest owners expressed concern that valuable nature areas had been destroyed in favour of industrial development, despite the possibility of alternative locations (Local workshop in Säve, March 2025).

Housing development is another key theme raised by several respondents in Säve. The expansion of residential areas was described as a long-term trend that increasingly affects forest land. In particular, participants criticised the political planning system in Gothenburg, which was perceived as short-sighted and difficult to adapt to as a forest owner. Forest values are often perceived as underestimated in municipal planning, especially in comparison with interests related to housing and infrastructure.

Indirect drivers: Urban expansion in Säve is primarily driven by continued urbanisation, as Gothenburg's population is expected to grow in the coming decades. This demographic pressure creates increasing demand for housing and logistics infrastructure. A further indirect driver is the growing concern for national food security in response to global instability, such as the Covid-19 pandemic and the war in Ukraine. As a result, preserving arable land is becoming a more clearly defined political priority. This has led to a reallocation of development pressure from farmland to forested areas. For instance, Skanska, the company behind the Kålsared logistics centre, adjusted the purpose of the centre after 2022 to also function as a food reserve, reflecting this changing awareness.

3.4 Culture-Based Dynamics

Forest owners often consider both relational and instrumental values of their forests, which was explored on a deep level in the interviews, while the intrinsic values of the forest were considerably less apparent. Most forest owners who live on or close to their forest properties, or who have family heritage connected to the property, refer to recreational values (walking, running, picking berries, hunting), a feeling of satisfaction of owning or being on your own land. Those with stronger family bonds to their properties also tend to view themselves as stewards, with emotional ties to the property and a sense of responsibility in memory of their relatives:

The farm we have in Torestorp, we manage it more emotionally than rationally. [...] There's a connection to the past and to the hard work of our ancestors. It's something we want to care for in the best possible way (Interview with 'Erik', October 2024).

Then there's a large [drained] bog area there as well, with older trees on it. It was my dad's pet project, so I don't really have the heart to just cut it down

now. But you can also see that spruce doesn't thrive very well on drained wetlands – they don't look too healthy (Interview with 'Stina', September 2024).

But you understand, it's a lot of money. If my ancestors hadn't done what they did, I wouldn't have had... It would have just... No, so that's why I want to make sure that, regardless of who owns the land after me, it will probably still have value – if it's managed properly (Interview with 'Andreas', September 2024).

Instrumental values connected to timber production tended to be slightly downplayed by the forest owners, where most considered timber and wood production as a supplementary income. When mentioned explicitly, income from logging is often connected to renovating farms and houses on the property, not seldom after acquisition. Investments in equipment or infrastructure connected to the property. Interestingly, in Sävje, with few exceptions the only purely instrumental value of the forest itself (if we consider recreation as a more relational type of value) is its use as firewood for some respondents, a few who also sell firewood to others. The geographical location of the properties in Sävje however give them a market value to be sold or parcelled for housing development.

Conflicting values are most evident when it comes to tensions between private forest owners, authorities and corporations. For example, some forest owners consider an active management of nature or culture values to be more important than the government authorities, especially on their own land:

Yes, then they did like they did here. He placed orchids... that old man lay down there and removed everything that was supposed to look nice. There were 12 orchid stands. And the Forest Agency was going to create a special area... And it's really easy to make a nice biotope area – just bring in forest machines and cut down every damn tree that has any value. Cut them all down and leave all the crap, then it's considered good. And at the same time, they wipe out the orchids, because they'll probably never come back. [...] I try to avoid looking at it because I get angry when I see it. When I started, when I was a kid, you used to call the Forest Agency for advice – and you still can today, but now you have to do the opposite of what they say, then it'll turn out well. Slightly exaggerated. (Interview with 'Jens', September 2024).

I actually went against the Forest Agency. We have a continuity forest area out there. And you're really not supposed to do much in it. But I went in there now and took out the spruce and all the larger birch. To maintain the same structure as when it was established, so to speak. Otherwise, it would've just ended up with a few large birches with the spruce forest growing in underneath (Interview with 'Johan', September 2024).

The notion of managed forests is also connected to aesthetic values among many forest owners, which is at least partly conditioned by the history of intensive forest management throughout the 20th century. This largely contradicts the notion of forest biodiversity, particularly the importance of deadwood (Pötzelsberger et al., 2021). Such views are especially evident in Sävje, with negative expressions towards the inactive management of the municipality:

We've picked a lot of mushrooms and so on. And we've been to so many... In the City of Gothenburg, there's a lot of... Gothenburg-owned, I mean the city owns a lot of forest. And they don't manage it. So it looks like a war zone (Interview with 'Johanna', October 2024).

Up there, they cut down a lot of forest and stacked it in a pile, but then they never came back to collect it. It's been lying there for 20 years. And no one dares to take it and use it for firewood either. It's municipal forest, after all (Interview with 'Anton', September 2024).

And you can go and have a look at some of these forests – it's always fun to see what continuous cover forestry looks like. And at least the few parts I've

seen in Gothenburg's [municipal forests], it's more or less a sea of scrub. And the question is whether that's really what nature and recreation want (Interview with 'Viktor', September 2024).

One of the neighbours gets really upset that I leave... if a tree has fallen and I don't have to remove it because of insect damage or something like that, then I leave it where it is. And he gets really bothered by it because he thinks it looks messy (Workshop with Dryaderna, March 2025).

At the same time, there is a strong tendency for criticism towards the forest industry and large-scale forestry among the forest owners, particularly when it comes to larger clear-cuts and a single-minded economic focus in forest management:

We forest owners in southern Sweden feel that... it's really unfortunate that they make these clear-cuts up in Norrland and... then all forest owners get lumped together. We get blamed for something that doesn't really happen down here (Interview with 'Tommy', October 2024).

O: *No... so what's the right way [to manage the forest]?*

J: *The way I see it, it's smaller logging areas and an active but small-scale forestry. If you go up to northern Sweden where there's much more company-owned forest, you don't see it the same way. They send out the harvester in the fall and let it run and cut trees all year long. It's kind of like letting the cow out in spring and bringing it back in in the fall (Interview with 'Johan', September 2024).*

Views related to landscape restoration were primarily raised on the workshop in Säve, where heathland restoration was raised as one possible scenario for increased forest use in the area. Participants were negative towards such a scenario, pointing out that there are plenty of barren, bedrock and heather dominated landscape elsewhere along the coast (Workshop in Säve, 21 March 2025). To a certain extent, this reflects a so called 'shifting baseline syndrome', where the reforested landscape developed during the 20th century has become the new normal situation. Similar views are evident in the forest strategy from the City of Gothenburg, where restoration of the pre-reforestation landscape is not mentioned.

3.5 Identity-Based Dynamics

The primary identity-based dynamics evident in the data from interviews and workshop with forest-owners concerns factors such as age and gender. In general, the literature on forest owners attitudes towards environmental values tie factors such as female gender to more positive attitudes, while high age is instead related to more negative stances (Tiebel et al., 2022). However, both the interviews and the local workshops that we organised revealed rather limited gender-related patterns when it comes to environmental attitudes.

The main gender-related component was primarily tied to decision-making and division of responsibility between partners owning forests together, such as between husband and wife. In many cases, it was difficult to recruit female forest owners who owned forests with their male partners to be interviewed, since they often referred us to their male partner instead. To counteract this, and to potentially capture the patterns observed in previous research, we focused on reaching a larger representation on female forest owners, and by the end of the interview data collection we also specifically targeted female individuals who owned their properties either alone, or together with another female (often a relative). While these interviews revealed interesting views, background factors and attitudes towards forestry, it is not evident that this deviates in any important ways from the male forest owners, apart from less hands-on involvement in forestry work. A few exceptions exist, however, with individuals such as 'Maria' and 'Stina' who are involved in alternative forestry practice and innovation, to a degree beyond any of the male respondents in the

case study. For reasons described below, this has likely to do with other background factors.

An important gender-related component that came out from the interviews, albeit to a limited extent, was the involvement of some female forest owners in women-only networks for forest owners. This was primarily raised in relation to the respondents mentioning that they had took part in seminars and meetings for female forest owners, for example in the interview with the sisters 'Katrin' and 'Jenny':

O: *How important is it that it's specifically a network for female forest owners, as opposed to being mixed?*

K: *I don't really know if it's that important, but maybe they feel like people speak a different language.*

[...]

J: *But I think it's also about wanting to involve women, because traditionally it's been the men who've handled things. But now, there are quite a few like the two of us.*

K: *Like you said, men have been dominant in forestry. So now they're highlighting women so they can have a voice, I think (Interview with 'Katrin' and 'Jenny', October 2024).*

As a consequence of this, we contacted one of these female-only networks, Dryaderna (eng. the dryads), to organise a focus-group interview around gender-aspects as well as their perspectives on forestry in general. This workshop revealed that the primary reason for forming this network was to provide an informational arena to organise meetings and seminars for knowledge exchange for female forest owners. There was an overall view that females were discriminated against in ordinary knowledge-exchange arenas and that male forest owners had difficulties accepting females as active and knowledgeable decision makers. Apart from this, their overall view on forest management and forestry issues did not differ much from the overall tendencies in the other interviews and workshops (Focus group interview with Dryaderna, March 2025). To a certain extent, this reflects the overall masculine norm and female masculinisation tendencies in Swedish forestry observed in previous research on female-only forest owner networks (Laszlo Ambjörnsson, 2021).

Another gender-related aspect that came up in the stakeholder workshop was connected to how advisors often approach the male forest owner even though the forest is also owned by a female (Workshop with stakeholder, Gothenburg, August 2025). To a certain extent, this also reflect our own difficulties in recruiting female forest owners for the interviews, since they often told us to contact their husband instead.

When it comes to questions of age and environmental attitudes, there are no clear tendencies. Overall, the average age of interview respondents and workshop participants was high. There are examples of both younger and older respondents/participants having clear positive and negative attitudes towards biodiversity conservation in general.

One age-related theme that can be identified concerns generational succession, and intergenerational perspectives, which is also connected to notions of stewardship. For practical reasons, such issues were more prominent in older interview respondents, since generational succession of the forest property is less far off time-wise. In some cases, this means starting to delegate some decision-making to younger relatives, which may also lead to new forestry decisions, for example deciding to plant deciduous trees in some parts or taking on board new knowledge. Age is also connected to health-related issues, meaning that older forest owners sometimes out of necessity needs to delegate some of the physical work in the forest. This is also not seldom an opportunity to introduce younger relatives and their partners to forestry.

There is an ethnic dimension to labour practices in forestry that, while present in the material, has not been explored in depth in this study. An increasing amount of forestry work is carried out by foreign workers, particularly from Poland and the Baltic states.

Interview respondents noted that this has led to tensions, as some forest owners perceive these workers as lacking familiarity with, or sensitivity to, local conditions. The reliance on foreign labour stems largely from challenges in recruiting Swedish workers, mainly due to the low wages offered. Comparable patterns can be seen in seasonal agricultural sectors. Previous research has interpreted the increasing recruitment of foreign labour in the Swedish green industry sector as a 'spatial fix' through which capitalism spatially solves its internal frictions, in this case the friction of decreased local labour supply due to urbanisation, demographic change and working conditions (Olofsson & Lundmark, 2025).

3.6 Political/Institutional Dynamics

As already described above under section 3.3, even-aged silviculture is clearly entrenched in the Swedish politics and institutions surrounding forestry, constituting a clear barrier towards alternative practices. On a shallow level, we can observe how this 'lock-in' has created clear path-dependencies on several geographical levels ranging from the local to the national scale, and which also affects how Sweden acts on a European political arena. This silvicultural model has been deeply embedded through over two centuries of policy development, education, and industrial investment, creating a forest culture that views sustained yield and uniform age-classes as the norm. Even today, forestry education and advisory services continue to prioritize even-aged systems, reinforcing this path dependency despite growing calls for more multifunctional approaches (Angelstam et al., 2022). There are several vested interests within the forestry sector tied to industrial actors and current markets for forestry products. Our stakeholder workshop further emphasized this point, where the rather narrow role of the conventional forestry advisor, who is also most times a timber buyer, was pointed out (Workshop with stakeholders, Gothenburg, August 2025).

Importantly, however, we must also note how these path-dependencies are not only a result of past decision-making limiting contemporary possibilities but are continuously reproduced and entrenched through material practice over space and time. Physical infrastructure such as forest roads, ditches, transportation networks and industries are excellent examples of this. We can see these types of infrastructures as part of earlier solutions for industrial expansion, or 'socioecological fixes' (Ekers & and Prudham, 2017) which are continuously maintained and expanded in order to make way for resource flows to the forest industry. The forest industry and connected institutions are also currently in the process of responding to climate and biodiversity crises, partly resulting from these earlier solutions. This is done through incorporating environmental values continuously and dynamically within the logics of industrial forestry through systems such as biodiversity premiums/credits (including carbon), certification standards and arguing for the necessity of renewable biomass. Tensions arise in this process, recently marked not the least by the large forest company SCA pausing their FSC-certification due to too large restrictions and wanting to create space for renegotiation of the certification standard (SVT, 2025).

Path-dependencies, lock-ins and institutional inertia in this case study is thus strongly related to an ongoing reproduction of the forest industry, also constituting a large economic sector in Sweden and a large share of national exports. This is a reality which many forest owners find themselves drawn into through the physical, institutional and knowledge-related infrastructure available to individual owners. Hired forestry work, advisory services and the wider market for forest products, tied to the major industrial actors in this arena, restrict the number of possible choices in forest management. There are alternative movements going on in Swedish forestry, which if leveraged or upscaled have potential to transform the forest sector. However, those movements are largely also constrained by the fixated nature of available forestry infrastructure.

4. Transformative biodiversity innovations

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4.1 Analysis of Inclusion/Exclusion Mechanisms

Exclusionary practices

The exclusion of more diverse practices and perspectives in private forest ownership in western Sweden is shaped by several different dynamics: forest management norms, uneven knowledge access, current forestry regulations and economic structures. In combination, these serve to restrict possibilities for alternative practices and favours the adoption of industrial forestry.

Forest management norms

The ingrained practice of even-aged silviculture that has shaped Swedish forestry for more than 100 years contributes significantly to the marginalisation of alternative practices. Many of the interviewed forest owners, especially in Ambjörnarp and Istorp, express a feeling that they are already contributing to environmental values while practicing traditional certified forestry, often through actors such as Södra and Derome. In general, respondents express that private forest owners are primarily logging smaller areas, and compared to larger actors they are more considerate with their own forests:

O: *Do you think forestry could be changed in some way? How can biodiversity be improved or increased? [...]*

B: *That's the question. They've tried things like small clear-cuts and such. And we're already doing that. We don't do large clear-cuts. It's half a hectare. One hectare if it has to be done. And we leave a lot of seed trees and such. [...] No one around here is doing huge clear-cuts, actually. If it's larger forest owners, then maybe they do larger clear-cuts (Interview with 'Börje', September 2024).*

O: *How would you wish [the forestry debate] looked? What would you wish people did instead?*

B: *I think maybe those who have problems... Or who think that large clear-cuts and... that biodiversity isn't very good there. They should perhaps [more] focus on those who are doing things wrong, rather than making [a] general statement about how forestry in Sweden is. Because it's not like that in southern Sweden. Sure, the occasional forest might be mismanaged here too. But a forest farm down here is no more than 50 hectares. Then maybe you can harvest one hectare a year (Interview with 'Tommy', October 2024).*

No, but small forest owners [...] have a closer connection to their environment. They live nearby or own land nearby, so in some way they try to do the best they can, whereas larger state and private forest owners deal with much bigger volumes and have a greater need to make money (Interview with 'Annika', May 2024).

This implies that many private owners primarily perceive the environmental problems in traditional even-aged forestry to be an issue of scale rather than the practice. This is also a potential reason why many private forest owners interviewed perceive that the wider forestry debate does not concern them. However, interviews also revealed tendencies in private forest owners that may undermine biodiversity actions, such as the image of the 'clean' forest. A connected problem here concerns the reliance of forest owners on external advice, in our case study often from actors such as Södra or Derome. As described under chapter 3.2 of deliverable 2.5, these actors serve to entrench traditional forestry practices among private forest owners for the sake of providing resources to the forest industry.

A specific historical dimension that hinders the adoption of alternative forestry practices is the early 20th-century debate in Sweden between selective logging (*blädning*) and clear-cut forestry (*trakthyggesbruk*). At that time, the discussion concluded with the view that selective logging had a clearly negative impact on long-term forest growth compared to clear-cutting. This perception still lingers among several forest owners and was brought up during both interviews and workshops, particularly in Ambjörnarp (e.g., interviews with 'Viktor' and 'Johan'). During the workshop in Ambjörnarp, it was suggested that the term "dimension cutting" (*dimensionshuggning*) be used instead, as "selective logging" carries historical baggage that makes it a sensitive concept.

Uneven knowledge access

The interviews reveal differences in knowledge access among private forest owners in our case study, especially when it comes to alternative forestry practices and general knowledge of biodiversity. This is not the least related to how informed forest owners are on forest management in general and the degree to which they are active themselves. A previous background, for example growing up with family members involved in forestry, often leads to larger capacities for individual decision making. However, when such a background is lacking, management decisions are often delegated. For example, 'Eva', a rather recent widow in her mid-60s whose husband bought forest properties as a kind of investment, and who has worked in her husband's company, has little practical knowledge in forestry herself. She owns a forest property which she rarely visits as she lives c. 10 kilometres away. While she is currently striving to build up her own knowledge on forestry, but so far, she has delegated the forest management on this property almost entirely to Derome (Interview with 'Eva', October 2024).

In some cases, with new forest owners, the knowledge they build up over time increases their capacity to question the status quo in forestry which forestry consultants often default to:

O: *Right, then it's hard for you to know whether you'll get any income from the forest. Do you know anything? Do you have any thoughts?*

J: *Yeah, actually, we brought in Derome. [...]. And we didn't want to end up in a situation like with storm Gudrun... where everything ends up like a game of pick-up sticks. Because we wouldn't be able to deal with that. So, we actually want to collect that money. [...] [W]e doesn't know anything about forestry. But the guy from Derome said it would be a final harvest, and then the area would be defined. And then he'd arrange the harvesters. But then I read something in Land magazine about selling by the stump. Like, you go out beforehand and say: we'll take that tree, and that one. It paid better too. Maybe not for our small volume, but I don't care. I don't want it to look like a clear-cut. I want to take the trees that should be taken. Because that, to me, is forest care (Interview with 'Johanna', October 2024).*

It is somewhat of a struggle as a new forest owner to know how to navigate the complex knowledge arena connected to forestry issues, where there also may be conflicting information. Many new forest owners wish to do the right thing for environment and biodiversity but find it difficult to know exactly what to do and why since different actors give different advice.

What I feel is that I want a forest where you can occasionally harvest – I'm thinking more like thinning. I would like to have an actively managed forest where you thin out some trees and then let it regenerate. But as I said, this isn't something I've worked with, so I don't know if this is a realistic wish, but that's what I would want – to harvest selectively. Because I really hate clear-cuts, I think they're awful. I want the forest to remain, to really still be there (Interview with 'Helena', May 2024).

A new forest owner attending our local workshop in Ambjörnarp, who wanted to have a forest management plan centred on conservation, expressed himself in this way:

At the same time, it's important that the forester you talk to – or someone in a similar role – understands what your intentions are. I wanted to adapt the forest management plan [...] to focus more on conservation. But in the end, it still turned out to be quite production oriented. So, you have to navigate that yourself. [...] I find that you really need to do a lot of research on your own, talk to many different people. I also get the sense that things are improving within Södra, but you can get different answers from different people, depending on their background and training. It's hard to know – do I have to do this, am I allowed to do that, and so on (Workshop in Ambjörnarp, March 2025).

At the same time, since knowledge production around forestry in a Swedish context is rather tied to the forest-industrial complex, there is a tendency for people with long practical experience, strong forestry educational backgrounds or strong connections to economic forestry to express themselves more negative towards alternative forestry practices:

O: *What's your view on continuous cover forestry?*

J: *A disaster.*

O: *In what way?*

J: *You get poorer stands, because you end up... we're going back to something that was once declared illegal.*

O: *You mean selective logging?*

J: *Yes, the selective logging that used to be illegal. That's the problem. But of course, we have to try to reinvent the wheel as many times as possible (Interview with 'Johan', September 2024).*

O: *Okay, what's your view on continuous cover forestry [...]?*

V: *Well, we've already tried that.*

O: *You're referring to the selective logging practices during the 20th century?*

V: *Exactly – or dimension cutting, or whatever they called it back then. So, we know exactly what a green lie looks like (Interview with 'Viktor', May 2024).*

Yes, if we're talking about selective cutting. I find it hard to believe in that. If I were to start doing selective cutting here, the harvesting costs would be high – that's probably the first thing that comes to mind. Then you get gaps, and the wind blows... If you're supposed to wait ten years, then you've got... It becomes really difficult to manage it in a sensible way. In an economically reasonable way (Interview with 'Andreas', September 2024).

The role that uneven knowledge access plays as an exclusionary mechanism is thus complex and context dependent. Limited knowledge leads to less capacity for independent decision-making and a larger reliance on forestry advisory services, but at the same time is often connected to knowledge seeking which may pave the way for interests in alternative practices. A larger knowledge base serves a foundation for being more independent in forest management, and while not always the case this does not seldom lead to stronger ties to even-aged silviculture.

Current forest regulations

Current Swedish Forest regulations play a significant role in shaping how private forest owners perceive and engage with biodiversity. Among many forest owners interviewed in the case study, biodiversity is often framed as something external, associated with the state agencies, EU policies or sometimes urban environmentalist agendas, rather than as a shared responsibility. This perception is enhanced through regulations that aims at environmental protection but frequently results in exclusion and disempowerment among landowners.

An often-recurring theme, not the least in the interviews, was that forest owners often associate biodiversity management with something imposed from above. The presence of certain species habitats – such as those of the capercaillie – can trigger legal restrictions on logging, with no automatic economic compensation for the affected landowners (e.g. Interview with 'Linda', May 2024; Interview with 'Jens', September 2024). Owners who have managed their forest to reach ecological continuity or high conservation values on their land may be faced with the fact that through promoting biodiversity they risk losing income or control over their land. To get any kind of compensation, they must typically initiate a legal process, which is time-consuming, uncertain and beyond the capacity of most individuals. This situation is largely perceived as unsustainable by a wide range of forestry actors, including environmental NGOs, which suggests that some kind of reform may not be far off.

Furthermore, the current regulatory system leads to practical geographical management decisions. Certification standards such as FSC or PEFC, which require a certain percentage of forest holding to be retention areas for conservation (typically 5-10%), are frequently met by setting aside unproductive, marginal or inaccessible forest land which in either case still would be less managed for forest production. This strategy allows owners to maintain productive forestry on the more economically valuable parts of their properties but distinctly limits the type of forest geographies that are typically set aside for conservation purposes, leading in turn to homogeneity of environmental values in the forest.

Economic structures

Economic structures in Swedish forestry create powerful exclusionary mechanisms that limit the adoption of biodiversity-enhancing practices among private forest owners. The prevailing market logic is strongly oriented toward standardized timber and pulp production, which marginalizes alternative forms of forestry such as long-rotation management, mixed-species stands, and continuous cover forestry.

Current market systems are structured around the demands of industrial actors who effectively set the terms for what qualifies as "marketable" forest products. Timber must conform to specific qualities and dimensions to be accepted by processing facilities, which means that overgrown or non-standard trees – often characteristic of more biodiverse or uneven-aged forests – are economically penalized. Forest owners who consider shifting toward biodiversity-oriented practices face structural disincentives, as their products may not find a viable market. This system reinforces production-oriented forestry and limits experimentation with alternative approaches.

The internal market also contributes to these constraints. Several respondents noted that trees exceeding standard dimensions are difficult or impossible to sell, as industrial processes are optimized for specific sizes. This technical limitation discourages forest owners from adopting longer rotation cycles that would allow forests to mature more naturally and increase biodiversity. The result is a system where forest management is shaped not only by ecological or ethical considerations but by what the market will accept – often to the detriment of biodiversity.

Inclusive mechanisms

The inclusive mechanisms active in the case study areas range from personal engagement to top-down initiatives and legal frameworks. In this sub-section, we divide these mechanisms into personal, horizontal and top-down.

Personal inclusive mechanisms

Many forest owners, especially those with close family ties or who live on or nearby their own forest land, exhibit strong place-based connections to their forests and the species in them. In the wider context of Swedish forestry, often defaulting to traditional even-aged

practices, personal engagement is very important in challenging the status quo. In the context of our interviews and workshops, this is most clearly expressed when it comes to forests closer to residential areas, which are more often used for recreational purposes, and which serve more clear aesthetic functions. There is a larger tendency for forest owners to use alternative practices, less monoculture forest stands and focus more on deciduous trees closer to their areas of residence:

If you're looking for a return on investment, then it might be more difficult to use alternative harvesting methods. But in our case – I'm speaking more generally now – but in our case, it's more about... the areas we're currently considering are closer to where we live, and in those cases, I think we'll choose the method that makes the forest look nice afterward (Interview with 'Anders', May 2024).

The same is true in the case of forest owners owning several forest properties, where they tend to prioritize recreational and aesthetic values on properties with closer geographic or emotional proximity.

I might be talking more than you'd like now, but as I mentioned, the farm we have in Torsestorp – we manage it more emotionally than rationally, and because of that we try to do things a bit differently. We've planted beech on two hectares, even though everyone said it wouldn't work, that beech can't grow there, but it's doing just fine. So, on that farm, we're focusing on creating a more varied type of forestry, but elsewhere we manage things more rationally (Interview with 'Erik', October 2024).

O: What would you say the forest means to you personally?

E: Here, where I live in my house, it means a lot. I love walking in the forest – even though it's not that big here, I would never move to the city. But then the one over in Grimmed, I'd say that one doesn't mean as much. Not in my heart, so to speak (Interview with 'Eva', October 2024).

There is also a strong tendency for many forest owners to host negative feelings towards too large clear-cuts, and this serves as a mechanism for being more open to practices where such clear-cuts are avoided. However, this seldom means adopting alternative forest management across the entire forest property, but rather to create or use the forest in way that avoids larger areas of clear-cuts but is still managed traditionally.

Another mechanism here is connected to the forest owners who are hunters in Ambjörnarp and Istorp, who often care deeply for wild species, especially larger mammals such as the moose, on their land. This also serves as an arena of some conflict with larger forestry corporation, which opens up for a wider critique of the forest industry.

And ideally, we should eradicate calves, shoot all of them, it seems. And we don't want that. We want... It's actually really fun to go up into the forest and see a moose, but they don't want that. Well, it's the forestry companies that are saying no. We have Sveaskog. And it's just about shooting, period. They don't care if there's a moose next year, they don't care about that, because they're focused on their forest. Whether there's any browsing damage or not, they don't care, they'll shoot anyway. So they're the ones influencing the county administrative board (Interview with 'Jens', September 2024).

What we were talking about earlier, a bit about moose hunting and such. In my world, it's entirely the fault of the large forestry companies that there are no moose. Because they've wrongly blamed the moose for browsing damage on pine trees and wanted to more or less eradicate the moose, forcing the tenants to hunt much more than they're actually interested in themselves (Interview with 'Simon', May 2024).

Horizontal inclusive mechanisms

December 2025

There are some signs in the case study of cooperative mechanisms which may have potential in ensuring more biodiversity-friendly practices among forest owners. An apparent example here is that members within Södra have pushed the organisation to give advice on continuous cover forestry since autumn 2024. This shows the potential of horizontal organisation among forest owners to push for changes in the largely industrial actors which they continuously interact with.

The workshops also revealed ideas for horizontal organisation that would enhance the capacity for forest owners to pursue alternative practices. At the workshop in Ambjörnarp, the idea of establishing a shared machinery pool for local forest owners was raised, since investing in forestry machines individually is often very expensive. Challenges with this idea were also discussed, particularly that heavily used large machines would require costly repairs. Nevertheless, it was seen as an opportunity to support more small-scale forestry operations (Workshop in Ambjörnarp, March 2025). The same idea was also brought up at the workshop in Istorp, where participants discussed the possibility of locally organizing a machine station for smaller harvesters to facilitate dimension cutting (Workshop in Istorp, March 2025).

The focus group interview with Dryaderna also showed the potential in horizontal organisation among forest owners, with less formal ties to industrial forest production. While it is unclear in what ways specifically female forest owners practice different kinds of forest management from their male counterparts, a forum such as Dryaderna at least seems to serve as an inclusive environment which broadens the perspective on forestry:

It's interesting because... at the men's forestry days, it used to be – maybe it's not as much anymore – but it was very clear that everything revolved around forestry. And in our gatherings, you meet so many women who have completely different jobs. And that's actually quite nice. Even though they are very interested in their forests, they also have slightly different ways of thinking about life (Workshop with Dryaderna, March 2025).

The problems of existing member organisations such as Södra were also raised in both workshops and interviews, especially the industrial ties of this actor and that they do not accept specialty assortments of timber, focusing on a narrow range of products (Workshop in Istorp, March 2025). In one of the interviews, the potential of creating a branch organization for small forest owners was raised in contrast:

E: *We are always in the shadow of the large forest owners and forest companies. I don't know how we are supposed to make our voices heard – we should have our own industry association for small forest owners to speak up through. But as far as I know, we don't have one.*

O: *How do you feel about Södra then? Don't they represent you in any way?*

E: *I don't think so. Sure, it's member-owned, but somehow it feels like they have one foot in the big forest companies and one foot among the members. But to me, they feel more like a large forest company than true representatives.*

O: *Do you think it could make a difference if forest owners organized themselves independently?*

E: *Yes, I actually do. Not least because forest companies often shape how people think forestry should be done. Things like thinning – when and how often. They push that everywhere because it benefits their industry (Interview with 'Erik', October 2024).*

Another example of horizontal organization is the hunting teams, in which many forest owners are involved. Within the hunting teams, landowners (and others, such as those who lease hunting rights) come together. Hunting teams often work with various types of wildlife management, such as improving habitats and providing supplementary feeding. In Ambjörnarp, an example was given of how the local hunting team defies the moose quotas assigned to them by the County Administrative Board, which several forest owners engaged in hunting believe are set too high:

O: *What's your impression of the moose population?*

K: *Very small, really far too small. The hunting team that operates on our land doesn't shoot as many animals as they are allocated.*

O: *So they're trying on their own to increase it?*

K: *Yes, and they're also very careful about which animals they shoot. They avoid shooting the males – the moose bulls – that are in their prime. Instead, they prefer to shoot older animals and calves. They want to keep the animals that will produce the next generation (Interview with 'Kristin', October 2024).*

These types of horizontal mechanisms certainly have the potential to be developed further through different bottom-up initiatives, and as shown here some of these types of organizational initiatives are already initiated locally and regionally.

Top-down mechanisms

Although not efficient in handling the contradictions between production and conservation interests the current Swedish forestry legislation serves as an important inclusive mechanism, especially in comparison to earlier legislations from the 70s and 80s. The current legislation allows a large amount of freedom for forest owners to choose their type of management and use according to their own interests, where previous legislations had more formal rules which served to enhance the production interests in the forests. This "freedom under responsibility" has become the lead word for Swedish forestry, meaning that as long as forest owners abide by certain legislation, primarily for environmental considerations, they are free to manage their forests for their own goals and purposes. However, there has also been calls for more active involvement of the government in setting more clear boundaries for Swedish forestry, both from actors with industrial interests (who wants to ensure that the forest remains in use) and from people or organisations interested in promoting biodiversity conservation and climate adaptation (e.g. more forest area under formal protection by the state). The Swedish Government is currently working with updating the forest legislation. A government-initiated public inquiry has proposed financial compensation at 125% of market value when environmental considerations prevent logging, simplifying the approval process for forestry operations and capping the cost of surveys for protected species (with excess costs covered by the state). If such legislation is finally put into practice, this would mean larger space for promoting environmental values in Swedish forests.

The government has also directed Skogsstyrelsen and Naturvårdsverket to develop strategies to increase the share of continuous-cover forestry in Swedish forests. A report from this work described increasing the share of continuous-cover practices in state-owned forest companies to 20-25% as an important step and giving financial incentives, targeted consultation and developing business models to promote the adoption of such practices among private forest owners (Naturvårdsverket & Skogsstyrelsen, 2023). Like the suggested changes in the forest legislation, an adoption and development of such policies would likely increase the number of viable alternatives in forest management, paving the way for more nature-inclusive management types.

Public actors such as the Swedish Forestry Agency (Skogsstyrelsen) and SMHI (Swedish Meteorological and Hydrological Institute) have also intensified efforts to promote climate adaptation and biodiversity in forestry. These agencies have developed educational campaigns, digital advisory tools, and reports that encourage forest owners to reduce dependence on Norway spruce monocultures, in favour of mixed-species stands better adapted to a warming climate. The Forestry Agency has, for instance, published recommendations for diversifying species composition and adjusting silvicultural practices to new climatic realities. SMHI has contributed with climate models and local projections, helping forest owners assess future risks related to drought, storms, and pest outbreaks – factors that directly affect forest management strategies. Although few of the forest owners we have interacted with are aware of these resources available to them, if promoted more

efficiently they would not only increase climate adaptation in Swedish forestry, but also present pathways away from traditional conifer monocultures.

As mentioned under chapter 3.6 of deliverable 2.5, there are also various ongoing strategies within the forest industrial sector which largely serves the function to uphold industrial forest production under the pressures of environmental change. However, although part of a status quo movement, it should also be recognized that some of these have potential to transform material practices and make way for more nature-inclusive ways to manage at least parts of the forest. One example of this is the development of biodiversity credits, in Sweden under the platform Treebula, where companies can purchase credits to fund biodiversity-enhancing measures in private forests. Payments are made to forest owners who commit to promoting biodiversity and a continuous monitoring of these values aim to ensure accountability. The first such transaction in Sweden occurred in the autumn of 2024. If developed further, this type of business model may allow forest owners a financial incentive to promote biodiversity, although it can be questioned what types of biodiversity that will be promoted under such schemes and what effects it would have on forest management on a larger scale. Another example is Södra Skogsägarna's nature conservation premium, which incentivises members to voluntarily set aside a larger proportion of their forests for conservation. Forest owners who allocate up to 14% of their total forest area for conservation purposes receive a higher price per cubic meter of timber harvested from the remaining forest area. However, questions can also be raised here whether 14% is enough to preserve biodiversity, especially under the rather homogenous geographical strategies by which already unproductive land is chosen for conservation purposes.

4.2 Niche Innovators and Key Players

Since our case study analyses a case where there is no formal societal partner, and no coordinated action among the forest owners for biodiversity restoration/regeneration, we have not engaged in practical activities with the innovators that we have identified towards this goal, nor have they engaged us. Our case study has been focused on trying to understand the conditions for working with and engaging private forest owners in biodiversity efforts in their forests, and while doing so a few individuals have emerged as more innovative and experimental than others. Here, we focus on contextually analysing what makes these innovators unique and discuss the potential of upscaling their innovations. Innovators 1 and 2 were engaged in the local workshops that we organised, while innovator 3 did not have the opportunity to participate.

To maintain confidentiality while providing detailed information relevant to the study of innovation, certain details about the innovators have been generalised. Additionally, a gender-neutral description has been used to further protect the individuals' identities (they/them). We have also chosen not to disclose the month of the interview, since this may enable identification or connection to other quotes and individual information in this report. Furthermore, while each innovator represents one of the study areas, we have chosen not to name these areas explicitly.

Innovator 1

This forest owner is in their seventies and deeply engaged in questions of biodiversity and climate change at both local and international levels. With a background as a journalist for Swedish national radio and as a former press officer at the European Parliament, they represent a generation politicised during the 1968 movement and the anti-nuclear campaigns of the 1980s. Today, they are still politically engaged and a member of national activist groups, participating in public climate demonstrations.

Although having spent much of their life elsewhere, they have strong ties to the local community, having grown up in the area. A few years ago, they returned to live on their family farm. They currently own c. 50 hectares of forest land divided between two

properties inherited through their family and are committed to landscape stewardship that goes beyond personal benefit, aiming to provide ecosystem services for the wider society.

They hold a membership in Södra Skogsägarna by heritage but are rather critical of its standard forest management practices. To deepen their knowledge, they have pursued nature-oriented courses offered by adult education institutions, the Board of Forestry, and the Swedish Meteorological and Hydrological Institute.

Innovator 1 sees biodiversity loss and climate change as interconnected and equally serious threats, shaped by a background in professional work and political engagement. They oppose industrial forestry and monocultures, advocating for reduced consumption and more continuous-cover forestry to enhance resilience against climate change. They value ecological and aesthetic qualities of broadleaf forests, aiming for greater diversity instead of monocultures.

Innovations include planting oak and other broadleaf trees, restoring wetland areas to create carbon sinks and promote biodiversity, and developing a forest management plan focused on ecosystem services rather than personal profit. The plan, created in collaboration with a biologist, draws on historical maps to guide restoration efforts. Although full implementation is still pending, the owner's approach emphasizes long-term societal benefits in terms of climate and biodiversity.

Innovator 1 describe themselves as rather marginalised among the local private forest owners who primarily practice traditional forestry:

O: *Isn't there someone who comes and asks you how you do things, someone who's curious?*

M: *They naturally think they know much more than I do because they are farmers, and the closest neighbour down here has worked as a forest worker, and the one who leases land has really large forests and has bought up a lot. He didn't have very large forests to begin with. He does one good thing – he has a lot of horses that he uses for work in the forest. [...] Otherwise, it's completely traditional – clear-cuts and spruce plantations (Interview with Innovator 1, 2024).*

The same impression was given when Innovator 1 attended the local workshop where they raised the importance of a changed forestry legislation, with the forestry act incorporated under the Environmental Code, and called for Sweden to fulfil the international commitments it has signed. This was not taken up for further discussion by the other forest owners present; the sense was that the proposal either went over their heads or was actively ignored. Still, Innovator 1 with a background in journalism has managed to make their voice heard in other contexts such as regional media.

Innovator 2

This forest owner is in their fifties with a background in public administration, they have experience working in both Swedish Government offices and municipal settings. About 15 years ago, they moved back to their family farm and transitioned into forestry, completing a foundational forestry program and additional distance studies at Växjö University.

Today, they divide their time between forestry work and running a small-scale agricultural business. They own approximately 30 hectares of forest land and manage the forest largely manually, gradually transitioning to alternative practices such as various forms of continuous-cover forestry. This approach is strongly inspired by their child, who works at a cultural heritage reserve and advocates for historical, low-impact forest management.

They are also working towards greater self-sufficiency in food and raw materials, aiming to reduce reliance on external inputs. Their role as a freelance forest planner has provided a broad network among local forest owners. While not generally perceived as radical, they are attentive to the individual goals of each landowner and tailor forest management plans accordingly. They maintain strong collaborative ties with neighbours, sharing access to forestry machinery and coordinating work, resulting in largely self-sufficient but locally

cooperative forest management. Due to their forestry activities and work, they have a large network of forest owners in the local area.

For innovator 2, the forest is a place of reflection and restoration, but also a site for creative experimentation. The owner actively reshapes their forest with a strong focus on biodiversity, mixing tree species and structures even when this challenges rational forestry norms. They see biodiversity as essential for ecological functions and are critical of the pulpwood-oriented model within Södra, instead aiming to align ecological care with the production of high-quality timber for craft and construction.

Their approach is marked by curiosity and innovation: they test continuous-cover forestry, selective thinning, and natural regeneration in old pine stands. They increase the presence of broadleaved trees and undergrowth to support wildlife and climate resilience. They exchange wood and forestry services with neighbours and explore forest grazing and commercial blueberry production as new uses of the land. Much of this is done in dialogue with their child, and they are considering submitting motions to Södra to promote more diverse forms of forestry.

The large forestry network of innovator 2 is particularly useful when it comes to marketing products from their alternative forest management and ensuring a degree of self-sufficiency. For example, they have a designated area where they work with a so-called seed tree stand of old pines, intended to seed naturally and regenerate the forest underneath. These pines are of high quality and old age, and through their network they have the opportunity to sell this timber locally through selective logging:

Now we met someone who lives up here in the forest [...] he helps out with carpentry in the local heritage association, and he works with log construction nowadays since he moved up here to a small cottage. [...] He now buys standing timber, the good quality trees, and he wants to use local wood for the heritage association's buildings [...]. So he's interested in buying pine trees standing here, and he doesn't buy everything at once, but instead, if he needs five pines or whatever he might need, he just takes those instead of bringing in machinery. [...] As the crow flies, it's just like from the mast over there to here, [...] so he can just cross through the forest and our land to fetch them here, and that's how we sell the timber (Interview with Innovator 2, 2024).

Innovator 2 is largely careful in advocating their own views when interacting with other forest owners professionally, a setting which otherwise potentially could serve as an arena for transformative action. However, their closest neighbours are practicing a similar kind of forestry which gives Innovator 2 a certain local influence, especially since they are collaborating closely with each other. Their local setting constitutes a local pocket of alternative practices, which likely serves as an important facilitator for this which would be more difficult to pursue individually.

Innovator 3

This forest owner is in their sixties and has become increasingly engaged in forest management over the past few years. With a background in the construction industry, including running their own business and nearly three decades in product development at Volvo, they are self-taught in forestry. Their practical understanding of wood, developed through years in construction, strongly influences how they manage their land today. Although politically reserved, they are socially active through collaboration with a son-in-law who supports practical forest work and through participation in online groups for small-scale forestry.

The owner lives on a horse farm together with family members and holds a shared ownership of the property. Initially seeking land mainly for horse activities, they have gradually developed a deep interest in the forest, which covers about half the property. Forestry work is primarily directed towards personal use rather than commercial profit, with activities like small-scale logging, timber sawing, and firewood production. They have

used timber from their own forest to build structures such as machine halls and stables, focusing on resource efficiency and self-sufficiency.

Innovator 2 connects forest management to active stewardship and personal craftsmanship. They emphasize removing storm-felled trees, maintaining a clean and accessible forest environment, and supporting biodiversity and ecosystem functions, particularly for pollinators. Regulations around biodiversity are generally accepted as they are not perceived to interfere significantly with the owner's management approach.

Innovations include using a personal sawmill to produce building materials, practicing selective logging and continuous-cover forestry to maintain an ongoing supply of older trees, and experimenting with an informal forest inventory to monitor tree numbers and ages. Their approach reflects a practical, resource-oriented creativity aimed at sustainable and self-reliant forest use.

Innovator 3 knows all the local forest owners but feels that these owners do not actively manage their forests. They say they do not want to complain about their neighbours, but for example, they feel that windfallen trees are left for too long, which can lead to infestations such as bark beetles. They also mention that several owners just hire a logging company when needed, and while some have done so, most are completely inactive in managing their forests. They do not seem to have any ambition to influence how others manage their land, and therefore his way of managing the forest has had little impact on local forest management.

4.3 Scalable Bottom-Up Innovations for Transformative Change

In our case study, a range of bottom-up innovations have emerged, primarily in contact with the key innovators listed above. These have primarily been assessed in the context of local workshops with private forest owners organised in March 2025, where we also explored further ideas and took top-down initiatives into consideration. The bottom-up innovations identified are listed below.

1. **Continuous Cover Forestry (CCF):** This is an alternative to clear-cutting, which maintains forest continuity and promotes/preserves biodiversity dependent on continuity (such as capercaillie), primarily through selective harvesting, or dimensional cutting. There are also alternatives such as gap harvesting or retained shelterwood, although selective harvesting of various forms was the primary management form put forward in both interviews and workshops. Although this is not a local innovation per se, since it is already practiced internationally and in other areas nationally, as already mentioned there is a clear bottom-up push from members within Södra to make this organisation provide advisory service for CCF, which has now been successful. Local innovators such as Innovators 2 and 3 also show how CCF can be applied to set goals and used in creative and innovative ways as part of a more self-sufficiently directed forest production.
2. **Use of Biologists for Forest Planning:** This innovation is distinctly tied to Innovator 1, where the goal was to develop forest management for a wider range of 'ecosystem services', a term used by the Innovator themselves. Such an approach deviates in many ways from usual forestry practices focused on wood and timber production, focusing on landscape restoration and a move away from previous monoculture and even-aged management systems.
3. **High-quality timber production:** This was primarily raised as an innovation by Innovator 2 in Istorp but plays into the management of Innovator 3 and was taken up as a point of discussion in all of the local workshops. The production of high-quality timber as a long-lasting material for building or handicraft fundamentally requires alternative forestry practices which deviates from even-aged silviculture. CCF is an important component of this, but it is also dependent on geographic context and adaptation to local conditions.

4. **Commercial Bilberry Production:** Innovator 2 also raised a personal innovation and the potential that they saw in commercialising bilberries as a way to promote multi-use forestry, which would make it possible to manage the forest in other ways than primarily for wood production.

Transformative potential and equity

Out of these innovations listed, the one with the most radical divergence from current forest management is the use of a biologist for forest planning. Adopting such innovations means moving away from valuing the forest primarily for personal gains (be they economic, material, recreational or other) towards a view where the local forests play an intricate role in a wider environmental context, serving larger societal purpose (for example as a carbon sink) but also being valued in itself. In turn, this means a large motion towards a 'nature-positive' forest management. Since the forest landscape today on a wide scale is strongly shaped by human intention as an economic resource, and also in relation to the fact that the aim of a biologically orientated forest management plan would be to restore the landscape to an earlier state also heavily influenced by human use, such a forest management would require a close interaction between human management and different non-human actants. What this means in practice is that landscape restoration is dependent on human intervention, observation and close consideration of species and environmental responses over time in order to reach a set restoration goal.

However, in a wider context, this innovation seems largely marginalised, and it is questionable to what extent it could be upscaled in practice, especially in cases where forest uses serve personal and practical material purposes which also evolves over time. Innovator 1 themselves mention that this innovation was possible since they did not rely economically on an income from the forest, and the biologist employed for this purpose was a personal contact (Interview with Innovator 1, 2024). In cases where an income from the forest serves a reproductive purpose in a household, family or farm economy it is often more difficult to pursue alternative practices, not the least since forestry is dependent on long-term management with large uncertainties which means that long-term risks need careful evaluation. To a certain extent, this also aligns with ongoing research into how to widen the scope of current forest management plans by introducing a wider landscape perspective through regional plans for Green Infrastructure (Karlsson et al., 2024). However, as noted by Karlsson et al (2024), current forest legislation is largely built around voluntariness which means that implementation of such plans builds on personal interest and engagement. The same could be said of biologist forest management plans, which implementation builds both on material possibility and personal interests.

CCF and high-quality timber are two innovations that are highly connected to each other, and which has a transformative potential not the least when it comes to material practices and outcomes in the forest. It is widely recognised that CCF is superior to even-aged silviculture in supporting forest biodiversity, for example regarding deadwood retention, habitat heterogeneity and mycorrhizal development (Atlegrim & Sjöberg, 2004; Joelsson et al., 2018; Sterkenburg et al., 2019). In many cases, such as the case with the capercaillie hindering clear cuts mentioned under section 3.2, CCF is possible to practice in places where regular logging is restricted legally for environmental considerations (ATL, 2024). The relationship between CCF and high-quality timber is rather uncertain scientifically, since very few studies exist, but CCF generally produces denser tree rings although the quality of sawn goods generally is comparable to traditional retention forestry. A specific method mentioned for the production of high-grade timber is overstorey retention for pine (Piispanen et al., 2025), which was specifically practiced by Innovator 2.

While this emphasises CCF as a transformative material practice, it is less evident how such forest management would impact worldviews in a wider sense, or if the forest still is used primarily for instrumental purposes. As exemplified both by Innovator 2 and 3, the forest, while fundamentally an environment of enjoyment and recognised for its intrinsic environmental values (e.g. as a habitat), it is primarily discussed as a resource for personal goals and aims.

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As shown by the member-driven development in the organisation Södra, these types of management practices are attractive enough to drive changes within large industrially oriented membership organisations. Upscaling of such practices are therefore already ongoing in a Swedish context, also encouraged by government authorities (Naturvårdsverket & Skogsstyrelsen, 2023). A major constraint to wider upscaling is constituted by the legacies of even-aged silviculture in Sweden, including industrial supply chains, forest politics and market access. Forests managed under CCF cannot meet current or future industrial demands for pulpwood and standardised assortments of timber (Stål et al., 2024).

At the local workshops organised, CCF and high-quality timber or at least alternative timber assortments than the usual was specifically taken up for discussion. In Ambjörnarp, restrictions related to sawmills and the industry was mentioned, where the industry primarily prioritises rapid growth and coniferous trees. This leads to less possibilities for developing slower growing forests with higher quality and also restricting the market for deciduous trees. A potential solution to this was to develop small-scale local sawmills which could take care of and market high quality timber (Workshop in Ambjörnarp, March 2025). In Istorp, there was a wider group of forest owners interested in or already practicing CCF in parts of their forests. However, important constraints were also raised such as transitioning existing spruce monocultures, the large-scale direction of industrial markets and the shifting national forest legislations which makes long-term planning difficult (Workshop in Istorp, March 2025). In Säve, where very few forest owners engaged in the workshop had practical knowledge or experience in forestry, high-quality timber production through dimensional and selective cutting seemed attractive. This was specifically raised in relation to a transition from a more resource intensive society to more long-term resource use, although local conditions for such timber were mentioned as rather unsuitable by more experienced participants (Workshop in Säve, March 2025).

In summary, our local workshops clearly illustrated that there is considerable interest in pursuing alternative practices such as CCF and high-quality timber, although there are many constraints to overcome ranging from industrial supply chains and markets to local geographic conditions and legacies of past even-aged silviculture. As also shown in the description of Innovators 2 and 3, the adoption of such practices depends on both local social networks, collaboration or individual practical capacities. The largest potential for upscaling such practices likely thus start in the development of local and regional markets for such products, including overcoming restrictions relating to machinery and logistics.

The last innovation mentioned here, commercial bilberry production, is deemed to carry the least potential for transformative upscaling, due to climate, social and equity reasons. This is not the least the case since there is already a Swedish bilberry industry intricately entwined in global commodity chains through its nutritional and medicinal character. The Swedish bilberry industry has grown from small family businesses selling locally to mass global exportation dependent on the recruitment of cheap foreign labour, often from Asian countries (Hedberg, 2016). A large share of exported wild-picked bilberries are refined (increasing the value) and used in the global medical industry, with connected long-distance transportation and increased emissions. At the same time, bilberries and particularly blueberries are important to fill demands on the Swedish market (Lundgren, 2021). Thus, in order to commercialise and upscale Swedish bilberry production in socially/environmentally sustainable and equitable way the current market logics through which Swedish wild bilberries are globally valued needs to be changed, along with the dependence on cheap foreign labour.

If analysed as an alternative forest management, with the goal to increase bilberry cover and production amounts in the forest, simulations have shown that a combination of different management practices, including both traditional retention forestry and CCF etc., is the best alternative (Bergenheim, 2024). This means that innovations in this area may lead to increased possibilities for alternative practices in Swedish forestry, also pursuing values beyond wood production. However, as already mentioned, it is doubtful whether upscaling of such this innovation can be considered transformative in a wider social and environmental sense.

4.4 Initial Mapping of Interventions

In our case study, we regard the workshops we organized – particularly those held in Istorp, Ambjörnarp, and Säve – as the main interventions. This is based on the fact that private forest owners rarely meet to discuss forestry-related issues in settings that deviate from standard forestry contexts. Typically, such encounters take place during forestry days or courses organized by actors like Södra or the Swedish Forest Agency. These gatherings are often characterized by top-down information transfer between experts and forest owners. By contrast, our workshops were designed to foster peer-to-peer dialogue around alternative forest management practices and, more broadly, around pressing issues affecting forest biodiversity. We aimed to provide a platform for forest owners to articulate their needs and perspectives on forestry in a shared and reflective space.

A recent literature review on private forest owners and forest-related services (Matilainen et al., 2023) noted that most existing studies adopt a top-down approach, focusing on how to convince forest owners to adopt specific services or participate in centrally designed forestry programmes. The need to understand forest owners' perspectives and wishes is widely acknowledged, empirical research focusing on such a bottom-up perspective remains limited. Our qualitative case study, and especially the workshops, directly contribute to filling this gap. From this perspective, the workshops can be considered as interventions that aim to deepen the knowledge about the relationship between forest governance and the agency of forest owners. Our workshops, also supported by the interviews, demonstrate that the needs and interests of forest owners vary significantly depending on local geographic, economic, and social conditions. This should be of high significance for understanding how biodiversity-promoting practices interacts with the social, cultural and economic conditions underlying the management of forest owners in different contexts. In this sense, our approach also deviates from conventional approaches to understanding private forest owner perspectives.

The workshops also served as testing grounds for introducing and discussing various niche innovations in forest management. In particular, we raised discussions around Continuous Cover Forestry (CCF) and high-quality timber production, which allowed participants to critically evaluate these practices considering their own goals and local conditions. We also introduced other innovations not as prominent in the interview material, but common in other forestry contexts, such as landscape restoration, nature tourism and bio-credits. These were introduced along with the niche innovations listed above as a means to assess which ones sparked the most interest as a topic for discussion. Overall, these innovations were not technically evaluated but brought up in collective discussion, where participants considered how such approaches might align or conflict with their own forest management goals.

Importantly, the workshops were designed to reflect specific characteristics of each area. In Istorp and Ambjörnarp, with a high level of active engagement in forestry, the workshops focused on the prospects for local implementation of alternative practices. Participants were also asked to identify their own needs and wishes concerning forest management, with the aim to bring these insights to a follow-up workshop with regional decision-makers. In contrast, in Säve few forest owners were actively managing their forests beyond harvesting of firewood or small-scale timber sales. The focus there shifted to the question of how to encourage more active management among forest owners in the area. This was particularly relevant because many Säve's historical biodiversity values are linked to open or semi-open habitats like former pastures and heathlands, which are increasingly threatened by reforestation due to abandonment.

The second thematic discussion in Säve addressed the future of the forest in light of urban expansion. Säve is located on Hisingen island, where the city of Gothenburg is growing rapidly. Participants expressed concern about the weak protection status of forests compared to agricultural land, and many felt that municipal growth strategies often were valued higher than preserving forest values.

At this point, we have no quantitative metrics to evaluate the success or impact of the workshops, and we are unable to tell whether any practical outcomes have resulted from our workshops. It is important to remember that our case study is situated in an early phase of where no organised biodiversity initiatives exist locally among the involved forest owners. Our workshops should thus be seen as exploratory interventions – first steps towards building dialogue and communication among forest owners who usually rarely interact with each other or interact primarily with their closest neighbours. We did this in a horizontal setting as compared to conventional primarily informational forestry settings. Our goal was to help forest owners recognise the existence of shared interests, and how those do not always align with the interests of industrial forestry, or in the case of Säv, with urban land expansion. We believe we succeeded in creating an open, reflective space where participants could explore both tensions and common ground.

From our perspective, the workshops fulfilled this purpose. The discussions were open-ended, allowing us to observe how discussions evolved around selected themes, deviated from them and revealing both agreements and disagreements. In both Ambjörnarp and Istorp, interest in Continuous Cover Forestry was strong, although some participants were highly critical – typically based on alternative management goals or prior practical forestry experiences. Still, even among those with differing views, some shared concerns were also made clear. For example, in Ambjörnarp, the idea of a shared machinery pool sparked interest across participant groups, although practical limitations were also mentioned. In Istorp, EU-level forest policy and its implications for Swedish forest owners served as a common point of debate and concern.

In Säv, CCF also sparked interest, particularly as a method for managing small or inaccessible forest plots with less effort. However, the discussion around urban development sparked the most interest and debate among the participants. Several participants expressed a municipal imbalance between protections for agricultural land and forest land, and that the municipality prioritised municipal expansion over forest values. The views on this were not only critical, since the municipality needed space to grow, but the geographical prioritisation of the municipality was a point of some negative views since development primarily focused on areas with existing infrastructure and leaving others less developed. Some forest owners who had participated in housing development projects pointed to the possibility of integrating green spaces with new housing, but past experiences were also mentioned where valued forest landscapes had been entirely cleared for development. A few participants reported legal conflicts with the municipality over land expropriation for development purposes. While no clear solution was formulated, the discussion showed that geographic proximity to the city played a major role in how vulnerable owners felt to urban development pressure.

Overall, the workshops revealed many of the practical opportunities and obstacles tied to environmentally sustainable forest management. Through these interventions, we initiated local conversations that likely would not have taken place otherwise.

4.5 Discussion

Our case study illustrates a complex interplay between often structural constraints and local agency in the possibilities or barriers for biodiversity innovations among private forest owners in southwestern Sweden. Based on the analysis of inclusion/exclusion mechanisms (section 4.2), niche innovators and innovations (sections 4.3 and 4.4) and interventions (section 4.5), here we discuss how transformative change may be supported or hindered in the context of private forest ownership.

One of the key results here is that exclusionary mechanisms based in forestry norms, knowledge structures, regulations and markets serve as large constraints for transformative change and biodiversity innovations in Swedish forestry sector, and among private forest owners. Even-aged silviculture remains the dominant form of managing forests, and the interviews that we conducted revealed that private forest owners often perceive their management as already environmentally friendly. This is primarily related

to a prominent view among many respondents that the main environmental problem in Swedish forestry is an issue of scale rather than the practice itself. Small-scale forestry, regardless of management form, is largely perceived as less problematic than large-scale forestry. Although there might be some truth to partly motivate such views, this serves to limit more fundamental engagement with alternative forest management such as CCF. Historical legacies also negatively impact the adoption of CCF, especially since similar practices were made illegal in Sweden during the 20th century.

Knowledge structures are another factor impacting the upscaling and adoption of practices such as CCF. Access to different knowledge is uneven and highly influenced by background, previous experience and the use of advisory services. Paradoxically, newer or less experienced owners are at the same time more prone for less individual decision making due to a reliance on external advice, yet at the same time more open to new information. This is especially true with individuals actively seeking out new knowledge on their own to inform their forest management, as opposed to individuals who primarily use advisory services to manage a land use where they have little to no knowledge or interest.

Current regulatory frameworks in forestry simultaneously allow for a wide range of practices (e.g. the current forest legislation) yet creates a strong sense of distrust and influence of external restrictions when forest owners are encountered with environmental forestry regulations, especially species protection laws. These are widely seen as something externally imposed, often connected to financial disincentives for species protection, contrasting a view of biodiversity as a goal shared among people and society at large. In turn this contradicts a valuation of nature in itself, since the presence of certain species in practice means an instrumental devaluation of the land, even in cases where non-human actants such as capercaillie are highly valued and enjoyed by the forest owners.

Economic structures also serve as fundamental structural barriers for transformative change, since the current forest industry is structured around standardised production of pulp and timber products which restricts the range of available options for marketing more diverse forest values, such as high-quality timber. Such structures within the wider sector puts constraints on local innovations, and both workshops and interviews (including with innovator 2 and 3) reveal how practicing CCF largely depends on local arenas of consumption or exchange or finding specific pockets of use for the products of such forest management.

Personal connection to forests is an inclusive mechanism that has a potential to allow for more innovative use of the forest among private forest owners. Owners with emotional or place-based ties to their forest are more likely to deviate from industrial norms and prioritise other values, ecological, aesthetical or recreational, although primarily in parts of their forests to which those connections are more prominent. Many forest owners describe a geographic prioritisation in their forests for different purposes. Another arena for alternative practices and a fundamental critique of industrial norms is apparent with those forest owners who are also hunters, with concern for game species (especially moose). Here, the impression is that the wider forest industry is largely incompatible with the sustainable management of species for hunting. This opens for some alternative practices and a larger openness for pursuing other values in the forest, also including non-human actants.

Our local workshop interventions, where we discussed innovations and explored the wishes and needs of the forest owners, created novel horizontal spaces for dialogue among forest owners who usually do not interact with each other in such settings. This revealed largely the wide interest in alternative forest management, but also many of the constraints that actively work against a wider upscaling of such practices. While it was clear that similar activities in the future would create horizontal spaces for discussion and exchange beyond usual top-down forms of interaction between forest owners and forestry organisations, most issues were left open and unresolved. No solution was presented on how to implement more biodiversity-friendly forest management in practice, nor how to combine urbanisation with forest preservation.

Importantly, this points to the constraints restricting transformative change for biodiversity in the Swedish forestry sector. While most innovations listed here, such as CCF, biologist forest management plans and commercial bilberry production have potential for upscaling, a broader upscaling largely depends on systemic change in markets, global value chains, advisory systems and forest legislation. Innovator 2 is especially interesting in this regard, since they show local pockets exhibiting a certain 'resistance' to status quo norms may be organised using local social networks and collaboration. It is likely such collective local initiatives that might be a way forward for forest owners who want to pursue alternative practices, which over time might serve to initiate a wider transformation of the sector. However, overcoming current constraints is a massive undertaking which likely will need a combination of bottom-up and top-down initiatives and which is also dependent on the wider development including the shifts and turns of global markets, regional/national labour capacity and the urgency of ongoing climate and environmental crises.

Understanding transformative innovation through the eyes of the capercaillie

It was dark in the forest where I moved. The dense rows of low spruces enclosed me as I walked across the barren ground, dry twigs crackling beneath my claws. Dry, tight branches scraped against my feathers. My former display site had been transformed – the trees were gone, the ground laid bare. I searched for a new place, a new stage for my display, but so far, my search had been in vain. The forest here smelled monotonous, the visibility was poor, and it spelled danger for me. Who knows what hides among the branches?

I crouched low as I moved forward, alert to approaching threats, shifting from cover to cover in the dense forest. A deep track in the ground stopped me temporarily, where bare soil and pooled water lay exposed. Something very large had passed here, tearing up the earth. Brushwood filled the hollows. I flew cautiously over and made it to the other side.

Then suddenly, the forest opened up, and I was met by new scents – damp earth, moss, and old leaves. Old trees mixed with young ones, and light filtered down through the shifting canopy.

I moved across the ground, over mushrooms pushing up through the moss beneath my claws, over fallen trees where food could be found. Berry shrubs spread out before me, with blooming bilberry shoots. Further ahead I saw low deciduous trees, their leaves beginning to burst – tender, nourishing leaves for me. Again, I crouched, searching for danger in the forest. No sounds stirred my fears. The birds sang their spring songs. I passed a few tracks of an animal and torn moss, as if a tree had recently been dragged by. Only the large stump of the tree remained, and I jumped up onto it. The visibility in the forest was good. I listened again. No danger. Still watchful, I filled my chest, and a low bubbling rose in my throat. My first display in this place, where I could find peace, food, and safety.

5. Social-Ecological System Analysis

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5.1 SES dynamics, interactions, and relations

Our case study departs from a landscape geographical analysis of SES, where a given landscape is seen as the local result of coalescing processes and entities over space and time (Stenseke, 2018). An important difference between a landscape approach and SES is that landscape focuses on physical proximity, local variation and local contexts in which a unique combination of social and ecological processes are at work (Stenseke et al., 2012). In this context, we approach our different case study areas as local landscape arenas with differing activities and processes occupying the same space and producing local complexities which are also dependent on intricate relationships across scales (Stenseke, 2023).

SES impact on different actor groups

The different actors described under section 3.2 are all part of shaping and being shaped by the landscape with which they interact. On a conceptual level, the landscape is not an entity separate from the actors but can instead be considered the sum of divergent actors and processes, a sum which also has consequences for the effects and conditions of wider decision-making. In this section, we therefore focus first on describing how the key actors from 3.2 are impacted by the *physical* landscape and the organization of its practical use.

The different actor groups – private forest owners, forest-owner associations (Södra skogsägarna), companies, state agencies, NGOs and nonhuman actants – are all intimately part of the historically developed landscape in which their actions play out, which is also constrained by institutional, economic and material path-dependencies connected to policies, markets, infrastructure and the physical development of the forest and the surrounding landscape over time.

Forest owners depend directly on the physical conditions for forestry on their properties (e.g. topography, soils and forestry legacies) and are generally also restricted by industrial market logics, certification systems, forest legislation as well as local knowledge networks and norms. In Säve, since few forest owners are conducting active forestry or are members of Södra, they are less bound to these restrictions, but their capacity to use the forest actively (also for alternative purposes) is constrained by less knowledge (e.g. due to being new and inexperienced forest owners) as well as the physical topography with steep slopes making modern forest machinery less usable.

Companies such as Sveaskog and Derome depend on the local forest landscapes for raw material for the forest industry and are also dependent on following established environmental principles and regulations. The current challenges that companies face in doing so under rising forest yield challenges and environmental concerns is marked by the tension between major forest owning companies such as SCA and the certification organization FSC.

Forest-owner associations are driven by the interests of their members and to pursue profits with the use of their industries, for which the resources come from the forests owned by their members. They are thus dependent on regular outtakes of forest, and in turn the physical condition for doing so plays an important role in this.

NGOs like the Swedish Society for Nature Conservation (SSNC) are generally monitoring the interactions between logging and ecological conditions, but in our case they do not have a large local presence in our case study areas, at least not as expressed in either interviews or workshops.

Government agencies like the Swedish Forest Agency (SFA) or the County Administrative Board (CAB) regional are primarily locally encountered either through the enforcement of environmental regulations (e.g. for biodiversity) or in the case of SFA

through communication and advisory services. While the conditions of local landscapes play a part of larger regional or national landscapes or sectors that these agencies are obliged to handle, it is highly likely that they seldom encounter our specific case study areas in their daily work.

Municipalities play only a limited role in Istorp and Ambjörnarp but is a major actor in Söve where Gothenburg Municipality owns large amounts agricultural land and forests. The municipality is affected by the conditions of the landscape for future development purposes, where some land (such as forest) is more easily motivated for development while other land has a larger protection status. In Söve, and in a wider sense the entire island of Hisingen, the municipality also balances residential and industrial development on arable and forested land, since the city needs new residential areas for a growing population but also to cater to industrial interests also in connected to the nationally important harbor of Gothenburg.

Non-human actants, such as animals, birds, vegetation are directly impacted by the physical conditions of the local landscape and its connected management, since they are dependent on that landscape for direct survival. The moose is a good example of this, which was brought up in several interviews with forest owners. Many of them perceive that the moose are threatened in their areas due to overhunting being incentivized by the CAB. The CAB is in turn affected by industrial forest interests, primarily from the north of Sweden where moose is perceived as a threat to new pine plantations due to browsing.

Decision-making processes and power relations between relevant actor groups

Formally, direct decision-making capacity is in the hands of the forest owners, both private, corporate or other types of organizations (such as the Swedish church). Especially since the new forest law in 1993, under the parole of "freedom with responsibility", the forest owners have a large degree of freedom in choice of management and directions with their forestry, as long as they adhere to current environmental considerations (regarding biodiversity, cultural heritage, water and soil) and ensure long term sustainable forest yields through replantation. In practice, however, the decision-making capacities of private forest owners are constrained by economic structures, advisory systems, knowledge access and market demands (see section 4.2 on exclusionary mechanisms). In practice, many practical decisions about forest land use are delegated to a large degree to forest consultants who are also connected to industrial actors and to the certification system. Most of the forest owners we have interacted with primarily own forests as a supplementary activity and income, which means that their everyday interests are largely connected to other questions. Larger actors, both companies, forest owner associations and certification organizations thus have a large power over what occurs in practice in privately owned forests. The Swedish state, both the government and government agencies, to certain degree holds less power over the state of the forest than these large forestry actors, since legislations which also steers the supervision of forestry serves mostly reactive purposes. Just as the forest legislation from 1993 was a reaction to increased environmental awareness in combination with a general neoliberal political call for deregulation (Enander, 2007), the ongoing reworking of the legislation by the current government has been accused of primarily reacting to calls from the forest industry for decreased regulation and control (Westholm, 2024: 58-62).

Types of knowledge informing decision-making and biodiversity framing

Official and more overarching governance processes are primarily informed by formal and science-based definitions of biodiversity and wider forest policies through EU directives, certification systems and national legislations. This was revealed in the case study when interviewed forest owners were asked about their perception of biodiversity, which to a large extent was seen as a policy and media-related concept rather than something tangible. Forest owners instead rely on other types of knowledge related to their own experiences, their relation to the forest property, emotional/aesthetic aspects and practical

dimensions of land use. This generates a certain friction when official implementations of environmental policies conflict with forest owner perception of the values (including biodiversity) on their forest properties, where the owner may question the local relevance and applicability of the policy, or its implementation.

Furthermore, the general impression is that policy rarely interacts with the wider group of forest owners in a participatory manner, but rather with representation limited to forest owner associations with industrial ties, which are also regional actors with regional types of knowledge. While these associations have a high degree of professional knowledge concerning the productive and environmental values of the forests of their members, more locally oriented knowledge tends to be obscured in the wider forest governance system, for practical reasons.

Ecological functioning of the SES and direct drivers of biodiversity loss

The forests of our three case study areas are situated in the northern temperate forest zone. Temperate forest ecosystems are shaped by the interplay of soil processes, disturbance, species interactions, and animal influences. Nutrients cycle through decaying litter and dead wood, with climate and tree species affecting decomposition. Disturbances – from storms to fire – create varied successional paths, while treefall gaps sustain diversity by enabling regeneration. Plants adapt to shade through seasonal strategies or root associations, and animals – from squirrels to deer and insects – disperse seeds, pollinate, graze, or defoliate, influencing forest structure and composition over time (Frelich et al., 2015). In this context, and especially in Sweden, forestry is often considered as a type of disturbance.

Disturbances come in many different forms and frequencies. Certain forest ecosystems generate rather stable local environments due to the interaction between different processes creating a multi-layered forests. Larger disturbances such as forest fires or massive storms may however eradicate such landscapes in a short time-span, and often occur with some frequency when looking at a forest landscape across centuries (Angelstam & Holmer, 1997). Forests of various kinds in a “natural state” has certain patterns of disturbances over time, and the specific variation of forests within a given landscape or region thus means a certain pattern of disturbances. The human use of a forest over time strongly contributes to these patterns and affects the forest in similar ways.

The direct drivers of biodiversity loss in the case study varies between the studied areas. In S ve the processes of reforestation and urbanization are the most dominant causes of biodiversity loss, while even-aged silviculture is more dominant in Ambj rnarp and Istorp. Urbanization is not a direct driver of biodiversity loss in these study areas, while reforestation in Istorp is also a driver. These drivers are described more fully under section 3.3, including their underlying causes.

Values underpinning decision-making processes

Policymaking in Swedish forestry is primarily guided by instrumental and intrinsic/ecological values, where the current Swedish forest legislation to a certain extent aims to balance wood production with environmental values through acknowledging both values as important. While these values are still very much active in policymaking, it is also clear that future policies will need to account for the undesired effects of granting considerable decision-making freedom to forest owners, both private, state and commercial actors. This is not the least marked by the fact that both the forest industry and environmental NGOs are dissatisfied with the current situation.

Forest owners, on the other hand, are more often guided by relational values such as emotional attachment to land, feelings of stewardship toward past and future generations, aesthetic preferences and recreational aspects. These values are especially prominent among owners with multigenerational ties to their properties or who live near their forests. While policymaking, especially when related to instrumental values of forests, tend to be

focused on short-term gains, the relational values that forest owners hold encourage long-term thinking, more sensitivity to local conditions and in some cases an opposition to externally imposed obligations and management practices. While many forest owners also recognize the instrumental values of their land, such values are rather often framed as supporting a supplementary income where the forest only plays a minor role in their household economy. However, economic pressures and market incentives still influence management choices, especially when infrastructure, advisory services, and buyer systems are geared toward conventional forestry.

Political, cultural and institutional power dynamics

Governance of the local SES can be divided into multiple levels. The forest owners are the ones who formally holds much of the governing capacity over the forest, through the Swedish forest model focused on 'freedom under responsibility'. Power over the forest is largely manifested by those actors whose knowledge, values and narratives have materialized in concrete forest practices. This means that power is overall concentrated to control over or have large access to the systems by which forestry is actually carried out: advisory services, market structures, machinery, certification and policy implementation.

For example, even though forest owners often possess detailed knowledge about their land, they still rely to a large degree on knowledge produced and communicated through the forestry advisory system, especially with forest owners in Istorp and Ambjörnarp who are more inclined to actively use their forests for timber production. Advisory knowledge (e.g. through Södra or Derome) by necessity reflects standardized forestry systems with a focus on timber production and forest growth metrics. Forest owners who attempt alternative approaches often find it difficult to access to reliable guidance or material support, which limits the practical influence of non-dominant knowledge forms. In Säve, specific knowledge about forest management is not as well developed, which is related both to the practical difficulties of conducting conventional forestry in the area, as well as the higher turnover of properties in the area. On the one hand, the lack of knowledge and practical engagement with forestry limits the potential for an increased alternative use of the forest, and on the other the practical difficulties in the area limits the interest from the forest industry.

Values connected to care, continuity and biodiversity are commonly expressed among forest owners, regardless of their management style. In most cases, owners view their current practices as already aligned with these values, likely based in familiarity with the land, historical use and local norms. Management decisions are not only shaped by individual convictions and advisory knowledge but also by the surrounding management of the forest landscape and practices of neighboring landowners. A smaller group of owners express a desire to shift towards alternative approaches, such as continuous-cover forestry, based on personal values or ecological concerns. However, these intentions rarely translate into broader change, partly due to uncertainty around practical implementation, economic outcomes, and conflicting information in public debates.

The overarching narrative around biodiversity among private forest owners is shaped by political and institutional frameworks that emphasize individual responsibility and continuity with existing practices. Since 1993, biodiversity has been treated as one consideration among others, to be balanced within the prevailing model of production forestry. Institutional actors have largely supported this framing by promoting biodiversity measures that fit within conventional management, which reinforces the view that major changes are neither necessary nor expected.

Embedding the local SES in the high impact sector

The overarching narrative in forestry, although challenged by environmental actors, frames biodiversity as something that can be integrated into existing production patterns and not as something that may require a different way of organising forestry. Forests are seen

as resources that should be managed effectively, with biodiversity as a secondary consideration rather than as a starting point. For private forest owners, the sector's overarching narrative has primarily functioned to legitimise existing forestry practices rather than to change them. The relatively uncritical view many owners have of their own management reflects how the dominant framing of biodiversity has succeeded in presenting conventional forestry as already adequate. The narrative does not drive forest use directly but helps justify a form of use that continues for other, often economic or practical, reasons. At the same time, there is a clear distinction between company-owned forests and those managed by small-scale private owners, where a wider range of values tends to result in more diverse and more environmentally varied practices.

Economic structures' impact over the SES

In **Ambjörnarp** and **Istorp**, forestry remains a secondary income source for most owners, but decisions are still strongly shaped by how markets, technologies, knowledge systems, and regulations have developed in close alignment with the forest industry. Owners who express interest in alternative methods – such as high-quality timber production or more selective harvesting – face structural barriers, including a lack of established markets, limited infrastructure, and uncertainty around long-term returns. While there is demand for certain niche products, such as timber for historic building restoration, the broader system offers little support for such production.

In **Säve**, the situation is different. Forestry products have little or no role in the local economy, apart from firewood or occasional timber used for private construction. Instead, land value and real estate dynamics dominate. Proximity to Gothenburg has made property value – and not forest production – the primary economic factor in owning forest properties. Several interviewed owners describe parceling land for housing or engaging in speculative ownership as central components in the areas land use. The workshop in Säve reinforced this picture, with much of the discussion focusing on development pressure. Further to the south, with areas of national infrastructure linked to Göteborgs Hamn – which handles around 20% of Sweden's foreign trade – logistics development and industrial expansion increasingly compete with ecological and cultural values, often to the detriment of the latter.

Across all areas, the structure of the economy, what is profitable, what is logistically possible, and what is institutionally supported, has a clear influence on how the forest is used, even when not directly central to household income. The regional stakeholder workshop further emphasised this point, since both markets and infrastructures for alternative economic incomes from the forest on a general level are largely missing, which strongly constrains the viable options for the forest owner (Stakeholder workshop, Gothenburg, August 2025).

Assessment of biodiversity challenge and related biodiversity trends in the high impact sector

In the broader forest sector, biodiversity is assessed using a combination of regulatory frameworks, certification systems, and internal monitoring by major forestry companies. The Swedish Forest Agency evaluates ecological values in connection with harvest notifications and maintains a national register of key habitats, though systematic inventories have largely been paused. County Administrative Boards use such data for regional planning and oversight but do not conduct field-based monitoring themselves.

Certification schemes such as FSC and PEFC structure biodiversity assessments through checklists and audit routines. FSC applies more detailed criteria and, in some cases, supports scientific monitoring, while PEFC relies on broader sustainability standards. Large forest companies like SCA, Holmen and Södra track biodiversity using selected indicators, such as volumes of deadwood, the presence of old or broadleaved trees, and mapped

conservation areas. These indicators are followed over time and reported to demonstrate ecological responsibility.

Current enablers and barriers for transformative change

The main constraint to transformative innovation is the relatively passive role that forest owners assume over decision-making on their own forest properties, primarily due to a lack of alternative knowledge and access to practical alternatives. Conventional forestry relies on industry advisors, access to large machinery and, especially under current circumstances due to high wood prices caused by the war in Ukraine among other things, such forestry provides a reliable if supplementary type of income to the forest owner without any requirement for practical engagement or knowledge in forestry. The independent decisions that most forest owners make are limited geographically and often align with or do not contradict conventional forest management. In Sävje, where little forestry is practiced, a further constraint is the topography itself with steep slopes and shallow soils on the hills which are more or less unfit for conventional forestry. In turn, there is a lack of knowledge or interest in using the forest beyond recreational purposes and the collection of firewood. The proximity to Gothenburg, with pressure on properties for development and high property prices, means that the forest is systematically undervalued as a land use in economic terms.

When it comes to the enablers or opportunities for transformative change the relational values that forest owners rely on seem to be the aspect with the largest potential, combined with the fact that forestry does not constitute an important income for these owners. These values often do not align with economic or industrial values, although the aspect of stewardship or heritage often include path-dependencies to conventional forest management, since traditional clear-cut forestry has been the predominant model in Sweden since the early 20th century. There is considerable potential to mobilise forest owners for alternative practices, if those practices can be shown to align more closely with relational values and are economically viable and practical options also for forest owners with little to no interest in doing forestry work themselves. In turn, this relies largely on building alternative infrastructure, value-chains, knowledge-sharing networks and pockets of local organization for alternative practices. The case study has shown small embryos of such processes, particularly in Istorp, and there are larger ongoing developments towards this from the advisory side as well, for example through the network Plockhugget.

5.2 Vision: What alternative SES could be?

This alternative vision for the SES is formulated through our workshops and interviews, with the specific aim to detail how different types of forest owners with different needs, wishes and uses of the forest could potentially coexist and collaborate in a system which promotes biodiversity more fully and efficiently than today. Here, we divide the forest owners into four different categories: the passive steward, the innovative ecological manager, the production-oriented owner and the inactive peri-urban owner. The section ends with an analysis of how these different owners collaborate and interact in this alternative vision.

The Passive Steward

This forest owner do not manage their forest very actively, instead relying on advisors and conventional forestry practices through hired services from a forest owner association or a forest company. However, they still often have deep personal connections to their forests: walking, hunting, berry and mushroom picking, heritage etc. These forest owners want their forest to remain an accessible and recreational environment for future generations and also provide a small income with minimal effort. In the alternative SES, this owner has access to simple and tailored management

options – such as selective thinning or conservation agreements – that allow biodiversity to increase without requiring high activity or incurs larger risks. They are supported by clear, long-term policy frameworks that allow a trustworthy delegation of forestry decisions.

The Innovate Ecological Manager

This owner is deeply engaged with their forest. They prefer continuous cover forestry, selective harvesting and allowing diversity in tree species and age. They use the forest for high-quality timber, fuelwood and materials for on-farm use or building restoration. These forest owners collaborate with neighbors, test alternative methods and sometimes organize shared machine use or other collaborative initiatives. In the alternative SES, their creative practices are more fully supported. They can access grants for ecological restoration or innovations and have their own networks to promote peer learning. Their forests become inspirational sites for other forest owners.

The Production-Oriented Owner

This owner relies on forestry as a key part of their livelihood, practicing clearcutting and replanting according to industry standards, optimizing for yields and timber/wood markets. In the alternative SES, their role still remains vital but the system incentivizes transitions towards long-rotation forestry, mixed-species stands and climate-resistant strategies. Certification schemes value both production and biodiversity and are more fully adapted to allow for a diversity of set asides geographically. New markets for ecosystem services, biocredits and high-quality timber support profitability while allowing for a higher diversity of economically viable practices which supports biodiversity in the forest. These owners thus remain largely competitive in this alternative SES.

The Inactive Peri-Urban Owner

This forest owner has typically bought a property, often for horse keeping, consisting of an older farm with both arable land and forest. By this owner, the forest may be viewed as land that simply exists without any need for maintenance, as a future development potential (often for housing) or that is used for recreational purposes. In the alternative SES, these owners are offered low-threshold alternatives to make use of their forests, for example through long-term leasing schemes where others manage the forest for biodiversity or cultural values. They may eventually choose to participate or invest in further development of biodiversity, for example through landscape restoration grants.

Summary

In this alternative vision of the SES, the diversity of ownership types is seen as an essential foundation for diversity in the forest and builds on structures and arguments already put forward in the contemporary debate. Each type of forest owner contributes in different ways: some by stewarding, others by production of renewable materials and others by simply allowing nature to develop on its own. The system is supported by reliable institutions that value multiple goals in the forest, offer different type of support depending on local and individual contexts and facilitate diverse arenas of knowledge exchange.

Increased biodiversity emerges not primarily by formal regulations, but through collaboration between individuals, organizations and public authorities. Passive stewards conserve biodiversity structures and continuity, innovative managers refine it, production owners contribute to societal resource needs and inactive owners may offer

spaces for experimentation or preservation. Policies, advisory systems and markets allow and incentivize a diverse range of practices and a move away from conformity.

5.3 Discussion

Our case study, departing from a landscape approach and emphasizing the interaction between human intention, relational processes, material practices and the conditions of the physical (socio-natural) landscape, illustrates how private forestry does not occur in non-occupied space but in a wider landscape arena shaped by the coalescence of social and ecological processes over space and time. Such a coalescence means a problematizing of decision-making as an entirely contemporary practice, since choice of forest management today is often the result of historically and spatially conditioned possibilities constrained by available infrastructure, markets, knowledge practices and earlier decisions. The landscape is not primarily there to be governed but is part and parcel of the governing conditions themselves.

Furthermore, our case study shows that while forest owners in Sweden have a large formal freedom in decision-making, their decision-making capacity is varied and circumscribed by access to material resources such as access to machinery, household economy and the physical conditions of the forest, in combination with practical access to advisory services of different kinds and directions. It is not only primarily the intention of the forest owner that decides action and behavior, but rather how such intentions interact with access to material, infrastructural and knowledge-wise resources. Power in this case should thus be understood as both the practical ability to shape material outcomes in the landscape as well as influence over decision-making.

Another important result is that the access to alternative practices in private forestry is largely constrained by the reproductive processes of the current Swedish forest industry. Knowledge, infrastructure and material practices that are easily available to most private forest owners, along with the politics and institutions that regulate forestry, are mostly conditioned to serve the functions of the forest industry and in turn the economically important function of this sector for Sweden as a whole. This includes current certification schemes, such as FSC, which complement conventional forestry rather than challenging the status quo. Alternative forestry knowledge exists, which on paper is more and more promoted also by state agencies under certain international and environmental pressure, but a public infrastructure where this knowledge materializes into action through implemented directives is largely missing.

To a certain extent, our case study complements earlier research by putting larger emphasis on the importance of material practices and constraints. For example, Tiebel et al. (2024), through using the IPBES framework of transformative change and an approach informed by the leverage point framework by Abson et al. (2017), have identified several key leverage points for transformative change for biodiversity among private forest owners in north-west Germany. According to these authors, the leverage points with largest potential for transformative change lie in the intent (values, norms and goals) and design (institutional structure, power and information flows) domains. The most influential leverage point is considered under the domain of intent, since "[c]onservation action requires forest owners to recognize the importance of biodiversity conservation as well as to act accordingly (Tiebel et al., 2024: 348)."

While we agree that the relational values that many forest owners hold has a certain transformative potential, we also argue that the main barriers to transformative change for biodiversity among private forest owners in Sweden is not cognitive but structural. The possibility for transformative change is not accelerated through more knowledge or improved personal values, but through building an infrastructure and formal material support for alternative practices in privately owned forests. As shown by this case study, there is some potential to build and locally accelerate such a process through bottom-up initiatives which practically engage forest owners in alternative forestry by local collaboration. Considering the pressure on achieving national and international

environmental commitments, it is also likely that this must eventually be met by more formal official practical support on a national level.

Understanding the Landscape through the Eyes of the Capercaillie

Days passed. I remained in the new forest. Its silence was different, alive and promising. Here the light did not blind me, but scattered gently across the ground, tracing the curve of moss and root. I had found my stage again. Not the same, never the same, but good enough.

Each morning, I tested the air. Damp with dew, rich with the scents of bark and blossom. I walked with care, wings low, feathers brushing against bramble and dead branches. The forest spoke in a language I knew: slow decay, soft growth, the rhythm of things and beings returning over the seasons.

But I also felt the edge. Not far from here, the sound of metal biting wood still echoed. I could sense it in the tension of the birds around me, the way the squirrels paused too long. There, the forest frayed, and the ground hardened. I did not go there. I stayed in the shifting places, where spruce gave way to birch, where pine stood tall over fields of bilberry. I followed the ants, the beetles, the hens. We knew the safe paths. We remembered.

Now, in the twilight hours, I return to my stump. The forest is quiet, and I rise. Wings spread, chest lifted, the bubbling call rises from me again, steady and full. I am here. I am still here. And while no trees last forever, I hope this forest will remain ours for generations to come.

6. Locally tested interventions

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6.1 Evaluation of strategies in action

In the Swedish case study, strategies in action have largely emerged from local practices rather than from explicit and designed interventions. Instead of building on an existing societal partnership or promoting a particular biodiversity innovation, our research sought to explore and analyse forest owners' own strategies and understandings regarding biodiversity management. Through qualitative face-to-face interviews, walk-along interviews, and a series of workshops held between spring and summer 2025, the case study has examined how private forest owners in southwestern Sweden engage with biodiversity, and how these engagements reflect both potential enablers and barriers to transformative change.

Although no single practice or initiative clearly qualifies as transformative in an institutional or societal sense, the case study identified several tendencies that may contain the seeds of future change. Some forest owners expressed interest in alternative silvicultural practices, such as continuous-cover forestry or the introduction of more mixed stands, often motivated by concerns over climate change or aesthetic preferences, or species diversity. This was especially explicitly visible in the Ambjörnarp and Istorp workshops, where owners discussed their dissatisfaction with monocultures and clear-cuts, and their aspirations to maintain a more varied and dynamic forest landscape. However, such approaches remain rare in practice. Even owners with opinions in favour of biodiversity often continue to manage their land according to conventional, albeit small-scale, even-aged forestry. This discrepancy illustrates the gap between intentions and structural constraints – including economic market structures, limited advisory support, and current institutional inertia – that continue to favour production-oriented forestry.

The transformative potential of these emerging strategies lies less in their current extent and more in their relational and reflexive dimensions. Many forest owners articulated a deep emotional connection to their land, framed through ideas of intergenerational stewardship and place-based responsibility. These sentiments, while not always expressed in ecological or scientific language, reflect long-term considerations and a concern for continuity, which align well with core principles of biodiversity conservation. Through the workshops, forest owners were able to encounter others with differing or similar views and begin to position their own practices and wishes within a broader spectrum of forest management. This dialogue appeared to stimulate reflection on what biodiversity and alternative forestry might mean in practice and what current limitations and possibilities there are for the individual forest owner.

Forest owners often make autonomous decisions about their forest management, with many choosing to diversify tree species. While this may align with biodiversity goals, it is frequently driven by other motives – such as aesthetic preferences near homes or recreational areas, or practical experiences showing that spruce monocultures, historically common, are ill-suited to certain soils and increasingly vulnerable to drought. As a result, diversification occurs even among owners who do not explicitly frame their practices in ecological terms. However, workshops revealed that current forestry market structures are poorly adapted to support alternative management models (Workshops in Ambjörnarp and Istorp, March 2025). The system is adapted to bulk timber and pulpwood production, making it difficult to sell high-quality wood for crafts or building restoration. In response, some owners – particularly in Istorp – have initiated local collaborations to exchange goods and services, aiming to sustain alternative forestry through mutual support (Workshop in Istorp, March 2025; Interview with 'Maria', May 2024). In Säve, urbanisation itself emerged as a direct driver of biodiversity loss. Many forest owners acknowledged the need for housing and had sold land for development yet expressed concern that municipal planning prioritised short-term expansion where infrastructure already existed, rather than distributing development more evenly across the area. Workshop participants felt that ecological values in the forest were overlooked and called for more consistent, long-term

strategies balancing conservation with growth (Workshop in Säve, March 2025). Across all case study areas, landscape conditions further shaped what forms of forestry were feasible. Steep slopes, wet soils, and inaccessible areas often remained unmanaged simply because they were impractical to harvest, thereby acting as somewhat unintentional biodiversity refuges.

Despite these examples, the case study also revealed how fragmented ownership, lack of alternative collective infrastructure, and policy uncertainty limit forest owners' capacity to engage in more coordinated or strategic biodiversity initiatives. While forest owners in Sweden have considerable legal freedom to manage their land, their practical agency is often constrained by time, knowledge gaps, available technology and market structures. Many participants expressed confusion or frustration over shifting policy signals and contradictory advice from authorities in a longer time perspective, particularly around biodiversity and acceptable management practices. Some recounted negative experiences with conservation interventions, where external actors were perceived to have intervened without sufficient understanding of local conditions or without adequate compensation (Workshop in Ambjörnarp, March 2025). These experiences contribute to a rather widespread scepticism toward top-down governance and a preference for autonomy in forest decision-making.

The workshop with Dryaderna, the network of female forest owners (Workshop with Dryaderna, March 2025), aimed at examining the specific conditions for female forest owners and analyse whether women face particular challenges when it comes to questions of biodiversity and the potential for transformative change. As this workshop revealed, the primary reason for this network was to provide an arena for knowledge exchange and dissemination between female forest owners in a more open way than allowed for in ordinary settings. According to the participants, the actual forestry conducted by female forest owners do not diverge in any significant way from their male counterparts, although they face certain discrimination with regards to recognition of their knowledge as forest owners. Although previous literature tends to emphasize the higher involvement of female forest owners in nature conservation and environmental values (Bakx et al., 2024; Tiebel et al., 2022), such assumptions have also recently been called into question based on more decisive factors for management directions such as property size (Hansen et al., 2025). Another aspect, that research about female forest owner networks emphasize, is that female forest owners tend to replicate masculine forestry norms (Laszlo Ambjörnsson, 2021).

The project attempted to address some of these constraints by creating horizontal arenas for dialogue through our workshops. The workshop format – based on small-group discussions and supported by visual materials and thematic questions – enabled participants to speak on their own terms, and encouraged those with less formal knowledge to participate, with varied degrees of success. Although no collective strategies or formal innovations were co-produced, the workshops served as arenas where personal knowledge and practical experiences could be exchanged and validated locally. They made the internal diversity of the forest owner group visible – from those focused on production, to those motivated by conservation, recreation, or tradition – and challenged the image of the “typical” forest owner often invoked in public discourse.

Importantly, the case study also recognised the limits of its own influence, where we sought primarily to identify barriers, emerging practices, and supporting local reflexivity. While no direct replication of strategies or scaling of innovations occurred during the study period, the regional stakeholder workshop (Workshop in Gothenburg, August 2025) bridged local insights with higher governance levels, including forest authorities, advisory organisations, and environmental NGOs. This hopefully helped to connect the situated knowledge and latent potential of private forest owners with broader processes of policy development and institutional adaptation.

6.2 Enablers and disruptors

The case study reveals several enablers and disruptors influencing the potential for biodiversity net-gain and transformative change. These emerge from the interaction between the material realities of forest ownership, institutional frameworks, and broader economic structures, rather than from isolated interventions or policies.

One key enabler identified is the freedom of choice in forest management granted to private forest owners under Swedish forest law. This legal autonomy allows owners to pursue biodiversity-enhancing practices if they want, including continuous cover forestry, leaving deadwood, promoting deciduous tree species, and setting aside conservation areas. Some forest owners use this freedom as an opportunity to align forest use with personal values, including long-term stewardship, aesthetic preferences, or ecological interest. However, while this flexibility theoretically enables diverse forest management practices, it functions as an enabler only when owners possess the knowledge, values, resources, and support networks to act on it.

A second enabler is the presence of strong place-based knowledge and long-term ownership, especially in more rural and forest-dominated areas like Ambjörnarp and Istorp. Here, forest owners often manage land that has been in the family for generations, providing a deeper understanding of local ecology and landscape dynamics. In these settings, some landowners resist conventional homogenous forest management and instead develop forest practices better adapted to site conditions. Some emphasize soil improvement through ash spreading or selective harvesting aimed at maintaining ecological structure (Workshops in Istorp and Ambjörnarp, March 2025). These actions are sometimes related to local knowledge and peer-to-peer learning rather than formal extension systems (Workshop in Ambjörnarp, March 2025).

Third, local collaboration and exchange of services have emerged as important enablers, particularly in areas where state or market support is limited. In Istorp, some landowners have developed informal networks to trade timber, services, and knowledge, partly as a means to foster local self-sufficiency (Workshop in Istorp, March 2025). This generates a level of independence and collective capacity that can support biodiversity goals, especially when it enables alternative harvesting methods or the use of non-standard forest products.

However, these enablers are often constrained or undermined by powerful and persistent disruptors. Foremost among these is the market structure for forest products, which remains geared toward pulpwood and bulk timber. This favours large-scale, mechanised, and standardised forest operations. Certification systems such as FSC or PEFC, while designed to ensure sustainability, are experienced by many private owners as too bureaucratic and poorly adapted to small-scale or biodiversity-oriented forestry (Workshop in Ambjörnarp, March 2025). Even owners who wish to produce high-quality timber or manage for ecological values often find that buyers, contractors, and sawmills are uninterested or unequipped to handle such products (Workshops in Ambjörnarp and Istorp, March 2025). This represents a fundamental mismatch between local ambitions and the economic infrastructure of the forestry sector.

Another major disruptor is the dominance of large forest companies and institutional actors, which shape norms and expectations in forestry. Their management models often prioritise clear-cutting, rapid rotation, and homogenous stands, which set the standard for what is seen as “productive” or “modern” forestry. For small and medium-sized private owners, especially those lacking forestry training or advisory support, these models may appear to be the only viable or legitimate options.

Policy inconsistency across time further acts as a disruptor. Owners recall how past state subsidies encouraged practices now considered detrimental to biodiversity, such as spruce planting on unsuitable soils or to suppress deciduous tree growth through herbicide spraying (Workshop in Ambjörnarp, March 2025). Current biodiversity policies, while aiming to reverse these trends, are often met with scepticism because of their shifting nature and perceived lack of grounding in local realities (Workshops in Ambjörnarp and Istorp, and

December 2025

with Dryaderna, March 2025). This generates a credibility gap that limits the transformative potential of top-down strategies.

In more urbanised contexts, such as Säve, a different set of disruptors emerges. Here, urban expansion and real estate speculation are important drivers of biodiversity loss. Forest land is here valued for its development potential rather than its ecological or forest-based functions. Many owners have sold or subdivided land for housing, and forest management is often oriented toward aesthetic or recreational functions rather than long-term biodiversity strategies or conventional forestry. Municipal planning, according to several workshop participants, prioritises development where infrastructure already exists (Workshop in Säve, March 2025), which may reinforce pressures on existing remaining forest patches in those areas. Participants also described local politics as short-term and inconsistent. Despite these challenges, a potential enabler is apparent where some owners in Säve have a multifunctional land use, where forest land serves multiple overlapping purposes: recreation, privacy, informal conservation, and limited timber production primarily for firewood. While not necessarily aligned with formal biodiversity goals, these uses can help maintain heterogeneous forest structures and provide refuges for species.

Regarding the replicability of enablers, the findings suggest that while some practices – like local cooperation – are context-specific, the underlying enabling conditions (e.g. autonomy, embedded knowledge, peer learning) could be supported more broadly through targeted policy and institutional support. For example, advisory systems that further validate and support diverse forest management approaches, rather than focusing on promoting standardised solutions, could help scale local innovations. Likewise, procurement systems that recognise non-standard timber products or more strongly reward ecological outcomes, such as further development of conservation premiums or biodiversity credits if done in non-standard ways, could broaden the impact of small-scale biodiversity efforts.

In terms of addressing disruptors, local actors currently have limited capacity to challenge structural market conditions or institutional forestry norms. Some resist by operating in niche markets or through informal economies, but this does not amount to systemic change. Bridging this gap would require interventions at national or even EU level, such as regulatory reforms, differentiated subsidies, or market incentives for ecosystem services.

The interaction between local and national/EU policy is complex. While EU directives on biodiversity and climate increasingly emphasise ecological restoration and multifunctional landscapes, they are filtered through national forest policy, which in Sweden remains deeply shaped by the dual goals of production and environmental protection. In practice, production goals dominate, due primarily to historical inertia, and biodiversity strategies tend to be additive rather than transformative. Local actors often experience EU-linked policies – such as the Nature Restoration Law – as top-down and misaligned with on-the-ground conditions, and circumscribing both national and local senses of self-determination. At the same time, national implementation of these policies varies depending on political priorities, which further contributes to uncertainty.

In conclusion, transformative change in Swedish private forestry is currently constrained by a combination of entrenched market structures, institutional inertia, and weak integration between ecological and economic goals. Nonetheless, enablers exist in the form of legal autonomy, local knowledge, peer collaboration, and multifunctional land use. Strengthening these enablers – for example through broader advisory support and market innovation – while actively mitigating the structural disruptors identified above, will be essential to any future strategy for biodiversity regeneration in this context.

6.3 Failed and successful practices

Successful Practices

A major success in this case study was the ability to reach a broad and diverse set of private forest owners in three local study areas, without relying primarily on established

organisations such as forest companies or associations. Instead, contact was made directly with forest owners, resulting in a wide range of perspectives in both interviews and workshops. This allowed us to explore a spectrum of forest management practices across geographic, economic, and social contexts – from peri-urban areas in Säve to small-scale farming landscapes in Istorp and forest-dominated rural settings in Ambjörnarp.

Another success was the initiation of local dialogues through our workshops, which enabled forest owners to reflect on alternative or diversified forest management practices. These workshops revealed existing practices of variation and adaptation among forest owners and also initiated discussions around collaboration and autonomy, particularly in relation to industrial forestry norms. For instance, in Istorp, existing informal exchange networks between owners – where timber, machinery, and services are traded – appear to offer a foundation for alternative forms of land management. These findings point to a potential for more horizontal and locally grounded forms of organising among forest owners, which could support biodiversity regeneration beyond current certification schemes.

From a research design perspective, the case study succeeded in highlighting that some forest owners often already engage in practices that deviate from the standard industrial model. While certification schemes typically encourage certain set-asides – such as steep slopes or wetlands that are left unmanaged or managed in a limited way – some owners actively experiment with alternative management strategies even on productive land. This includes practices like selective logging and mixed-species planting. Such initiatives, though currently small in scale, offer promising models for increasing structural and species diversity in Swedish forests while responding to both ecological and owner-specific values.

Another important success was the final stakeholder workshop in August 2025, where actors from across the forestry sector – authorities, advisors, industry and NGOs – were brought together (Workshop with stakeholders, Gothenburg, August 2025). That this was achieved within a relatively short project timeframe suggests a strong interest in locally driven, bottom-up perspectives on forestry, and demonstrates the potential to elevate insights from small-scale ownership contexts into broader policy discussions.

Failed or Less Effective Practices

One clear limitation of the study was the difficulty in reaching forest owners who hold strongly negative views on biodiversity or alternative forest management. While the study did include some sceptical voices – which provided particularly valuable interviews – a broader representation of this group would have enriched the analysis of barriers to biodiversity regeneration. For example, we may have benefited from approaching such owners through more familiar channels like forest owner associations (e.g. Södra), which could have lent credibility and increased positive responses to participation.

Similarly, the study faced challenges in engaging with landowners primarily involved in property speculation, particularly in Säve. These owners, who represent a significant portion of the local forest ownership structure, were generally uninterested in participating. Their absence leaves a gap in the analysis, as their actions – such as parcelling or keeping forest land for residential development – constitute an important driver of biodiversity loss in peri-urban areas. Including their perspectives might have revealed further obstacles to landscape-level regeneration.

Finally, the absence of a clear societal partner in the project – such as a municipality or coordinated landowner group – meant that we as researchers had to drive the process independently. This made it difficult to co-develop formal biodiversity strategies or implementation plans. The fragmented nature of forest ownership, where individual actors operate largely autonomously, further constrained the potential for formalised interventions during the project period.

Strategic Gaps and Missed Opportunities

The most significant gap in the study relates to the lack of formal structures for horizontal collaboration among forest owners. While individual practices varied considerably and some networks existed informally, there was little evidence of coordinated collective action to promote biodiversity regeneration, apart from the previously mentioned conservation premium by Södra. Nonetheless, the workshops indicated a potential openness to collaboration, particularly in areas where owners share values or challenges.

Another gap concerns the disconnect between local alternative practices and prevailing market structures. Several owners expressed frustration with timber buyers' focus on bulk pulpwood, which undermines efforts to produce high-quality or niche timber products. These economic structures act as disruptors by making it difficult for owners to pursue diversified strategies, even when motivated to do so.

In terms of knowledge integration, there was limited incorporation of younger or more diverse voices in the study. Forest ownership in Sweden tends to be older and male-dominated, and while some efforts were made to engage other perspectives – such as female owners or those with mixed-use landscapes – a wider geographical focus would have enabled to further target certain groups of forest owners.

Conclusion and Lessons Learned

This case study shows that private forest owners are already engaging in a range of diverse and context-sensitive management practices, many of which contain elements supportive of biodiversity regeneration. However, these efforts are often individualised, small-scale, and poorly aligned with broader market and policy structures. The most successful practices identified in this study – direct owner engagement, local dialogue creation, and documentation of informal networks – suggest that bottom-up approaches have strong potential if given adequate support.

Conversely, difficulties in reaching sceptical owners or property speculators highlight the importance of credibility, trust, and framing when addressing contested topics like biodiversity. The lack of a formal societal partner limited the potential for strategy co-design, but also made visible the need for future projects that focus explicitly on fostering horizontal organisation and peer-driven learning among forest owners.

Ultimately, the study illustrates both the limitations and the latent potential of fragmented ownership systems. While structural disruptors remain – such as market logics and certification biases – seeds of change exist in the form of local knowledge, alternative values, and emerging collaborative tendencies. A future project could build on these findings by supporting forest owner-driven local networks, improving communication channels between local and national actors, and further challenging the one-size-fits-all orientation of current forest governance models.

6.4 Co-learning

Introduction: Co-learning in an exploratory case

In the Swedish case study, co-learning emerged primarily as a research-led process in the absence of an established societal partner. The ambition was not to implement a predefined action plan, but to explore whether an analysis of local bottom-up processes could initiate dialogue and reflection among private forest owners around more biodiversity-friendly forest management. In this context, co-learning was also a way to test the potential for new forms of organisation, shared understanding, and local knowledge about forestry and biodiversity.

Co-learning as a principle and method

The foundation of the case was a large number of qualitative interviews with forest owners in three distinct areas – Säve, Istorp, and Ambjörnarp – which provided empirical insights and served as a basis for workshop development. These interviews revealed the diversity of ownership structures, motivations, and land-use practices, and informed the design of the workshops that followed. Each workshop was planned with the explicit aim to generate open-ended discussions among local actors, without predefined outcomes or expectations.

Rather than seeking consensus, the workshops were designed to allow tensions and disagreements to surface, making it possible to identify both shared concerns and points of friction. The co-learning approach was therefore exploratory and emergent, aimed at revealing latent possibilities for cooperation and critical reflection on prevailing forestry practices. By intentionally including moments of collective synthesis – where group discussions were summarized and reflected upon in plenary – the workshops created spaces for mutual recognition and exchange between forest owners with different perspectives.

Co-learning during the chapter 6 preparation

Three main types of co-learning activities were conducted during the preparation of this deliverable: the thematic workshops with forest owners, the targeted workshop with female forest owners (Dryaderna), and the August 2025 stakeholder workshop which brought together actors from civil society, state agencies, and research.

In the Ambjörnarp and Istorp workshops (March 2025), the discussions focused on possibilities and obstacles for more biodiversity-sensitive or alternative forestry, as well as identifying messages that forest owners themselves wanted to transmit to regional stakeholders. These workshops served as both moments of knowledge sharing and sites of reflection on forest management under changing ecological and policy conditions. In Säve (March 2025), where urban pressures are more tangible, the discussion centred on how forest owners relate to urbanisation, property speculation, and ecological values in an increasingly urbanised landscape. This workshop offered insight into how ecological concerns are weighed against economic and social pressures in a semi-urban setting. The workshop with Dryaderna (March 2025) addressed gender-specific challenges among female forest owners and provided valuable insights into the reasons for organising women-only networks for knowledge sharing among forest owners. Finally, the stakeholder workshop in August 2025 gathered a wider range of actors and created a forum for feedback and strategic dialogue. This was not only a moment of co-learning between researchers and societal actors, but also a way to leverage the findings from the local workshops into a broader institutional setting.

Co-learning dynamics in the case study

The most significant outcome of the co-learning moments was the confirmation that local dialogue around biodiversity is both possible and meaningful. While forest owners differed in their priorities and practices, many shared concerns emerged – such as market limitations, bureaucratic obstacles, and uncertainty around future policy. At the same time, geographical context and degree of forest management activity shaped which challenges were most pressing. The workshops showed that despite these differences, forest owners could engage in constructive conversation and identify opportunities for local collaboration and mutual support.

In Istorp, for example, some participants expressed interest in further developing local exchange systems and reducing their dependence on the conventional mass timber market. These reflections did not result in immediate collective action but demonstrated a latent willingness to explore alternatives, especially among forest owners with limited trust in large-scale actors. Some tensions also emerged, where some participants strongly advocated continuous cover forestry, while others viewed it as economically unviable – especially those with long experience in mechanised forestry (Workshop in Istorp, March

2025). In Ambjörnarp, discussions revealed tensions around how to manage carbon sequestration: whether through more active silviculture or by allowing natural succession (Workshop in Ambjörnarp, March 2025). These tensions did not resolve into agreement, but they helped clarify the differences among the participants and their different viewpoints.

Importantly, the co-learning moments were not limited to the participants themselves. For the researchers, the workshops revealed further how forest owners formulate problems, identify common points and obstacles, and relate their individual decisions to broader ecological and policy contexts. In this sense, co-learning also served as a means of refining the research team's understanding of transformative potential under highly individualised ownership conditions.

However, the case study also revealed some of the limits of co-learning in this context. Despite efforts to reach a broad spectrum of forest owners, those who were explicitly opposed to biodiversity measures or sceptical of alternative practices were underrepresented in both interviews and workshops. As noted in previous sections, these groups were harder to engage and may have perceived the project as biased. This reduced the range of views in some settings and limited the extent to which co-learning could encompass the full spectrum of tensions in Swedish forestry. Future efforts may need to work more deliberately with trusted intermediaries (e.g. Södra) or with alternative recruitment strategies.

Conclusion: Key insights and future directions

In conclusion, co-learning in the Swedish allowed for the emergence of new understandings among forest owners, created modest spaces for mutual recognition, and surfaced informal practices that could serve as entry points for future action. Although no joint action plans were developed, the workshops functioned as important sites of reflection and pointed to the potential for more bottom-up approaches to biodiversity governance. For researchers, the co-learning approach reinforced the usefulness of open-ended, conversational formats in building and understanding locally grounded knowledge in a wider context. Looking forward, deeper co-learning would require sustained engagement, mechanisms for follow-up, and possibly the emergence of intermediary actors who can stabilise and support informal initiatives. But as an initial step, the workshops and interviews conducted in this case study have laid the groundwork for such future processes and may serve as a model for how to approach highly fragmented actor landscapes in other contexts as well.

6.5 Testing of interventions

Introduction: What was tested and why it matters

In our case study, interventions took the form of workshops organised and facilitated by the research team. Unlike other project cases, there was no official societal partner with a mandate to lead the process. Forest owners in the study areas are not collectively organised around biodiversity issues, and this absence strongly shaped our approach. The workshops themselves became the intervention, aiming to create an arena for discussion where forest owners could articulate their views, exchange experiences, and reflect on the challenges of forestry and biodiversity.

Testing in this sense did not mean measuring behavioural changes or producing specific outcomes. Rather, it meant critically assessing whether such researcher-led workshops could function as entry points for dialogue and for surfacing knowledge about opportunities and obstacles to biodiversity-friendly forestry. This is significant because biodiversity loss in private forestry is tied to how markets and institutions enable or constrain alternative actions, and how fragmented groups of owners can be mobilised locally around common concerns to overcome these constraints.

Description of the testing process

The testing was conducted in connection to the three local workshops in the case study areas (Säve, Istorp, and Ambjörnarp), one workshop with the female forest owner network Dryaderna, and complemented by one regional stakeholder workshop. Each local workshop gathered forest owners with diverse backgrounds, motivations, and management strategies. Some were highly production-oriented, others more focused on recreation, aesthetics, or conservation values. The workshops were designed around sets of thematic questions and provided informational material, with the dual purpose of initiating local dialogue and providing material for analytical reflection.

No formal feedback workshop was organised. The main reason for this was the absence of a societal partner who could take responsibility for co-hosting such a process. Instead, the research team itself carried out the evaluation of the workshops. From our perspective, the local workshops worked effectively as interventions given their aims, and the stakeholder workshop served to test the insights generated against a wider governance and policy context. In this way, the process still provided a form of feedback loop, albeit mediated by researchers rather than through a formal societal partner.

Stakeholder engagement and participatory processes

The workshops showed that it is possible to mobilise a broad set of forest owners, even in contexts where they are not organised collectively around biodiversity. This in itself is an important finding: with relatively modest effort, we could bring together individuals with different priorities, values, and levels of forestry activity. Participants generally expressed appreciation for the opportunity to exchange experiences in a neutral setting, something that rarely happens otherwise.

At the same time, the testing also made clear the limitations. The workshops were one-off events, and no structures for sustained participation were created. For interventions to move beyond the exploratory stage, more durable mechanisms would be needed – such as identifying local ambassadors with strong trust and networks, who could take forward discussions and innovations beyond the workshop setting, an insight particularly generated from Workshop 5 (Workshop with stakeholders, Gothenburg, August 2025). The participatory process was thus valuable as a test of what is possible, but it also highlighted limits of long-term engagement when no local organisational structure exists.

Knowledge co-production and collaboration

The most tangible form of co-production that emerged from the workshops concerned the barriers to alternative forestry practices. Discussions revealed, in concrete terms, how existing market structures limit forest owners' options. Many participants noted that while they might be interested in diversifying their forests or producing higher-quality timber, the infrastructure and markets for such outputs are largely absent (Workshops in Ambjörnarp and Istorp, March 2025). Pulpwood and bulk timber dominate, leaving little incentive for owners to manage forests differently.

Another insight concerned the challenges of inactivity. In Säve, several owners showed little inclination to actively manage their forests, due to lack of time, limited interest or knowledge barriers (Workshop in Säve, March 2025). This raised questions about how biodiversity strategies might address situations where the barrier is primarily not resistance to change but rather disengagement, and a fundamental lack of demonstrable viable options.

From the testing perspective, these discussions were particularly valuable. They provided grounded, practice-based insights that allowed us to better understand the structural barriers and opportunities. They also demonstrated that co-production in this context does not necessarily mean agreement on solutions, but rather the surfacing of critical constraints that need to be addressed if interventions are to gain traction.

Impact on policy and decision-making

Direct policy effects were not expected at this early stage of a transformative change process, and none can be observed yet. However, the stakeholder workshop provided an indirect channel for testing local insights against regional governance structures (Workshop with Stakeholders, Gothenburg, August 2025). Here, several key issues emerged.

First, participants problematised the one-sided nature of forestry advice, which remains heavily oriented toward industrial production, especially since the advisors are often timber buyers as well. This raised the question of whether advisory systems can be diversified to better support alternative forms of forestry. Second, there was broad recognition of the lack of market and infrastructural solutions. Without new outlets for timber products or systems that reward biodiversity-oriented management, local innovations are unlikely to spread. While a few examples exist, as noted in the text above regarding Södra's conservation premium and biodiversity credits, these are still only embryos of the needed development. Third, the discussion highlighted the importance of local innovators and ambassadors. Change requires individuals who not only experiment with new practices but also gain trust among peers, thereby helping to diffuse new ideas and methods.

While it is impossible at this stage to know whether these insights will translate into policy change, the workshop served as a testing ground for framing such issues in a collective arena. The fact that actors from different sides – authorities, industry, advisors and forestry organisations – engaged in this discussion suggests that space exists for further dialogue.

Community-level changes and social perceptions

At the local level, it is not yet possible to say whether the workshops produced changes in perceptions or practices among forest owners. Forestry operates on long timescales, and one-off interventions are unlikely to lead to immediate shifts, or tangible outcomes of such shifts. We can hope that new ideas were planted and that owners began reflecting on biodiversity in ways they had not before, but this cannot be substantiated with evidence at this stage.

Similarly, it is unlikely that any new practices have been adopted as a direct result of the workshops. For such changes to occur, a sequence of interventions would be necessary, ideally combined with support from other actors and institutional/policy incentives. What the testing did demonstrate is that forest owners are willing to discuss these issues and that dialogue can highlight both shared concerns and divergent perspectives. This is an important first step, but it remains limited in scope.

Transformative potential

Taken together, the results suggest that workshops can serve as useful interventions, but also that their transformative potential is limited if they remain isolated and short-term. The main contribution of our interventions was to open up discussion arenas: forest owners came together to discuss biodiversity and alternative forestry, structural barriers were articulated, and regional actors engaged with the findings.

At the same time, the workshops did not and could not resolve the deeper barriers of the system. Market structures, advisory systems, and institutional path dependencies remain strong. Without changes in these areas, even motivated owners will face difficulties in adopting alternative practices. The interventions therefore revealed both opportunities and limits: dialogue is possible, awareness of barriers can be increased, but transformative change requires broader structural shifts.

Future interventions could build on this by:

- Identifying local ambassadors who can sustain engagement and diffuse innovations.
- Creating forums where owners, advisors, and market actors can interact more directly.
- Embedding workshop-style interventions in longer-term processes rather than treating them as one-off events.

Lessons and open questions

The testing process provided important lessons. It showed that unorganised actors can be drawn upon to engage with each other, and that dialogue can surface key structural barriers such as market limitations and one-sided advisory systems. It demonstrated that researcher-led workshops can function as effective interventions when no societal partner exists, and that these can be complemented by broader stakeholder forums to situate findings in a governance context.

At the same time, the process highlighted the limits of such interventions. Without follow-up, sustained organisation, or institutional anchoring, the effects are likely to remain modest. The long timescales of forestry mean that any changes in perception or practice will take time to materialise and cannot be captured in the short term.

The open questions are therefore: how can temporary interventions be scaled up or embedded in more durable structures? How can new markets and infrastructures be developed to support alternative forestry practices? And how can advisory systems be diversified so that biodiversity-oriented approaches receive similar institutional support to industrial forestry?

Our testing suggests that with modest effort, meaningful dialogue can be initiated, and key structural constraints can be brought to the surface. The challenge is to build on these initial steps and connect them to broader processes of change

6.6 Discussion

The Swedish case study did not follow the conventional model of testing interventions through formalised feedback workshops with societal partners. Unlike other cases in the consortium, no official societal partner existed in this context, for reasons described in the text above. Private forest owners in southwestern Sweden constitute a highly fragmented actor group, without strong collective representation around biodiversity concerns. This meant that our interventions could not be designed as joint action plans negotiated with partners, but rather as research-led workshops aimed at stimulating dialogue, eliciting perspectives, and assessing barriers and opportunities for more biodiversity-friendly forestry.

From this point of view, the workshops themselves became the intervention. They were not supplementary exercises to test pre-existing strategies, but the primary mechanism through which we sought to engage actors, surface tensions, and experiment with new ways of discussing a diversified forestry. The purpose of testing, therefore, was to evaluate whether such workshops could function as arenas of engagement, what kinds of knowledge and conflicts they revealed, and how they might be improved or scaled up for projects in the future.

Forest owner workshops as interventions

Across the three local workshops in Säve, Istorp, and Ambjörnarp, we succeeded in gathering a surprisingly broad spectrum of forest owners, given that the workshops were aimed at discussing alternative forestry. This was a result we did not take for granted, given that owners are typically addressed individually through industry or state channels.

The willingness of owners to come together in a neutral, research-organised arena should itself be seen as an intervention outcome. These meetings created opportunities for exchange that are otherwise largely absent, especially for owners who are neither strongly integrated in the forestry industry nor part of conservation organisations.

The character of the discussions varied across locations. In Säve, close to Gothenburg, the main issue was inactivity: many owners were not actively managing their forests, and findings ways to activate them proved to be a difficult issue which if handled could help counter the challenge of urbanisation. In Istorp, with its stronger agricultural base, the workshop revealed a more collaborative orientation and highlighted local exchange practices that could, in principle, support alternative forms of forestry. In Ambjörnarp, in a more forest-dominated setting, debates revolved around carbon, species choice, and the pressures of industrial demand.

Taken together, these local interventions confirmed both the diversity of ownership contexts and sets of common concerns. At the workshops in Ambjörnarp and Istorp, participants pointed to the dominance of conventional industrial markets, the lack of alternative outlets for timber, and the one-sided character of advisory services that primarily reproduce industrial practices. These insights were not generated by external experts but articulated collectively by the owners themselves once given a forum to do so.

Stakeholder workshop and comparative testing

Workshop 5, with a wider group of stakeholders, was important not only as a continuation of the case study but also as a test of whether the local findings resonated in a broader context. Here, forest owners' perspectives were set against the views of advisory organisations, county administrations, NGOs, and industry representatives. This workshop confirmed that many of the issues raised locally – such as the narrowness of advisory services, the dependence on conventional industrial markets, and the importance of institutional support for experimentation – are widely recognised. Several participants emphasised the importance of local ambassadors and innovators who can demonstrate alternative practices and build legitimacy among peers.

In this sense, the stakeholder workshop functioned as both an evaluation of our earlier interventions and as an intervention in itself. It demonstrated that it is possible to convene diverse actors on short notice and use local perspectives as an entry point for wider debate. While we cannot claim that this has led to any immediate policy change, it helped situate the case study within ongoing regional conversations and opened possible avenues for future collaboration.

Reflections on effects and limitations

The testing phase revealed a number of important dynamics. On the positive side, it showed that dialogue formats of this kind can successfully bring together actors who would not otherwise meet. The workshops also revealed a more complex picture of owners' motivations than is often assumed, demonstrating that there is no single 'private forest owner' perspective but a mosaic of orientations, practices, and constraints.

At the same time, the limitations were clear. Forestry is a long-term activity, and it is not possible to assess within the project period whether perceptions or practices have changed as a result of participation. We can hope that the discussions introduced new ways of thinking for some owners, but we cannot provide evidence of this. More importantly, the workshops showed that willingness to engage with biodiversity is not sufficient if structural barriers remain. Without alternative markets, more diverse advisory systems, and enabling infrastructure, individual owners are unlikely to adopt radically different practices, regardless of personal interest.

Another limitation was representativity. Certain groups – especially property investors and owners strongly opposed to conservation – were underrepresented. This is partly a result of recruitment difficulties and partly of self-selection. While this does not invalidate the findings, it does suggest that interventions of this type may tend to attract the more reflective or willing participants.

Finally, the lack of continuity must be acknowledged. The workshops were one-off events. For transformative potential to be realised, they would need to be followed up, embedded in local structures, and connected to broader institutional frameworks. As they stand, they represent promising interventions, but fragile ones.

Lessons for future interventions

Despite these limits, several lessons emerge. First, relatively modest interventions can mobilise diverse forest owners and create spaces for dialogue that are otherwise lacking. Second, such interventions can help reveal not just individual attitudes but overarching bottlenecks, particularly the structural dependence on conventional wood markets and the narrow scope of advisory systems connected to this. Third, linking local perspectives to broader governance discussions, as we did in the stakeholder workshop, can amplify their relevance and highlight potential pathways forward.

For future strategies, a number of elements seem crucial. Identifying and supporting local ambassadors with strong community trust could enhance the legitimacy and impact of interventions. Creating follow-up processes that embed workshops into longer-term dialogue would increase their durability. Finally, interventions need to be connected to policy and market reforms if they are to lead to actual changes in practice. Dialogue alone cannot overcome structural barriers.

The fleeting character of intervention through the eyes of the capercaillie

During a daytime nap I awake to a sound. Footsteps approach. Several humans are in the forest. I freeze, hidden on my branch, gazing out across my display ground. The humans draw nearer, speaking their language among themselves. They do not sneak in silence to conceal themselves, but trample and talk as if nothing in the world could frighten them. I relax slightly yet remain tense. They do not seem threatening. Not yet.

Now I see them clearly, they have entered my display ground. Three humans, still talking. One points toward the surrounding trees and gestures, the others watch. Their voices are loud. One of them points to the tracks of the great animal in the soil beneath them, to the trace of dragged logs and then to the stump. Another holds a wooden stick in one hand and a white block in the other. The stick moves across the block and the human nods.

They begin to move again, now away from me. I relax, but I do not stir. I have learned to be cautious, at least when the frenzy of spring display does not take hold of my body. The humans are farther off now, soon vanishing beyond sight. Will they return? Only time knows.

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UNICT Simeto river alliance for biodiversity

D2.5, Italy

December 2025

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Funded by
the European Union

Summary²⁷

The Simeto River and its Valley, located in inner Sicily, form a territory of outstanding biodiversity, cultural richness, and historical complexity. This area serves as a case study on how local communities understand and respond to biodiversity challenges, developing innovative ways of living and working that can lead towards a more just, equitable, and sustainable society.

Covering about 4,183 km² in eastern Sicily, the Simeto Basin shapes Catania Plain. The 113-kilometre river begins where three mountain streams—Cutò, Martello, and Saracena—meet in the Nebrodi Mountains and flows into the Ionian Sea. Along its course, it is joined by other rivers and springs, creating a complex network of waterways that sustain both natural habitats and agricultural landscapes. Here, farmland, small towns, and fragments of natural ecosystems coexist in a territory that reflects centuries of interaction between people and the ecosystem. Because of this close interdependence, the Valley can be described as a rural–urban continuum, where cultivated fields, villages, and uncultivated areas alternate uninterruptedly.

The river has two main stretches: the lower course and the middle-to-upper reaches. The upper section retains much of its natural character, with gorges and basalt cliffs carved by the water. Dams and weirs—built to store water, regulate flow, and generate hydroelectric power—mark the landscape. Owned by ENEL, Italy's National Electricity Company, these infrastructures also fragment the river into disconnected segments.

Despite local differences, the river and its basin form a single geographical unit: the Simeto Valley. Shared traditions, farming systems, and water governance practices reveal both common challenges and collective opportunities for change.

Over time, the river's role in daily life has diminished. Urban centres have grown into economic and demographic hubs, while the river itself has become less visible and less inhabited. Intensive monoculture and large energy infrastructures have altered its ecological balance, creating zones of both ecological and social "desertification." Although the river continues to provide water, energy, and fertile soil, these uses are often extractive and shaped by top-down policies that overlook local needs and exclude participatory decision-making as well as the agency of non-human entities.

Today, the Simeto River and its Valley face three main biodiversity challenges, intensified by the climate crisis and the severe droughts that have affected Sicily in recent years. The first challenge is the fragmentation of habitats caused by heavy river engineering, which disrupts ecological corridors and affects both aquatic and terrestrial species. The second is the dominance of conventional farming methods based on intensive monocultures—mainly citrus—and the widespread use of fertilisers and pesticides. These practices exhaust soils, pollute water, and, together with droughts and wildfires, accelerate desertification. The third challenge is the conversion of farmland into large photovoltaic plants, following the crisis of citrus farming. As citrus production became unprofitable and land values collapsed, investors turned to energy production, rapidly transforming the Valley's landscapes and economies.

Together, these challenges shape the Valley's socio-ecological system and the relations among its many actors: farmers using both conventional and alternative methods, livestock breeders, water authorities, energy companies, civil society organisations, and local institutions responsible for managing natural and cultural heritage—often with limited administrative capacity.

²⁷ The deliverable was produced through differentiated contributions within the research unit, covering overall coordination, field research, data collection, data analysis, text drafting, and final content revision, and also benefited from the contribution of researcher **Paolo Gruppuso**, who participated in the research design and fieldwork and acted as a data collector.

The case study examines how these actors face and adapt to such pressures, developing strategies that also help mitigate the problems they confront. The research is organised around three strands.

The first explores how emerging forms of alternative agriculture that are increasingly practiced along the river middle course. Drawing from ethnographic research, this first strand is focused on those lived experiences that break away from the economic and relational mode of production linked with citrus monoculture as part of broader efforts to “re-inhabit” the river. The second strand focuses on irrigation water, analysing cooperation and conflict in how it is distributed and managed, especially among citrus farmers. The third examines the conversion of farmland into photovoltaic plants. Using collaborative mapping, the research developed an online geoportal to visualise the scale of this process and to strengthen local communities’ agency by providing accessible and reliable evidence.

In line with the BIOTraCes methodological framework, the study applies Participatory Action Research (PAR) methods. The UNICT research team worked in close partnership with the **Participatory Praesidium of the Simeto River Agreement (Presidio Partecipativo)**, a civic network with a long-term commitment to addressing the Valley’s social and ecological challenges. The Presidio unites citizens and grassroots organisations from eleven municipalities in the provinces of Enna and Catania. Its work focuses on three key areas: (i) environmental education and youth engagement, (ii) inclusion of marginalised groups—especially migrant workers—to counter exploitative labour practices, and (iii) responses to critical environmental issues affecting the Valley. Over the years, it has gained extensive experience in collaborative research and community-based governance.

The Presidio contributed to all stages of this study. During the design phase, its input helped identify the three interconnected main research themes—water, agriculture, and energy. During fieldwork, it actively participated in the first and third strands: through the **Simeto Ecomuseum group** who engaged in the reflection about historical and contemporary materials on the transformations of the “way of dwelling” in the Valley; and it facilitated local participation in mapping the expansion of photovoltaic plants and their effects on biodiversity and cultural heritage.

In the later stages of the project, the Presidio co-organised with UNICT a permanent exhibition and a two-week festival (late May–early June 2025) that presented archival and field materials on the history of inhabiting the Simeto River.

Alongside the Presidio, the research also engaged other actors—some already connected to it—such as:

Alongside the Presidio, the research also engaged other actors—some already connected to it—such as:

- Farmers practising permaculture and herders
- Farmers involved in conventional agriculture²⁸;
- Grassroots organisations promoting biodiversity and cultural heritage protection

²⁸ The term “conventional agriculture” is preferable to “traditional agriculture” when referring to industrial farming practices characterised by the use of chemical fertilisers and pesticides in combination with mechanisation. There are two main reasons for this choice. First, the [FAO Glossary defines conventional agriculture](#) in precisely these terms, aligning with the description above. Second, the adjective traditional is ill-suited to describe the Green Revolution that, from the mid-twentieth century to the 1980s, substantially increased productivity through the intensive use of chemical inputs and machinery in large-scale monocultures. Being a revolution, it represented a rupture with tradition rather than its continuation. Conversely, alternative agricultural practices, as observed in our case studies, can be seen—at least in part—as a re-appropriation of pre-Green Revolution techniques, although even these cannot be considered entirely “traditional.”

1. Case study introduction

1.1 Justification of the importance of the case study

The Simeto River, the longest in Sicily (113 km) and the island's largest basin (around 4,000 km²), lies at the core of a distinctive Mediterranean landscape. Over centuries, the river has shaped the Simeto Valley both ecologically and culturally, giving rise to a territory where human activity and natural processes have long been intertwined. The Valley's identity reflects a historically layered interplay between hydro-morphological dynamics, ecosystem factors, non-human communities, and agricultural and infrastructural development. Across time, it has absorbed the legacies of changing farming systems, evolving water-management regimes, and, more recently, the expansion of energy-production infrastructures. Together, these processes have produced a highly anthropized socio-ecological system in which water, agriculture, and energy remain closely interdependent.

Today, the Simeto River and its Valley face three major, interrelated challenges that endanger biodiversity and the long-term sustainability of local livelihoods. These pressures are intensified by the climate crisis and the prolonged droughts it has brought to Sicily.

The first challenge is the loss of ecological integrity caused by extensive river engineering. Dams, drainage networks, and canalisation works have fragmented the river's natural course, interrupting ecological corridors and diminishing habitat integrity. These interventions once sustained the rapid expansion of citrus monocultures throughout the twentieth century, embedding the Valley in a model of extractive agricultural productivity.

The second challenge stems from the ecological consequences of intensive monoculture farming. Dominated by citrus this production system has depleted soils, accelerated desertification, and increased agrochemical pollution. For decades, citrus cultivation formed the cornerstone of the Valley's economy and identity. Yet global restructuring of agri-food supply chains has rendered this model increasingly unviable. As plantations are abandoned, land becomes more exposed to wildfires and erosion. Combined with long-standing mismanagement of water resources and worsening droughts, these dynamics further undermine the Valley's ecological resilience.

The third challenge is the rapid conversion of farmland into industrial-scale agrophotovoltaic (PV) plants. In response to economic decline, many farmers are leasing or selling their land—often at low prices—to energy companies. This trend introduces a new "silicon monoculture," replacing one form of extractive use with another. While contributing to the renewable-energy transition, this process also reshapes landscapes, reduces ecological connectivity, and generates social tensions around land use and local agency.

Together, these challenges expose the need for transformative change in a highly degraded ecosystem they invite reflection on how participatory and inclusive governance can support more balanced relations between people and the ecosystem. By addressing these intertwined issues—river fragmentation, agricultural intensification, and energy industrialisation—the Simeto River case study illustrates how empowering local communities, pluralising knowledge systems, and embedding biodiversity concerns in territorial governance can generate pathways toward sustainability.

1.2 Explanation of the focus of the case study

This case study examines how local actors in the Simeto Valley respond to complex socio-ecological pressures, developing adaptive strategies that both address and mitigate biodiversity challenges. The study focuses on the intertwined dynamics of water, agriculture, and energy—three domains through which human and non-human relations are continuously reconfigured. To capture this complexity, the research adopts a nested structure organised around three interconnected strands.

The first strand explores the emerging of river-inhabiting practices. Particular attention is given to farmers adopting alternative agricultural approaches—including permaculture—which express broader efforts to re-inhabit and re-embed the river within local livelihoods. These practices reveal how new forms of ecological responsibility and place-based agency can emerge from below, linking biodiversity conservation to renewed cultural and economic approaches.

The second strand focuses on irrigation water, investigating how patterns of access, distribution, and control shape relations among users and institutions. By examining cooperation and conflict around the use of water infrastructures, the study sheds light on the governance tensions that define this scarce resource. The perspective of infrastructure users—particularly citrus farmers—was central to this analysis, highlighting the everyday negotiations and collective arrangements that sustain or contest water management practices.

The third strand analyses the large-scale conversion of farmland into industrial photovoltaic (PV) sites. Given the projected growth of this sector in the near future, the research employed critical collaborative mapping to develop an online geoportal. This tool serves two purposes: first, to assess the ecological and cultural impacts of this rapid transformation; and second, to empower local communities by providing accessible, transparent, and reliable data.

The case study was conducted using Participatory Action Research methods, in line with the BIOTraCes methodological framework. It was co-designed and co-implemented with the Participatory Praesidium of the Simeto River Agreement, the societal partner of the UNICT research team. This collaboration ensured that the research approach remained embedded in local realities and consistent with BIOTraCes' operative principles—pluralising knowledge, empowering communities, politicising structural inequalities, and embedding transformative practices in governance frameworks.

Through this cooperation, the methodological focus was refined to better reflect how diverse local actors—such as farmers transitioning away from monocultures, permaculture practitioners, herders, and residents facing environmental degradation and economic uncertainty—experience and respond to biodiversity challenges along the river. Rather than imposing external solutions, the project emphasises co-creation and reflexivity, where knowledge is co-produced through continuous dialogue and participatory engagement.

1.3 Research questions addressed by the case study

Building on this context, the Simeto Valley case study investigates how biodiversity is shaped by the interplay between ecological dynamics, land-use practices, and social relations. The research questions were developed through a Participatory Action Research approach, ensuring that they reflect both scientific inquiry and the situated knowledge of local actors. They aim to identify the conditions under which transformative change can emerge within the Valley's socio-ecological system.

The research questions are as follows:

Which processes, practices, and governance arrangements are beneficial or detrimental to biodiversity in the Simeto Valley, and how can they be addressed through participatory approaches?

Which groups, communities, and individuals are actively involved in these mechanisms, and how do their values, capacities, and relations of power influence outcomes for biodiversity?

How can beneficial processes be strengthened—and detrimental ones mitigated—through forms of collective agency, participatory governance, and co-produced knowledge?

Together, these questions guide the case study in exploring how plural forms of agency can contribute to empowering local communities, politicising existing inequalities, and embedding biodiversity protection within broader frameworks of territorial governance.

1.4 Reading guide

This report presents the Simeto Valley case study within the Horizon Europe project BIOTraCes (Biodiversity and Transformative Change for Plural and Nature-Positive Societies). It synthesises the findings of three interconnected deliverables—Transformative Biodiversity Innovations (D2.2), Socio-Ecological System Analysis (D2.3), and Locally Tested Interventions (D2.4)—offering an integrated perspective on the processes that shape biodiversity, governance, and transformation in the Simeto Valley,

The report is organised into six main sections that together trace the evolution of the research from diagnosis to experimentation. Section 1 introduces the case study, outlining its research focus and guiding questions. It explains why the Simeto Valley represents a critical site for investigating socio-ecological regeneration and participatory governance, and describes the long-standing collaboration with the societal partner, the *Participatory Praesidium of the Simeto River Agreement*

Section 2 details the Participatory Action Research methodology that underpins the study. It illustrates how the UNICT research team and local actors co-produced knowledge through ethnographic fieldwork, collaborative mapping, focus groups, and community-based events. This methodological framework reflects BIOTraCes' commitment to embedding research within local realities and fostering co-learning processes across different knowledge systems.

The following Section 3 provides the contextualisation of the case. It analyses the Valley's socio-economic, cultural, and institutional dimensions, identifying key actors, worldviews, and political dynamics that influence biodiversity. Through this lens, it situates the Simeto Valley as a socio-ecological landscape shaped by historical legacies of monocultural agriculture, fragmented water governance, and new pressures from energy transition processes.

Building on this contextual foundation, Section 4 explores transformative biodiversity innovations emerging from local practices and social networks. It examines how agroecological farmers, civic associations, and community organisations generate niche innovations that connect biodiversity protection with social inclusion and empowerment. The section highlights how such initiatives diverge from business-as-usual models, translating ecological care into participatory and transformative action.

Section 5 deepens the analysis through a comprehensive Socio-Ecological System (SES) perspective, investigating how agriculture, water, and energy interact as interdependent domains. It discusses the coexistence of extractive and regenerative dynamics, the role of power asymmetries, and the plural imaginaries shaping alternative visions for the Valley's future. Here, the report articulates the critical importance of recognising biodiversity as both an ecological and political construct, embedded in relations of care, conflict, and cohabitation.

Focusing on locally tested interventions, Section 6 describes and evaluates strategies co-designed and implemented with the societal partner and other local stakeholders. It assesses their transformative potential, their capacity to address indirect drivers of biodiversity loss, and the enablers and disruptors that shape their success. The section also documents key participatory processes, such as the *Facciamo la Valle!* festival and the collaborative mapping of photovoltaic infrastructures, which serve as laboratories for testing how participatory governance can sustain biodiversity regeneration in practice.

This report follows a coherent analytical progression that mirrors the structure of BIOTraCes Work Package 2. Each main section builds upon the previous one, forming a continuous movement from exploration to experimentation. Section 4 presents

Transformative Biodiversity Innovations (D2.2), focusing on emerging practices, actors, and inclusive mechanisms that challenge dominant socio-ecological arrangements. Section 5 develops the Socio-Ecological System Analysis (D2.3), examining cross-scale relations, feedback, and power dynamics that condition or enable such innovations. Section 6 addresses Locally Tested Interventions (D2.4), translating insights from the previous analyses into participatory experiments and community-based actions. Together, these sections establish a logical pathway from diagnosis to transformation, aligning field research with the Theory of Transformative Change that underpins BIOTraCes.

2. Research methods and application of PAR

2.1 Role of Societal Partner

Description of the Societal Partner

The societal partner of the Italian BIOTraCes case study is the Participatory Praesidium of the Simeto River Agreement (). This broad civic umbrella brings together individual citizens and a network of grassroots organisations active throughout the Simeto Valley, between the provinces of Enna and Catania. Since its foundation in 2015, the Presidio has become a key actor in promoting sustainable and inclusive development in the Valley.

Its activities focus on:

- (i) Promoting youth education, especially on environmental protection and community development.
- (ii) Fostering the inclusion of marginalised groups, particularly migrant workers, to counteract exploitative labour practices.
- (iii) Addressing critical environmental challenges affecting the Valley.

In pursuing these goals, the Presidio has consistently collaborated with academic and non-academic researchers, developing extensive experience in Participatory Action Research. This long-term practice of co-production and participatory governance provides the foundation for its current collaboration with the BIOTraCes team at the University of Catania

Role of the Societal Partner in the Research

The Participatory Praesidium collaborated across all phases of the case study, ensuring that the research process was co-designed, co-implemented, and contextually embedded in the Simeto Valley's socio-ecological system.

The preparatory phase took place between early 2023 and spring 2024. A workshop held in April 2023, followed by a series of collective field visits across the Simeto Valley (December 2023 – February 2024), initiated a relational process that led to the shared definition of the study's scope, objectives, and methodology.

During the research design phase, the Presidio directly contributed to identifying the main thematic focus of the case study. Its members proposed interpreting the Valley's complex socio-ecological relations through three interconnected domains: water, agriculture, and energy. This participatory insight informed the definition of three research strands:

- River inhabiting practices – exploring the rediscovery and transformation of ways of living along the Simeto with a focus on farmers inspired by permaculture as attempts to re-inhabit the river.
- Water micro-governance – investigating cooperation and conflict around irrigation infrastructures, analysing how these interactions shape collective management and access.
- Agri-photovoltaic energy – examining the growth of agro-photovoltaic infrastructures²⁹ within a context of agricultural crisis and increasing water scarcity.

In the fieldwork phase, the Presidio was directly involved in the first and third strands. In the first, the research team worked continuously with the Simeto Ecomuseum group, part of the Presidio network, to sample and classify materials documenting historical and contemporary inhabiting practices, like Ecomuseum several other local associations

²⁹ Agro-photovoltaic plants can allow for farming and stockbreeding activities to carry on. In this case, plants are defined as dual use plants or agro-photovoltaic plants. For brevity, we chose to use agro-photovoltaic to designate both types of plant.

connected with the Presidio join and work in the process: SciaraViva, Legambiente, ViviSimeto, Lipu and Biodistrict. In the third, the Presidio supported the engagement of participants and facilitated the collaborative mapping of the impacts of expanding agro-photovoltaic plants on the Valley's biodiversity and cultural heritage.

In the intervention, implementation, and dissemination phases, the Presidio continues to play a central role. Together with the UNICT research team, it has co-organised a permanent exhibition and a two-week festival (late May – early June 2025) to present archival and field materials documenting the evolving relationship between the river and its inhabitants since the nineteenth century.

Through these continuous interactions, the societal partner has contributed to empowering local actors, strengthening community agency, and embedding participatory governance as a transformative practice in biodiversity research.

Description of Other Groups (Permaculture Practitioners, Farmers, and Associations)

In addition to working with the Presidio, the BIOTraCes team collaborated with individuals and organisations outside its immediate network—some of whom had previous experience of cooperation with it. These included three main groups:

- (i) Farmers practising permaculture and herders;
- (ii) Farmers and herders engaged in conventional agriculture and breeding, but also small irrigation consortia that manage water;
- (iii) Grassroots organisations active in campaigns for the protection of biodiversity and cultural heritage.

Role of Other Groups in the Research

These groups participated in various capacities across the three research strands—as research participants in the first and second strands, and as co-researchers in the third.

In the first strand, contemporary practices of re-inhabiting the river were studied through ethnographic fieldwork. The research team lived and worked for several months (spring to autumn 2024) on a permaculture farm by the river, engaging daily with farmers and volunteers and documenting their ecological and social practices

In the second strand, the team investigated the micro-governance of water infrastructures through participant observation, joining citrus farmers in their everyday irrigation activities along the river's middle course.

In the third strand, the research addressed the impacts of industrial-scale agro-photovoltaic plants on biodiversity and cultural heritage. Together with grassroots organisations, the team developed a collaborative and critical map that combines georeferenced data on plant locations with information about native species, crops, and archaeological sites.

Particularly valuable were the local ecological and cultural knowledges contributed by environmental and cultural associations. These oral and place-based insights—often absent from institutional archives—proved essential for understanding the Valley's living heritage and making biodiversity data accessible to both research communities and the wider public.

Concluding Remarks

The collaboration with the Participatory Praesidium of the Simeto River Agreement has been pivotal in grounding the BIOTraCes case study within the lived realities of the Simeto Valley. Through continuous co-design and engagement, the Presidio enabled the integration of local knowledge, participatory governance, and community empowerment

into biodiversity research. Its partnership with UNICT fostered trust, reflexivity, and plural perspectives, ensuring that the study evolved as a shared process rather than an external investigation. By connecting civic actors, farmers, and researchers, the Presidio exemplifies how societal partnerships can translate participatory principles into transformative, territorially embedded practices for biodiversity protection.

2.2 Collaborative Research and Application of PAR

The Participatory Action Research approach adopted in the Simeto Valley case study has been both iterative and reflexive, unfolding through a continuous cycle of hypothesis formulation, data collection and analysis, validation, and reformulation. This dynamic process reflects BIOTraCes' commitment to co-producing knowledge that remains responsive to local realities and oriented toward transformative change within complex socio-ecological systems.

Throughout each phase, the societal partner Presidio together with individuals and groups outside its network, contributed to defining hypotheses, analysing and validating data, and shaping dissemination and intervention strategies. Their involvement ensured that the research remained embedded in the territory and attuned to the Valley's ecological and social dynamics.

At the same time, the research process developed along two complementary tracks. Some phases—such as hypothesis definition, validation, dissemination design, and intervention planning—were co-constructed with the societal partner through continuous dialogue and joint decision-making. Others—particularly data gathering, detailed analysis, and validation—were led more substantially by the UNICT research team, combining participatory engagement with the rigour of academic inquiry. This flexible arrangement allowed the PAR process to adapt to the specific contexts of each research strand.

Among the three strands, the third strand, focusing on industrial-scale photovoltaic (PV) energy, provided the most extensive opportunity for shared research practice. Here, grassroots organisations and individual participants collaborated in developing a critical and collaborative map of PV infrastructures and their interactions with biodiversity and cultural and archaeological heritage. Between September 2024 and January 2025, several informal meetings and two structured workshops were held to design this mapping process. Participants decided collectively to integrate their local ecological and territorial knowledge into a georeferenced dataset. From January 2025 onwards, multiple rounds of collaborative GIS-based surveys were conducted in the municipalities of Troina and Belpasso, in cooperation with Legambiente Ancipa and Sciarra Viva. These activities exemplified the BIOTraCes principle of embedding participatory governance in research practice, transforming mapping into a tool for community empowerment and evidence-based advocacy.

Fieldwork in the first and second research strands—respectively on river-inhabiting practices and the micro-governance of water infrastructures—also integrated participatory elements, albeit in less formalised ways. Both strands drew on ethnographic engagement, allowing researchers to live and work alongside local actors and to refine research questions through observation and dialogue.

In the first strand, long-term immersion in a permaculture farm during spring, summer and autumn of 2024 provided an opportunity to study a contemporary practice of re-inhabiting the river. Daily collaboration with farmers generated ongoing reflection and adjustment of research objectives, illustrating how grounded participation can re-shape inquiry.

In the second strand, the researcher took part in the day-to-day activities of citrus and olive farmers along the river's middle course, observing patterns of cooperation and conflict in irrigation management. This shadowing process revealed how institutional responsibilities and farmers' practices intersect in the governance of water, prompting a shift in focus toward the institutional dimensions of resource management.

Overall, the PAR approach in the Simeto Valley combined structured collaboration with contextual flexibility. While diverging from the classic PAR model in its distribution of roles and intensity of participation, it remained faithful to its guiding principles: co-production of knowledge, empowerment of local actors, and reflexive learning. The collaboration between the Presidio, other local groups, and the UNICT research team ensured that research outcomes were pluralised through diverse perspectives, embedded in territorial practice, and directed toward politicising structural challenges to biodiversity governance.

Concluding Remarks

The Participatory Action Research process in the Simeto Valley demonstrated how co-production of knowledge can become a vehicle for empowerment and transformative learning. Through iterative collaboration between the UNICT research team, the Presidio, and grassroots organisations, research evolved as both analytical inquiry and collective action. The flexible distribution of roles allowed each strand to balance scientific rigour with participatory depth. Mapping, ethnography, and lived engagement translated biodiversity research into a shared practice of governance. Ultimately, the PAR approach strengthened community agency, pluralised environmental knowledge, and laid the foundation for inclusive, place-based strategies of ecological regeneration.

2.3 Triangulation

The research methods identified in the research designing phase (see Deliverable 2.1) were applied and refined during the case study through continuous triangulation, ensuring the robustness and validity of findings:

- Deep collaborative mapping with critical and collaborative design ethnography;
- Focus group interviews;
- Document Analysis (implemented through archival, digital and oral-history research);
- Semi-structured interviews;
- Video interviews;
- Visual methods (pictures and short videos).

The methods were employed in different combinations across the three research stands, allowing for a comprehensive and multi-layered understanding of the Simeto Valley's socio-ecological system.

First research strand – Inhabiting the river

The investigation into river-inhabiting practices combined ethnography, participant observation, semi-structured interviews, and document analysis of both archival and secondary sources. Local and grey literature—including documents from public and private institutions as well as water- and energy-infrastructure agencies—were systematically reviewed to situate field data within wider socio-environmental transformations.

Fieldwork was carried out through collaborative ethnography in the mid-course section of the Simeto River, within the municipality of Paternò (Catania). The focal site was a small permaculture-inspired farm managed by a young heterosexual couple, near to one of the few accessible river entry points. Research activities took place in two phases—May–July 2024 and September–December 2024—and involved two researchers. The immersive ethnographic approach enabled sustained engagement with the site and its human and non-human inhabitants, generating a situated understanding of access dynamics, informal economies, and environmental practices.

This fieldwork was complemented by archival research at the Historical Archive of Paternò and by participatory workshops with local stakeholders, including farmers and members of

the Presidio. The first workshop included a community-mapping exercise to identify shared sites of ecological and cultural significance. Subsequent archival inquiry traced the long-term transformation of the river's socio-ecological relations, documenting the disappearance of traditional fishing practices and the expansion of monocultural agriculture. These shifts were linked to successive infrastructural developments—bridges, dams, and irrigation networks—that reshaped both ecological functions and community life.

Continuous participant observation during fieldwork provided daily insights into the practices of traditional farmers, livestock breeders, and new settlers pursuing biodiversity-oriented agriculture. This revealed a far more heterogeneous landscape than institutional data suggested and highlighted the bureaucratic frameworks mediating water and land management. Research interactions occurred in both formal and informal settings, often using walk-along interviews and audio-visual documentation. Visual methods—including short films integrating interviews, soundscapes, and landscape imagery—enriched the narrative and sensory dimensions of the research.

Second research strand – Water and agriculture

The second strand examined the interdependence between conventional farming and water management, considering farmers and irrigation consortia as mutually constitutive components of the same socio-ecological system. Particular attention was given to the water steward (*guardiani dell'acqua*), intermediary figures who allocate water within small local consortia through closely regulated shifts. Their daily interactions contrast with the more impersonal administration of the *Consorzio di Bonifica*³⁰, where large-scale infrastructures shape distant forms of management and conflict resolution.

Fieldwork unfolded across multiple sites. In Contrada Poggio Monaco (Paternò), informal interviews with farmers were complemented by video documentation. In Contrada Buglio (Santa Maria di Licodia), the research took an immersive form: the researcher lived as a resident farmer, managing irrigation water and cultivating land. This embodied participation provided an understanding of cooperation, exchange, and conflict within small scale water governance.

The researcher's positionality as a native of the Simeto Valley offered tacit knowledge and access that deepened inquiry while maintaining reflexivity. Fieldwork combined participant observation, informal interviews, direct engagement in farming, and collective restitution. Observation extended to informal meeting spaces where farmers discussed irrigation shifts, infrastructure issues, and market challenges. Prolonged presence fostered trust and the circulation of narratives that revealed the micro-politics of water governance.

Triangulation was further strengthened by archival research at the Historical Archive of Paternò, reconstructing water use from the late nineteenth to the mid-twentieth century. This historical perspective clarified how technological and institutional changes layered onto pre-existing practices, leaving durable legacies in the present. A further methodological moment was the Deep Mapping Laboratory held during the *Facciamo la Valle festival*, a participatory cartographic workshop where participants co-produced spatial and symbolic narratives linking memory, perception, and data.

By combining embodied observation, participatory mapping, historical documentation, and collective restitution, this strand generated a comprehensive account of the interdependencies between agriculture and water. It illuminated both local agency and multi-scalar governance tensions.

³⁰ The Consorzio di Bonifica 9 of Catania is a public land-reclamation and irrigation authority responsible for managing water infrastructures and distributing irrigation across the Catania Plain. It coordinates water allocation among farmers, maintains canals, dams, and pumping stations, and plays a central role in the governance of agricultural water resources within the Simeto River Basin.

Third research strand – Photovoltaic energy

The third strand investigated the rise of photovoltaic energy as a transformative process affecting socio-ecological relations in the Simeto Valley. It pursued two goals: to generate knowledge and to provide an instrument for community-based change. The central methodological objective was to develop a collaborative and critical map of agro-photovoltaic plants within the Valley's ecological, historical, and cultural context—an outcome bridging academic and non-academic production.

The study combined archival and document analysis, ethnographic observation, collaborative mapping, and in-depth focus groups and interviews. During the preparatory phase, online archives managed by institutional agencies were reviewed to gather data on plant locations, size, and ownership. This evidence guided the identification of five local gatekeepers distributed across the ten municipalities of the Valley. A first round of interviews validated and expanded this baseline information.

A second research phase—ongoing at the time of writing—began with the consolidation of cooperation with two grassroots organisations, Legambiente Ancipa and Sciara Viva, based respectively in Troina and Belpasso. Given the Valley's size, the collaborative mapping focused initially on these two municipalities. A series of informal meetings with the organisations determined what additional data the map should include beyond plant information. Although informal, these encounters employed techniques evolving from brainstorming to structured focus groups. The discussions led to the identification of a wide set of complementary data sources, and responsibilities for retrieving and systematising information were shared between UNICT researchers and community participants.

Reflections on triangulation

Across all strands, triangulation combined ethnographic immersion, participatory co-production, and archival-documentary reconstruction. This multi-method integration enabled cross-validation of data and the pluralisation of perspectives, ensuring that findings are both empirically grounded and socially meaningful. While the core methodological choices identified in the research designing phase were maintained, their implementation evolved through adaptive, field-based learning—a reflection of BIOTraCes' emphasis on flexibility, reflexivity, and embedding research in local practice.

3. Case Study Contextualization

3.1 Multidimensional Presentation

This hydrographic system of the Simeto River Basin creates a complex mosaic of natural and human-shaped environments, forming a landscape structured by overlapping agricultural and ecological layers. Predominantly a lotic system—defined by flowing waters and broad alluvial plains—the basin also includes lentic environments, such as lakes, reservoirs, and wetlands. Due to the intensity of human presence and agricultural use, the Simeto Valley can be described as an agro ecosystem, where agricultural production coexists with important ecological functions and ecosystem services (Maes, 2020).

Within this system, two main sub-areas can be distinguished: the middle-to-upper reaches and the lower course. The upper sections are characterised by lower levels of anthropogenic alteration and include basaltic gorges and natural formations carved by the river. Here, the primary infrastructures are dams and weirs, used to store water, regulate its flow, and produce hydroelectric energy. All are owned by ENEL, Italy's national electricity company, and they fragment the river into isolated stretches.

Downstream from the Ponte Barca weir in Paternò, the lower course begins. This stretch is heavily modified by human activity, notably through a double system of levees that straightened the river and confined it within a relatively narrow, artificial channel. Alongside these containment works lies an intricate irrigation network supplying the surrounding agricultural fields. These transformations originated from land-reclamation policies initiated during the Fascist era and implemented by the Society for the Regulation of the Simeto River (*Società per l'arginazione del fiume Simeto*), later replaced by the Reclamation Consortium in the post-war period. Following the catastrophic flood of 16 October 1951, large-scale hydraulic projects funded by the Southern Italy Development Fund (Cassa per il Mezzogiorno)³¹ radically re-engineered the river's morphology. Instead of adapting to existing wetlands, these interventions reduced the river's natural flow, eroded traditional fishing and navigation practices, and reshaped the surrounding ecosystems.

The extensive use of concrete for drainage, regulation, and canalisation facilitated the rapid expansion of intensive citrus monocultures, transforming the socio-ecological landscape within a few decades. Yet these works also served broader purposes: they supported the industrial expansion of the southern Catania metropolitan area, which relied on reclaimed lands for growth and flood control.

Beyond this primary division between the upper-middle and lower courses, further fragmentation exists due to variations in irrigation infrastructure, the jurisdiction of reclamation consortia, and the uneven distribution of water resources. Rural districts are defined less by historical boundaries than by their dependence on particular canals and reservoirs. The viability of agriculture and livestock farming—often within the same area—depends on the functionality of specific infrastructural systems. This patchwork of dependencies is mirrored in the region's social fabric, generating informal networks of cooperation and highlighting the need for multi-scalar analysis attentive to spatial specificity. Despite these internal variations, the river and its basin remain a unified macro-geographical entity—the Simeto Valley—where shared socio-cultural patterns, irrigation practices, and biodiversity challenges reveal interconnected opportunities and constraints.

Socio-demographic and economic context

³¹ The Cassa per il Mezzogiorno (Fund for the South) was a public agency established in 1950 by the Italian government to promote economic development and modernisation in Southern Italy through infrastructure projects, industrial incentives, and agricultural reform. Active until the 1980s, it played a central role in post-war state-led development but was later criticised for reinforcing dependency and clientelism in the Mezzogiorno.

Focusing on the municipalities historically and geographically linked to the Simeto River—excluding the wider Catania metropolitan area—the Valley encompasses eleven main administrative units: Adrano, Belpasso, Biancavilla, Catenanuova, Centuripe, Motta Sant’Anastasia, Paternò, Ragalna, Regalbuto, Santa Maria di Licodia, and Troina. Together they count over 170,000 inhabitants, though with significant internal variation and a general trend of depopulation.

Municipalities on the river’s right bank are typically smaller, more remote, and more severely affected by demographic decline, while those on the left—closer to the Catania metropolitan area—host larger urban centres, some exceeding 50,000 inhabitants. Here, population loss often takes the form of daily commuting to the urban-industrial area of Catania, producing a dynamic of temporary displacement rather than permanent abandonment.

Depopulation in the Simeto Valley thus manifests both as a long-term demographic trend, common to Italy’s internal regions, and as a daily spatial disconnection between residence and workplace. Many inhabitants commute to Catania for work or study, weakening social and economic ties to the riverine landscape. As a result, the Simeto has become increasingly marginal in everyday life, perceived more as a residual backdrop for quite rare leisure or cultural activities than as a living component of local livelihoods.

A further driver of marginalisation lies in the productive but non-residential character of the Catania Plain. Except for limited examples—such as the experimental agricultural settlement of Sferro—the territory lacks the clustered rural housing common in other Italian regions. The area is dominated by an intensive agricultural industry, producing both spatial and social distance from the river.

Overall, these dynamics create a complex socio-economic landscape in which urban centres act as demographic and economic hubs, while the river remains largely invisible. Its diminished economic role has been compounded by large-scale monocultures and energy infrastructures that capitalise on ecologically and socially depleted lands. The Simeto, channelled and fragmented, is often reduced to a line on the map—physically constrained, visually remote, and symbolically absent.

Amid these transformations, exploitative uses persist: the river continues to receive urban effluents, contribute to energy production, and serve as a site for reconstituting large estates oriented toward monoculture. These developments are often underlain by agricultural subsidies and top-down policies that fail to adapt to local territorial specificities or to engage in participatory planning.

In recent years, these dynamics have been amplified by the rapid expansion of industrial-scale agro-photovoltaic plants, directly linked to the crisis of citrus monocultures. As agricultural profitability declined, large external investors acquired or leased abandoned farmland for energy production. While framed as a contribution to the green transition, this shift often reproduces extractive land-use models, replacing cultivation with infrastructure and deepening the socio-ecological fragmentation of the Valley.

Historical and cultural background

The Simeto River Valley has a long and stratified history of human settlement and cultural transformation. The municipalities of Adrano, Belpasso, Biancavilla, Catenanuova, Centuripe, Motta Sant’Anastasia, Paternò, Ragalna, Regalbuto, Santa Maria di Licodia, and Troina bear witness to a continuous occupation stretching from prehistory to the present.

Archaeological findings attest to the Valley’s early agricultural and spiritual significance: ancient communities established settlements and sanctuaries dedicated to fertility and earth deities along the river’s fertile banks. With the advent of Greek colonisation and subsequent Roman integration, urban centres emerged along trade and military routes, transforming the Valley into a thriving agrarian hinterland. During the Hellenistic and Roman periods, towns such as Centuripe and Adrano developed complex infrastructures—

roads, aqueducts, and agricultural systems—that reinforced the region’s strategic and productive role.

The Middle Ages brought successive layers of reorganisation under Byzantine, Arab, and Norman rule. Centres such as Adrano and Paternò were reshaped by Norman agricultural reforms, while Troina, the first Norman capital of Sicily, became a focal point of religious and administrative renewal. Later, Biancavilla, founded by refugees from the Morea, preserved Arbëresh linguistic and cultural traditions for centuries.

More recently, agrarian reforms and post-unification state policies redrew administrative boundaries, redefined local governance and changed permanently the landscape by turning it in an agroindustrial set. During the twentieth century, the Simeto Valley became a major centre for citrus production, symbolising both agricultural prosperity and subsequent decline. Global competition and market restructuring progressively eroded this model, contributing to rural marginalisation and demographic contraction.

In recent decades, development initiatives have sought to revitalise internal areas, emphasising cultural heritage, historical continuity, and sustainable tourism. The archaeological remains of Centuripe, the historical architecture of Adrano and Biancavilla, and the medieval heritage of Troina exemplify ongoing efforts to link memory and innovation as drivers of local resilience.

Concluding remarks

In summary, the contextual analysis reveals how the Simeto Valley’s biodiversity challenges are deeply rooted in intertwined ecological, economic, and institutional processes. River fragmentation, agricultural intensification, and energy industrialisation have reshaped both habitats and social relations, while fragmented governance and limited participation have constrained collective responses. Yet within this landscape of constraint, alternative practices and alliances have begun to emerge—farmers experimenting with regenerative methods, civic organisations linking biodiversity to cultural heritage, and community networks reclaiming democratic agency over land and water. These initiatives, often marginal and precarious, embody the seeds of transformative change that reconnect ecological regeneration with social justice. The following section builds upon this background by analysing how such practices materialise as transformative biodiversity innovations, exploring their mechanisms of inclusion and exclusion, their capacity to scale, and their role in reconfiguring human–nature relations in the Simeto Valley.

3.2 Key Actors and their Impact on Worldviews

The Simeto Valley is shaped by a dense web of interactions among human and more-than-human actors, where economic dependency, political asymmetry, and competing environmental imaginaries coexist. These interrelations determine how biodiversity is understood, managed, or exploited and reveal profound divergences in the ways local communities define nature, degradation, and restoration.

Among the principal human actors, conventional farmers hold a dominant position in terms of land use and political visibility. They cultivate citrus in intensive monocultures, relying heavily on agrochemicals and mechanisation. Their relationship with the ecosystem can be defined as largely based on an extractivist paradigm (Zibechi 2016), viewing soil and water as inputs subordinated to market imperatives. Within this worldview, nature is conceptualised as a resource for productivity (Smith & Harvey 2008), while ecological degradation is framed as a technical or economic constraint to be managed rather than transformed. Dependence on subsidies and vulnerability to price fluctuations reinforce a cycle of environmental degradation and economic precarity.

By contrast, alternative and small-scale farmers, many of whom have non-agricultural backgrounds, embrace practices inspired by permaculture and agroecology. Their approach reframes biodiversity as an active co-producer of fertility and resilience showing a strong

place-dependency (Graddy 2014). They privilege soil regeneration, crop diversification, and sustainable water use, positioning nature as a partner in cohabitation rather than a passive substrate. These actors embody a regenerative worldview, yet remain structurally marginalised by limited access to land, water, and institutional support.

Migrant agricultural workers are mainly young men, predominantly from Maghreb countries, who are often employed under irregular or informal conditions. They represent a flexible and low-cost workforce that sustains both farming and livestock production across the Simeto Valley. Living conditions are precarious, with workers housed in temporary shelters, shanties, or abandoned vehicles near agricultural centres such as Paternò. Despite their invisibility and marginal position, these workers embody a worldview shaped by exploitation, displacement as well as racial differentiation (Davies et al., 2019). Their daily engagement with the land reproduces the extractive logic of the agro-industrial system, yet from a standpoint of exclusion: they work within and sustain a model from which they remain socially and politically detached. Occupying the most precarious positions in the agro-industrial chain, they face environmental degradation, unsafe conditions, and economic exploitation. Active mainly in citrus cultivation and seasonal harvesting, they operate within ecosystems already depleted by chemical use and soil exhaustion, revealing how exploitation of people and exploitation of nature are structurally intertwined in the agro-industry worldview.

Water authorities, infrastructure owners, and consortia—notably the Land Reclamation Consortium No. 9 of Catania, smaller local irrigation consortia, and public and private entities such as ENEL, the Basin Authority, and ARPA—form a central governance layer of the Simeto SES. They control water flows, maintenance, and access through a network of dams, canals, and weirs that both sustain and fragment biodiversity. ENEL's hydropower plants, in particular, act as de facto regulators of the river system, shaping its ecological and social rhythms. Collectively, these actors embody a technocratic worldview in which the river is managed as an engineered infrastructure optimised for efficiency, flood control, and production as well as symbol of "modernization" (Kaika 2006). Yet at the margins of this bureaucratic and corporate apparatus, local water guardians—workers tasked with maintaining canals and distributing irrigation—preserve experiential, place-based forms of environmental knowledge rooted in care and reciprocity. Their everyday practices reveal the coexistence of two distinct epistemologies: one centralised and extractive, the other local and relational, both crucial to understanding how water governance mediates biodiversity and shapes socio-ecological interdependence in the Simeto Valley.

The expansion of industrial-scale photovoltaic energy introduces a new set of actors—energy companies, financial investors, and infrastructure developers—who interpret the valley primarily as a solar energy reservoir to be converted into profit. Their interventions, legitimised by discourses of sustainability and the green transition, often replicate extractive logics, replacing agricultural production with energy infrastructure. In this view, nature becomes a surface for technological optimisation, and ecological regeneration is displaced by the rhetoric of decarbonisation detached from local livelihoods.

Local municipalities in the Simeto Valley exert significant influence over how the territory's social and ecological realities are understood. Through spatial planning, zoning, and public discourse, they can shape the worldview that defines what counts as "development," "nature," and "public interest." When guided by conventional growth-oriented logics, municipalities reinforce technocratic and extractive perspectives, seeing biodiversity mainly as a constraint to investment, when it is not entirely overlooked. However, when engaged in participatory governance through the Simeto River Agreement, some administrations promote an alternative worldview—one centred on ecological responsibility, collective stewardship, and the recognition of interdependence between human communities and the wider living environment.

Counterbalancing these forces, civil society organisations and grassroots networks, particularly the Participatory Praesidium of the Simeto River Agreement and the Simeto Ecomuseum, articulate a relational and care-based vision of the territory. They define biodiversity as a collective good inseparable from cultural heritage and community well-

being. Their initiatives—community mapping, environmental education, and participatory governance—translate the BIOTraCes principles of pluralising and empowering into situated practice. By mobilising local memory and affective attachments to place (Davidson & Milligan 2004), they contest dominant colonial framings of the valley as an “empty” or “backward” space (Dunlap 2022) and instead promote a vision of restoration as social, ecological, and cultural regeneration.

Across these actor constellations, power asymmetries remain stark. Economic elites, institutional agencies, and corporate investors dominate land, water, and energy governance, while relational and biodiversity-oriented actors operate within limited niches. Yet these very niches serve as incubators of transformative change, demonstrating alternative ways of living with the river and its ecosystems. In this plural landscape of knowledge and value, the Simeto Valley’s biodiversity challenge is not merely ecological—it is deeply political, reflecting conflicting worldviews over what nature is, who belongs to it, and who decides its future.

Concluding Remarks

The Simeto Valley reveals biodiversity as both an ecological condition and a political field shaped by contrasting worldviews. Extractive actors—industrial farmers, water authorities, and energy companies—continue to dominate through technocratic and market-driven logics that separate nature from culture. Yet alternative farmers, migrant workers, and grassroots organisations embody counter-perspectives grounded in care, reciprocity, and regeneration. Their practices challenge hierarchical governance and reimagine the valley as a living socio-ecological system. Although constrained by structural inequalities, these plural actors collectively prefigure transformative pathways where biodiversity becomes inseparable from justice, memory, and the right to inhabit the landscape differently.

3.3 Biodiversity Loss Factors

The current state of biodiversity in the Simeto Valley socio-ecological system is critically compromised. Field observations and participatory workshops reveal a landscape subject to profound ecological stress, where biological diversity has steadily declined over recent decades. The primary drivers of biodiversity loss combine direct ecological pressures—such as pollution, habitat fragmentation, and over-extraction of water—with indirect socio-economic and institutional dynamics, including agricultural restructuring, cultural disconnection from the river, and inadequate environmental governance.

Among the most significant direct pressures are the engineering and regimentation of the Simeto River, the widespread use of pesticides and agrochemicals to sustain industrial citrus production, and the rapid spread of land-intensive photovoltaic installations. These interventions collectively reduce biodiversity by fragmenting habitats, disrupting ecological corridors, and degrading soil and water quality. They have also generated processes of both physical and cultural desertification, weakening the reciprocal relations that once tied communities to the river and its ecosystems.

A major factor in this degradation is weak or non-existent environmental planning and management. As observed in many Mediterranean basins, the Simeto landscape has undergone deep anthropogenic transformations. Intensive farming practices, combined with urban runoff and inefficient waste treatment, have severely altered fluvial ecosystems. As noted by Pappalardo (2018), the river’s minimum vital flow has been drastically reduced, compromising aquatic habitats and diminishing water quality.

Participatory assessments conducted with the Societal Partner, particularly during the Focus Group on Biodiversity Loss Factors (March 2025), highlight waste mismanagement as a critical driver of biodiversity decline. The persistent burning or illegal burial of household waste in rural areas contaminates soil and groundwater, generating localised “fire lands” (Alliegro, 2017) where pollutants persist for decades. These practices, rooted

in everyday habits and infrastructural deficiencies, reveal how biodiversity loss is embedded not only in ecological processes but also in socio-cultural systems of neglect. The countryside, no longer inhabited as a productive space, increasingly serves as a site of disposal, reinforcing the disconnect between urban centres and rural stewardship.

This detachment is compounded by the dominance of citrus monoculture, which has reshaped the valley's agro-ecosystem since the mid-twentieth century. In pursuit of short-term profitability, diversified and polycultural systems once known as the "Sicilian Garden" (Barbera, 2021) were replaced by large-scale, chemically intensive plantations. This transformation led to soil depletion, agrochemical contamination, pest proliferation, and a narrowing of genetic diversity, ultimately undermining the resilience of both cultivated and wild species.

Today, this process is being accelerated by the expansion of industrial-scale agro-photovoltaic plants. The chronic crisis of the agricultural sector—exacerbated by drought and declining crop prices—has prompted many farmers to lease or sell their land for energy production. In many cases, these installations are not dual-use systems but entirely replace cultivation, producing what local observers describe as a "silicon monoculture." This new form of land occupation threatens biodiversity through soil sealing, disruption of local fauna, and the loss of landscape connectivity, further entrenching extractive land-use models under the banner of the green transition.

Water mismanagement and the poor maintenance of hydraulic infrastructures exacerbate these processes. Reduced water flow, illegal withdrawals for irrigation, and pollution from untreated wastewater have degraded aquatic habitats and compromised migratory bird routes between Africa and Northern Europe. The drying of riverbeds, combined with the recurrent wildfires that follow land abandonment, intensifies desertification and soil erosion.

Beyond ecological drivers, institutional and cultural factors play a decisive role in perpetuating biodiversity loss. The Simeto River's ecological and symbolic significance has been progressively eroded by urban expansion, private land enclosures, and the weakening of community engagement. The river has been transformed from a shared ecological commons into an invisible and inaccessible boundary. This detachment reflects decades of governance that prioritised hydraulic efficiency and agricultural productivity over ecological integrity and community participation.

Concluding remarks

Biodiversity decline in the Simeto Valley results from the interaction of structural, ecological, and cultural processes: extractive agricultural and energy systems, inefficient governance, and the erosion of social relations of care. Addressing these intertwined drivers requires not only technical remediation but also the re-embedding of human communities within the socio-ecological system through participatory, place-based governance. Only through such transformative change can the Simeto River and its valley recover their ecological functionality and cultural vitality as a living landscape.

3.4 Culture-Based Dynamics

The cultural dynamics of the Simeto Valley socio-ecological system are deeply entangled with the transformations brought by the agro-industrial economy. Over the past century, the expansion of citrus monoculture and the wider logic of industrial agriculture have redefined both ecological and cultural relations with the land. The values underpinning this system mirror those of economic competition and productivity, translating into a landscape shaped by extraction rather than co-habitation (Magnaghi 2019). Within this paradigm, nature is framed as a means of accumulation and biodiversity as a secondary or even obstructive factor.

Historically, dwelling patterns around the Simeto River reflected a delicate balance between proximity and distance. Because of climatic and sanitary constraints, settlements developed on surrounding highlands rather than along the riverbanks, maintaining a relationship of use without full occupation. The river was integral to subsistence but not a space of habitation—an arrangement that preserved a degree of ecological balance. The twentieth-century boom of citrus monoculture altered this equilibrium: while the pattern of distant dwelling persisted, the river basin was transformed into an intensively exploited production space. When the citrus sector later entered crisis, driven by global market pressures, this territory—once lived through daily agricultural practices—became marked by abandonment and detachment.

Today, this process has evolved into a new form of extraction linked to the rapid spread of industrial-scale agro-photovoltaic plants. This “silicon monoculture” described above reproduces the extractive logic of industrial farming under a green guise, transforming the valley’s identity from an agricultural landscape into an industrial energy production district. The process unfolds with minimal public consultation and limited local participation, shrinking democratic space and altering the cultural meaning of the territory without collective deliberation. What is presented as ecological modernisation risks deepening existing inequalities, marginalising local knowledge, and further detaching communities from their environment.

The loss of cultural investment in the land is thus not only a consequence of economic decline but also a symptom of shifting value systems. As agriculture ceased to be the main livelihood for much of the population, the countryside came to be perceived as peripheral—a site for disposal rather than care. The recurrent burning or illegal burial of waste in rural areas reflects this change in attitude³²: fields once associated with sustenance and stewardship are now treated as marginal zones where refuse can be left unseen. This practice, despite available waste services, reveals an underlying cultural fracture between urban and rural worlds and a weakened sense of responsibility toward the shared environment.

At the same time, the erosion of the Sicilian Garden model—a diversified and integrated system combining orchards, crops, livestock, and spontaneous vegetation—has eroded traditional ecological knowledge and the relational values it embodied. The industrialisation of agriculture introduced a competitive worldview, in which species are hierarchically ordered according to their market value. Practices such as pruning, irrigation, and pest control are now governed by technical efficiency and commercial criteria. Trees are shortened to facilitate harvesting; spontaneous flora is suppressed with herbicides; and biodiversity is often perceived as an obstacle to productivity. This utilitarian and instrumental logic, inherited from the post-war agricultural “boom,” persists even among those who express environmental concern, demonstrating how values and practices can diverge within the same individuals.

In contrast, new inhabitants and young farmers adopting agroecological or permaculture principles are reintroducing a different ethics of care. For them, farming represents both livelihood and life project—a form of “dwelling” that reconnects production with ecological regeneration. These actors cultivate smaller plots, often experimenting with retro-innovative techniques such as the traditional *saje* (earthen irrigation channels) redesigned with contemporary ecological principles (Zagata, 2020). They embody relational and intrinsic values of biodiversity, viewing nature as a co-actor in sustaining life rather than a resource to be preserved or to be optimised. However, their practices frequently clash with

³² The practice of burning waste in rural areas is a widespread yet complex micro-practice that cannot be reduced to mere irrationality or negligence. Beyond the apparent act of burning or abandoning materials that could otherwise be collected at home, this behaviour reflects a layered relationship with the countryside as a space of patchwork reuse, a site of creative repurposing, informal storage, and gradual accumulation. What eventually becomes “waste” often passes through stages of temporary usefulness or symbolic value. Although environmentally harmful, these practices reveal a non-linear dynamic between resourcefulness, habit, and neglect, which merits closer attention.

dominant agricultural culture and institutional frameworks that privilege standardised, high-yield production models.

This internal value conflict runs through the entire agrarian landscape. For conventional farmers, shaped by decades of market dependency and chemical-intensive agriculture, the ecological turn proposed by newcomers can appear naïve or economically unviable. Field interviews reveal that alternative farmers are sometimes dismissed as “playing at agriculture,” reflecting the difficulty of reconciling cultural imaginaries of success based on productivity with those rooted in sufficiency and ecological balance. Yet these tensions also foster dialogue and experimentation: younger actors learn from elders about soil and climate cycles, while elders begin to observe new regenerative techniques. This exchange – even at a starting stage - illustrates a hybridisation of knowledge systems, where expert, local, and experiential knowledges intersect in both conflict and co-learning.

These plural forms of knowledge also underpin contrasting visions of biodiversity and restoration. For conventional and institutional actors, biodiversity tends to be defined in regulatory or technical terms—something to be quantified, managed, or compensated for. For grassroots initiatives such as the Participatory Praesidium of the Simeto River Agreement and the Simeto Ecomuseum, biodiversity represents a relational and cultural asset, inseparable from memory, community well-being, and landscape identity. Their actions—environmental education, participatory mapping, and cultural events—seek to re-embed ecological values within collective narratives, aligning with BIOTraCes’ principles of pluralising and embedding.

The result is a landscape of value pluralism, where divergent worldviews coexist and sometimes collide. The extractive rationality of industrial agriculture and energy production continues to dominate economically and institutionally, while emergent relational paradigms remain marginal but symbolically powerful. This conflict extends into governance: decision-making processes over land and energy infrastructures often exclude local actors, reinforcing the top-down character of environmental planning. The shift from cultivation to extraction has thus not only transformed ecosystems but also reconfigured political participation, narrowing the spaces where communities can negotiate their ecological future.

Ultimately, the human–nature relationship in the Simeto Valley has undergone a long process of detachment—from coexistence and stewardship to exploitation and, increasingly, to alienation. Yet within this fractured cultural landscape, new forms of ecological imagination are emerging. Through community-led initiatives, participatory research, and alternative farming practices, local actors are beginning to redefine dwelling as a relational practice of care and reciprocity. These initiatives signal the possibility of transformative change grounded in cultural regeneration, where biodiversity is not merely protected but reconnected to the everyday meanings of life, work, and belonging in the valley.

Concluding Remarks

The cultural transformations of the Simeto Valley reveal how shifts in values underpin both ecological degradation and the potential for renewal. Industrial agriculture and energy extraction have fostered detachment from the land, replacing stewardship with exploitation and alienation. Yet emergent actors—new farmers, the Presidio, and the Simeto Ecomuseum—are reintroducing ethics of care that reconnect biodiversity with culture, memory, and belonging. Their practices exemplify a slow reweaving of human–nature relations, grounded in reciprocity rather than productivity. In this plural landscape, transformative change depends on cultural regeneration, where ecological restoration becomes inseparable from social and moral renewal.

3.5 Identity-Based Dynamics

In the case study, the connection between identity dynamics - such as gender, age, and religion - and biodiversity loss or related challenges appears limited rather than explicit. Nonetheless, several significant elements emerge that shed light on how these dimensions subtly influence local perceptions and practices related to biodiversity.

The agro-industrial sector is characterised not only by the prevalence but by the almost exclusive presence of men. In cultivated fields, operating tractors, managing irrigation, or herding livestock, only men are present, and the same applies to related sectors. Women are typically less involved in agriculture or animal care, although for fiscal reasons farms are often registered under their names to access unemployment benefits or other state subsidies. An exception is represented by the farmers/dwellers that practice agroecology, among whom women are increasingly engaged in practical agricultural work. By adopting techniques that diverge from intensive farming, they also interrupt the traditional male exclusivity in the rural areas of the Simeto Valley. In this case, although a gender imbalance remains evident, it does not appear to be a determining factor in explaining the processes driving biodiversity loss.

A second element relates to age. A significant proportion of local farmers are elderly men who, during the 1970s, benefited economically from intensive citrus cultivation. Today, however, many of their families do not continue agricultural activity. Given the sector's economic difficulties, these elderly farmers often encourage their children to pursue other professions. This dynamic contributes to land abandonment and favours the spread of a "silicon monoculture"—the conversion of farmland to photovoltaic energy production—which appears to offer older and tired landowners an easy and stable economic return over time.

Age also plays a role in the transmission of knowledge. Elderly farmers often serve as mentors to younger generations, passing on agricultural techniques rooted in intensive land exploitation. This transfer of knowledge, which often includes a nostalgic rhetoric of the "golden age" of citrus production, reinforces the continuity of an agro-industrial model that no longer guarantees the same economic outcomes. The younger generation, instead of questioning this past, tends to reproduce it, maintaining methods and visions that were once profitable but are now environmentally and economically unsustainable. This may create closed, identity-bound cycles that are difficult for researchers and practitioners to challenge or open to critical discussion about alternative productive approaches.

Finally, part of the agricultural workforce consists of migrant labourers, often with irregular legal status in Italy. These workers provide a flexible and inexpensive labour force accessible to landowners and intermediaries. They are mostly young men from Maghreb countries, recruited informally by caporals (caporali), often of Eastern European or Italian origin—who pay them around €20 or less for a 8/12 hours of work daily. Their living conditions are precarious: many reside in temporary shelters such as tents, shanties, or abandoned vehicles on the outskirts of agricultural centres like Paternò. Interaction with these marginal and almost invisible figures is extremely complex. Nevertheless, they constitute the frontline of agricultural production, sustaining both farming and livestock activities.

Concluding remarks

Identity-based dynamics in the Simeto Valley reveal how belonging, memory, and representation shape ecological relations as much as material practices do. Narratives of abandonment and resilience coexist, influencing how communities perceive both themselves and their environment. While older residents frame identity through loss and marginality, newer inhabitants and civic groups reinterpret it as an opportunity for regeneration. These intersecting identities often produce tension but also open dialogue across generations, origins, and social positions. Understanding biodiversity, therefore,

requires recognising identity as a living, contested process through which the valley continuously redefines its collective meaning and its relationship with the ecosystem.

3.6 Political/Institutional Dynamics

Political and institutional barriers to positive biodiversity change in the Simeto Valley are numerous and persistent. From the perspective of local political institutions, biodiversity is generally not perceived as a value to be safeguarded, but rather as a constraint that entails additional costs and administrative complexity. In many cases, protecting biodiversity requires the implementation of proactive measures that challenge existing development models and disrupt established interests.

Effective action for biodiversity conservation would require strong coordination across multiple levels of governance, yet such coordination is largely absent. The lack of institutional dialogue and mediation mechanisms constitutes one of the main obstacles to effective biodiversity management. Decision-making remains fragmented among agencies with overlapping mandates and limited communication, resulting in political inertia and the perpetuation of the status quo.

A concrete example is the case of the Passo Martino weir, a concrete barrier located approximately seven kilometres from the mouth of the Simeto River. The structure prevents several aquatic species from migrating upstream to reproduce, thereby compromising the river's ecological connectivity and biodiversity. Responsibility for the dismantling of the weir lies between the Metropolitan City of Catania, which manages the Simeto Oasis Reserve, and the River Basin Authority. Despite repeated appeals from environmental activists and civil society groups, no institution has taken concrete steps to remove the barrier.

This situation illustrates a broader pattern of institutional inertia and fragmented accountability. Although no authority has explicitly opposed the removal of the weir, neither has any taken the initiative to promote it. The reluctance to assume financial and organisational responsibility reflects a systemic weakness in governance, exacerbated by long-term budget cuts and the lack of inter-institutional collaboration, which together hinder even modest efforts at ecological restoration.

From a **BIOTraCes perspective**, this institutional deadlock underscores the need for *politicising* and *embedding* transformative practices within governance structures. The failure to act is not simply administrative but reflects deeper power asymmetries and a reluctance to confront the political dimensions of biodiversity loss. Overcoming such inertia requires redefining institutions as spaces of negotiation, where ecological restoration and participatory governance are embedded as shared, long-term commitments rather than delegated technical tasks.

Concluding Remarks

The Simeto Valley exemplifies how institutional inertia and fragmented governance can undermine biodiversity restoration. Despite widespread recognition of ecological degradation, political will remains weak, and inter-agency coordination is largely absent. The case of the Passo Martino weir exposes how overlapping responsibilities and risk aversion perpetuate inaction, reflecting deeper structural lock-ins within local governance. Transformative change thus demands more than technical solutions—it requires politicising biodiversity, embedding collaboration, and redefining institutions as arenas of shared ecological responsibility. Only through such systemic reconfiguration can governance move from passive management toward active, collective restoration of the Simeto River ecosystem.

4. Transformative Biodiversity Innovations

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4.1 Analysis of Inclusion/Exclusion Mechanisms

Exclusionary practices and inclusive mechanisms materialise deeper socio-ecological relations, registers of meaning, and cultural representations. Within capitalist dynamics, human–nature relations are framed through the logics of commodification, profit extraction, and capital accumulation (Smith & Harvey 2008). Consequently, exclusionary practices often emerge through the privatisation of ecosystem components destined for incorporation into business schemes, while simultaneously excluding other beings—human and non-human—from using these as life worlds. Conversely, mechanisms capable of including diverse perspectives on biodiversity typically develop externally to or at the margins of dominant economic practices, which remain embedded in the logic of endless accumulation.

The exclusion of alternative and marginal perspectives on biodiversity in the Simeto Valley stems from a dominant understanding of the ecosystem as a reservoir of resources and, therefore, of exchange value to be extracted and accumulated (Buscher et al., 2012). This worldview, central to the capitalist mode of production, is underpinned by values of opportunism, competition, and productivism—social attitudes oriented toward profit maximisation and indifferent to elements of the ecosystem that cannot be monetised.

These values and attitudes are embodied in the agro-industrial model of both citrus and wheat monoculture, which during the 1900s has transformed socio-ecological relations and reshaped the cultural, ecological, and social landscape in the image of intensive agriculture. The monocultural system has not only generated vast orange groves that continue to define the valley’s landscape but has also altered its micro-scale composition, including relationships between plants, humans, and other species.

Ethnographic conversations conducted during the first research strand reveal the depth of the transformations imposed on citrus trees to meet production requirements. A key example is the continuous development of pruning techniques designed to produce shorter trees for easier harvests and optimise row arrangements to maximise productivity per unit of land. Although effective from a business standpoint, these practices profoundly alter ecosystem equilibria, reinforcing competitive hierarchies among species rather than cooperation. These different ways of relating to the territory and to cultivated species are a point of generational conflict and mark the distinction between ways of life, dwelling styles, and cultivation practices. As Sandro (a pseudonym), one of the valley’s inhabitants who practices agroecology, explains, the choice to move to the countryside made a fracture visible for him:

“Transforming a part of the olive grove... let’s say that my goal when I bought this place was the desire to reconnect with the land. My father worked in the countryside, so I’ve always had that connection, even if there’s always a generational clash, right? So, with that generational clash, you distance yourself a bit because of the older generation’s approach which—let’s say—reflects how conventional agriculture developed over time. Obviously, it affected the previous generation, so when you talk to older people, they use synthetic fertilizers, pesticides, a more industrial kind of agriculture. I’ve always... let’s say, from my point of view, that way of doing things never really resonated with me” (Interview, 29.11.2024)

Moreover, elders and those accustomed to monocultural agro-industry frequently view spontaneous plant species or secondary crops as “competitors” to orange trees and their profit potential. This illustrates how values, attitudes, flows of knowledge, and economic practices intertwine to marginalise diverse understandings of biodiversity.

This capitalist logic perpetuates the notion that the valley is not a space for coexistence but rather an extraction site, where monoculture farming enables accumulation while producing residual toxicity from fertilisers and pesticides. The productivity of this model is

leveraged to discredit alternative agricultural approaches as economically unviable. As fieldwork indicates, permaculture and organic farmers often feel perceived as eccentric or unserious by conventional producers, who equate “proper agriculture” with industrial efficiency and output.

The same extractive rationale has expanded into the energy sector. Since the 1960s, natural gas extraction, followed by hydropower and more recently industrial-scale photovoltaic energy, has consolidated the region’s dependence on extractive development. The Simeto River has been heavily engineered, with two major dams and six hydropower plants permanently altering its flow, fragmenting habitat corridors, and excluding conservation practices compatible with a free-flowing river.

The ongoing expansion of agro-photovoltaic plants reproduces this logic. Approximately 6000 hectares are projected to be covered with solar panels in the coming years, much of it converted from abandoned citrus lands. This process, driven by the chronic crisis of the agricultural sector, leads farmers to rent their land for long-term contracts with energy companies. Carlo (farmer - pseudonym) explains that “For many decades, these lands were farmed intensively to produce citrus and grain, which are now being replaced with panels. From a citrus monoculture, we are transitioning to a silicon monoculture” (Interview, 15 11 2024). As a result, a new industrial landscape is emerging, signalling, at a deeper level, that the inclusion of alternative biodiversity perspectives is further constrained.

Regulatory frameworks exacerbate exclusion by limiting community participation in zoning and permitting processes. Local actors have minimal influence over where and how new plants are installed, leaving alternative territorial visions with little chance to emerge.

Conversely, through participatory research within BIOTraCes, inclusive approaches to human–nature relations are advanced in the Simeto Valley, particularly through the Simeto Ecomuseum, which represents an innovative model for engaging communities with the river and non-human entities. The Ecomuseum aims to empower marginalised groups by recognising their agency in shaping the landscape. It does so by promoting walking itineraries and a permanent exhibition that integrates archival data and ethnographic materials to historicise and revitalise the community’s relationship with the river. This model fosters a deeper awareness of ecological interdependence and opens pathways for the collective stewardship of biodiversity.

Similarly, alternative and permaculture-inspired agricultural practices offer inclusive mechanisms that restore disrupted relationships between humans and other life forms. These approaches reduce dependence on water, pesticides, and herbicides while reintroducing species diversity. Building upon local micro-practices, they provide a foundation for long-term biodiversity resilience and more equitable socio-ecological relations.

Finally, the collaborative and critical mapping of agro-photovoltaic plants, developed through cooperation between the UNICT BIOTraCes team and the Presidio, constitutes both a scientific and democratic innovation. By compiling georeferenced data from archives, surveys, and interviews, the mapping project will produce a publicly accessible cartography showing how energy infrastructures intersect with biodiversity and cultural heritage. This instrument will strengthen evidence-based policymaking, empower civil society with strategic knowledge, and enhance the inclusivity of territorial planning. The establishment of a joint management collective between the university and the Presidio will ensure the map’s long-term sustainability as a collaborative tool for pluralising biodiversity governance.

Concluding remarks

Exclusionary practices in the Simeto Valley derive from an extractive worldview that treats ecosystems as resources for accumulation, marginalising alternative ways of relating to nature. Intensive agriculture and industrial-scale energy production reproduce this logic,

excluding local actors and biodiversity perspectives. Inclusive mechanisms—such as the Simeto Ecomuseum, permaculture practices, and collaborative mapping—counter this exclusion by promoting participatory engagement, ecological care, and plural knowledge systems. These initiatives demonstrate that transformative biodiversity governance requires not only technical innovation but also social inclusion and cultural recognition, embedding local voices at the heart of ecological restoration.

4.2 Niche Innovators and Key Players

The Participatory Praesidium as a Driver of Innovation

In the case study Simeto River Alliance for Biodiversity, grassroots organisations and movements that have gathered over the years around the Participatory Praesidium of the Simeto River Agreement (Presidio Partecipativo)—the Societal Partner of the BIOTraCes project for the University of Catania—play a crucial role as innovators in the research area. However, to fully understand their influence and contribution to biodiversity restoration, it is important to clarify how the notion of “innovation” has evolved within this context over time.

Between the early 2000s and 2015, the group of activists in the Simeto River Valley, which had not yet taken the form of the Presidio, gradually developed a new approach to social innovation, focusing on how changes in practices or institutions could trigger deeper transformations in values, culture, and participatory paradigms, generating broader policy and regulatory effects (Moore et al., 2015). Realising that individual or emergency-driven initiatives—such as Orti di Pace G. Rosano and Reforestation in Contrada Niccolò—lacked the strength to achieve lasting change, the group decided to consolidate institutional relationships by promoting open innovation within public–private relations (Saija, 2016).

Supported by the expertise of the University of Catania, particularly the Department of Civil Engineering and Architecture (DiCAR), the group co-designed the Simeto River Agreement, a framework intended to create a permanent debate forum that was not only consultative but also deliberative. This approach was deeply innovative compared to standard Italian river agreements (contratti di fiume), which are primarily consultative community tools. The Presidio aimed to influence territorial policies; however, the way the River Agreement was signed—amid strong media and political pressure and in the absence of regulatory backing—quickly led to the failure of this experience during its first three years (2015–2018). As several members of societal partner later reflected, one of the core challenges of that phase was the push toward innovation as a goal, which often stretched the organisational capacity of the Presidium. As a participant noted during FG2, *“The pursuit of innovation for its own sake, as in other processes, became a limitation for the Presidio, as it absorbed a great deal of energy while at the same time leaving behind many micro-practices and concrete actions that we are only now carrying forward [...]”* (15/03/2025 – Participant, FG2). The attempt to innovate too rapidly suffered from the same weaknesses that had characterised earlier activism: a strong drive for change that lacked stable institutional foundations.

Pragmatic Reorientation and Incremental Change

This experience led the Presidio, now an umbrella association whose horizontally diffused model was being replicated by other initiatives, to deeply rethink its role and mission. It adopted a more pragmatic approach to innovation, centred on targeted project-based initiatives that, unlike past efforts, involved local administrators and built upon the experience of the River Agreement. This evolution ideally brought the Presidium back to its origins, with what may appear as pilot initiatives (e.g., Break Free, Science Trip), yet these differ significantly from earlier efforts as they are integrated into a broader and more coherent framework. While maintaining its strong orientation toward innovation, between 2018 and 2024 the Praesidium shifted its strategy from immediate, deep innovation toward

incremental and context-sensitive change, recognising the complexity of the socio-ecological system.

Today, the Presidio can be defined as an open social innovator pursuing a process-based model of transformative change. However, it cannot be considered a niche innovator in the strict sense (Geels & Schot, 2007), since it no longer operates from a marginal position but has become a central actor in local and regional policymaking.

Institutionalisation, Identity, and Participatory Governance

Over two decades, this group has introduced new languages and approaches to thinking and acting in the Simeto River Valley. From this process, the very identity of the “Simetini” has emerged, fostering a sense of unity within a historically fragmented context. This evolution has transformed both external perceptions—how the Valley’s municipalities are viewed from outside—and internal ones—how local communities perceive themselves in relation to neighbouring territories such as Catania, Enna, and the Nebrodi area. Activists within the Presidio have progressively developed new forms of social interaction and participatory democracy, positioning this collective as a key innovator at both regional and national levels.

Over the years, the Presidio’s practices have also focused on mitigating harmful environmental processes. At the macro level, activists initially opposed the construction of an incinerator in Contrada Cannizzola near the Simeto River, later halting plans for another landfill in Contrada Muglia and supporting the closure and remediation of the landfill in Contrada Valanghe d’Inverno in Motta S. Anastasia. Beyond these conflicts, the Presidio has promoted various initiatives to reconnect urban areas with the river, particularly through the Simeto Ecomuseum (EcoSI) launched in 2019. Over six years, the Ecomuseum has developed multiple projects, including a network of organic farmers through the Simeto Biodistrict (established in 2015).

Project-Based Innovation and Environmental Action

Alongside these broader interventions, several specific initiatives have increased ecological awareness, promoting local environmental stewardship and biodiversity protection. Notable examples include:

- ✓ LIFE Simeto Res (2015–2018), aimed at regulating water cycles in peri-urban areas, reducing soil sealing and uncontrolled cementification, and creating green zones for runoff management.
- ✓ PO FESR Ponte Barca (2017–2020), which focused on the Ponte Barca SIC area, establishing a civic monitoring network and designing nesting islands (not yet implemented).
- ✓ EcoSI Itineraries (2020–ongoing), a participatory monitoring tool promoted by the Simeto Ecomuseum.
- ✓ Open Science (2023–2025), which engages school-aged children in citizen science and river monitoring.
- ✓ Coltiviamo Bellezza (2024–ongoing), creating a biodiversity-rich urban garden in Paternò and promoting community participation in green space care.

These projects illustrate the Praesidium’s long-standing commitment to sustainable practices, directly addressing the Valley’s environmental challenges. Over time, this social collective has gained legitimacy, shifting from a peripheral role in local governance to a central position, particularly in municipalities that are part of the River Agreement. However, this newfound centrality also risks alienating its grassroots base—a challenge that remains central to the Praesidium’s current transformation.

Structural Gaps and Peripheral Networks

The BIOTraCes research has identified two interrelated phenomena within this evolution. First, the Presidio's efforts have concentrated primarily on urban areas, while remote rural zones—often key to biodiversity regeneration—remain more difficult to engage. Second, the Presidio has not yet fully connected with the existing informal rural networks that sustain local socio-ecological knowledge. Addressing these limitations is essential for strengthening its transformative reach.

From this collaboration, the UNICT research team expanded its inquiry to include other niche innovators operating outside or at the periphery of the Presidio's core network.

New Farmers and Dwellers as Niche Innovators

Among niche innovators operating outside or at the periphery of the Presidio's core network, the new farmers and dwellers of the Simeto Valley stand out. Many are young, educated adults—often without family ties to the region—who have chosen to live in rural areas and pursue organic, permaculture-inspired farming. Rejecting monoculture and agro-industrial models, they experiment with regenerative practices aimed at restoring soil fertility and biodiversity. Beyond their technical methods, they also build networks of solidarity and mutual learning, creating social-ecological infrastructures that allow newcomers to settle and collaborate despite limited economic means.

Their relationships with traditional farmers are marked by both proximity and distance. While sharing the same territory, they often operate in parallel social worlds, though the potential for exchange remains. Conventional farmers nonetheless preserve valuable knowledge on hybrid irrigation systems—combining earthen channels (*saje*) and storage tanks (*gebbie*)—that can inspire future retro-innovation (Zagata et al., 2020).

Low-Impact Dwelling and Retro-Innovation

Another dimension of innovation lies in low-impact dwelling practices (*abitare leggero*) and new relationships with water. These approaches involve the removal of buried plastic piping and the creation of small ponds and open irrigation channels that restore permeability between soil and water. Through processes of lithification (Luisetti, 2023), these structures mimic the river's own ecological dynamics, fostering biodiversity and reconfiguring human–non-human relations. These forms of retro-innovation (Zagata et al., 2020) do not simply imitate traditional techniques but refunctionalise them in the face of contemporary climate challenges.

Despite their significance, these niche innovators remain largely invisible within political and institutional arenas. Their marginality limits their capacity for influence but also allows greater autonomy in experimentation. Conversely, conventional farmers—while not typically innovative—maintain fundamental techniques and knowledge that could support transitions toward more sustainable practices.

Renewable Energy Communities (RECs)

Another emerging group of niche innovators consisted of Renewable Energy Communities (RECs) established in collaboration with the Presidio. These initiatives, developed through a process of dialogue and co-design between citizens, local associations, small producers, and researchers, sought to democratise energy production by promoting local ownership, collective investment, and fair redistribution of benefits. Grounded in the principles of energy justice, solidarity, and participatory governance, the RECs redefined the ecological transition as a social process rather than a purely technical one. Their cooperative structures aligned decarbonisation with community welfare and biodiversity protection, reducing land consumption while revitalising existing infrastructures and built environments.

Collaborative Mapping Networks

Equally significant were the grassroots organisations that participated in the collaborative mapping of agro-photovoltaic plants, developed through the cooperation between BIOTraCes researchers and the Praesidium. Specifically, the Praesidium played a crucial facilitative role, connecting local associations such as Sciara Viva (Belpasso) and Legambiente Ancipa (Troina) and coordinating collective field activities. Together, these actors combined local ecological knowledge, GIS-based data collection, and community-based monitoring to create an open, critical cartography linking energy infrastructures to biodiversity and cultural heritage. Beyond its technical output, this collaborative process strengthened participatory governance by empowering citizens to analyse land-use transformations, challenge exclusionary planning, and co-design more just and biodiversity-oriented territorial futures, embedding research within local networks of care and environmental stewardship. As Francesca (activist – pseudonym) pointed out :

“when you talk to some local officer enthusiast for these large photovoltaic plants, they often say «what’s wrong with putting panels on such empty lands...?», sometimes they even say «on these deserts»...because they just imply that the lands they target are empty, void of any life or story, uninhabited. That is why the map is important...because it shows exactly the contrary, it puts the plants into a context that is full of life, story and inhabitants!!” (Interview, 23/09/2025).

Concluding Remarks

The Simeto Valley hosts a rich network of innovators operating across civic, agricultural, and energy domains. The Participatory Praesidium anchors long-term participatory governance, while new farmers, RECs, and collaborative mapping networks experiment with novel forms of collective agency linking biodiversity, justice, and sustainability. Together, they embody the BIOTraCes principles of pluralising knowledge, empowering local actors, politicising structural inequalities, and embedding transformative practices in governance. Despite limitations of scale and visibility, these actors provide tangible pathways for transformative change, reconfiguring human–nature relations within the Simeto socio-ecological system.

4.3 Scalable Bottom-Up Innovations for Transformative Change

Several bottom-up innovations have emerged in the case study: new practices of the Simeto Ecomuseum focused on rediscovering the landscape and fostering multispecies agency; young farmers/dwellers who break with agro-industrial traditions and build associative and mutual-aid networks; civil-society actors and municipalities advocating alternative energy production while critically opposing the uncontrolled expansion of agro-photovoltaic plants presented as a “green,” impact-free solution; and conventional farmers who possess, share, and apply practical knowledge in water management, farming, and animal husbandry in synergy with the more-than-human world—knowledges that could become niche innovations if scaled to shift prevailing production patterns.

The Simeto Ecomuseum

The Simeto Ecomuseum can be considered a locally scalable bottom-up innovation. Linked to the activism of the Presidio, it was launched in 2019 after a participatory mapping process involving residents and territorial actors. It creates “[...] an agreement through which a community commits to taking care of a territory, implemented by means of a shared and integrated project for the protection, enhancement, maintenance, and cultural production of a geographically, socially, and economically homogeneous area, characterized by distinctive historical, cultural, tangible and intangible, landscape, and

environmental features³³." Though currently challenged by an unsustainable reliance on volunteer labour, the Ecomuseum aims to innovate methods, expand relationships, and consolidate its role as a territorial actor in dialogue with associations, the municipality, and economic stakeholders. Drawing on research materials, archival data, and the support of BIOTraCes researchers and professionals, it laid the groundwork for a permanent exhibition in Paternò, at the Presidio's premises.

With a deeply place-based approach and sensitivity to territorial transformations, the Ecomuseum departs from business-as-usual policies that struggle to envisage any coherent strategy for territorial enhancement. Operating in a marginalised socio-cultural and environmental context, it promotes local knowledge and economies to address drivers of marginalisation—such as limited knowledge of the valley's history, which fuels emotional and physical detachment. Within BIOTraCes, the Simeto Ecomuseum has focused on biodiversity, initiating a participatory action research process that valorises present-day marginal practices (e.g., livestock raising, fishing) as integral components of historical ecological systems. By interpreting these practices as ways of inhabiting the river and as elements of a complex ecological fabric, it adopts a holistic, historically grounded view of biodiversity (beyond quantitative indicators).

Through school initiatives and youth engagement, the Simeto Ecomuseum's innovation is cross-cutting and inclusive. With its community base and experience in territorial micro-economies, it has the potential to scale by framing biodiversity as the outcome of relational, productive, and historical ties. This trajectory is strengthened by exchanges with other ecomuseums (e.g., the May 25–June 8, 2025 festival) and by establishing the permanent exhibition with BIOTraCes support.

Grounded in environmental history, multispecies agency, and biodiversity, the permanent centre holds long-term transformative potential. If adequately supported, the Simeto Ecomuseum could become a reference actor and interlocutor for local administrations on river issues and transformations—functioning as a platform for dialogue among diverse actors and territories. It represents a scalable bottom-up innovation because it builds a territorial narrative that includes diverse ways of inhabiting the land. While aligned with conservation and nature protection, it addresses biodiversity place-specifically, valuing history, practices, and marginalised voices.

Agricultural and Water Management Innovations by farmers/dwellers

Farmers and residents inspired by permaculture are introducing small-scale biodiversity innovations in water management and cultivation. To make water visible and functional to ecological processes, they create micro-wetlands on their plots, countering the dominant, buried-pipe model. By constructing small basins and designing earthen irrigation channels (emulating traditional saje without cement), they retain soil moisture and support diverse plant and insect species. Some are removing legacy plastic piping, painstakingly unearthing networks installed decades ago that have become an invisible toxic infrastructure of the valley.

Agronomically, while continuing oranges and olives for economic viability, they experiment with additional crops and species to enrich soils and foster biodiversity—often selecting nitrogen-fixing plants. Combined with a rejection of pesticides, these practices enable gradual soil regeneration and significant gains in biodiversity. It is important to emphasize that these innovations related to agriculture and water management are closely connected to the choice to practice a way of dwelling that is alternative to the agro-industrial citrus system. One example comes from the interview with Clara (a pseudonym), who, although she has always lived in a town in the valley, chose to move to the countryside. In recalling her family's history, Clara tries to trace these transformations:

³³ Regional Law of Sicily No. 16/2014, Article 2

"I don't know whether these lands, when they were only oranges' orchards, were actually inhabited. I think they were inhabited only for the amount of time the farmer spent cultivating them — that is, the time spent working the land. At least, this is what I believe was traditionally done: you stayed on the land to do the work and then, of course, you went back home. [...] And today, in this sense, things are changing a bit, perhaps also in the way people perceive the countryside. There is a return to a different kind of relationship — one that is not only focused on obtaining basic necessities, but also on experiencing the countryside as something connected to the home, you know? Seeing the countryside also, in a way, as a home" (Interview, 23.11.2024)

This potential emerges precisely as climate impacts and water-management failures intensify, making alternative agriculture a viable path for those wishing to remain connected to the land.

The innovations show early scalability: from one advanced permaculture initiative started in 2012, at least four additional farmers in the same area now manage ~2-hectare plots with ecological practices. If water innovations (micro-wetlands, pipe removal) were diffused through broader networks, they could catalyse transformative interest among conventional farmers still adhering to business-as-usual practices.

Economic sustainability remains a core challenge. Consequently, innovations are low-cost and best suited to those willing to forgo the productivity levels and standardised outputs of chemically intensive agriculture. Many conventional farmers perceive wetland creation as a waste of water rather than a biodiversity and resilience strategy. By restoring species typical of the traditional "Sicilian Garden," new farmers seek to revive pre-monoculture practices, aligning—at the level of values—with older knowledge. However, such exchanges are rare, as dominant "conventional" knowledge is now tied to citrus monoculture rather than the self-sufficiency landscapes largely absent for decades.

Ultimately, the transformative potential lies not only in techniques but in the social, relational, and affective infrastructure that enables these inhabitants to live differently in the valley. These informal networks, which support biodiversity-positive practices, show periods of disintegration and reassembly, reflecting the economic and existential precarity underpinning them.

Bottom-up innovations in the energy sector

Scalable bottom-up energy innovations take multiple forms. First, the emergence of Renewable Energy Communities (RECs) carries transformative potential by democratising decision-making and information-sharing, reducing consumption, raising awareness, and gradually shifting away from high-energy consumption models. Their significance lies not only in material outcomes but in their inclusive constitution, bringing together individuals, associations, businesses, and institutions to form networks of knowledge and support. Originating in participatory processes with BIOTraCes involvement, RECs introduce participation into an otherwise highly technical domain, breaking with business-as-usual.

A second innovation is the participatory mapping of large-scale agro-photovoltaic plants. Launched by BIOTraCes, it engages local actors and municipalities in a participatory process that is methodologically relevant in a context largely lacking such tools. Beyond method, the innovation lies in building a knowledge base from which mobilisation and advocacy can emerge—clarifying how large-scale agro-photovoltaics reshape landscape and economy. The mapping responds to the wave of large-scale investments in agro-photovoltaic energy impacting the Valley.

Findings suggest that the siting and proliferation of infrastructures frequently escape both residents' and institutions' control. The mapping can help municipalities and citizens have a stronger voice amid rapid land appropriation. By highlighting desertification risks—economic, social, and agricultural—this innovation can ultimately support biodiversity. While agro photovoltaics may allow some under-panel crops, these do not contribute

meaningfully to biodiversity or farmer livelihoods, who increasingly rely on land rental rather than production.

Innovations in “conventional” agriculture

There are also bottom-up innovations to enhance or revive within “conventional” agriculture—especially synergies between production and the more-than-human. Although traditional farmers and livestock breeders have applied monoculture with an extractive approach, they also maintain micro-management practices that enable biodiversity to persist and even improve.

For example, *sulla coronaria*³⁴ cultivation for fodder supports pollinators, and the valley’s artificial reservoirs sustain migratory birds through fish–bird trophic relations. As a sheep breeder explained, recalling past practices:

“Bees are dying because in the Plain we used to grow a lot of *sulla*. Practically every household, every farmhouse had a flock of sheep, and *sulla* was one of the best and most important feeds for dairy animals and for fattening. Bees once relied on *sulla*, which was a rich and nourishing plant; now they die because they no longer have that resource. I remember that when bees found *sulla* flowers, they would swarm, they would leave the hives in great numbers. They don’t do that anymore because this plant is no longer there.” (Sheep breeder³⁵ – 20/05/2024)

Though overshadowed by destructive production methods, such practices are niches to leverage. Building on deep farmer–land–water relations, they could become innovations if scaled, progressively tempering harmful monoculture logics and the broader production mindset now in economic crisis.

The same applies to water management. Farmers and breeders share informal micro-management rooted in neighbourly relations and sociality. In contrast to the centralised consortium model, these practices could render water management more rational and sustainable, while empowering farmers and breeders as inhabitants and guardians of the valley’s waters.

Concluding remarks

Bottom-up innovations in the Simeto Valley include the Simeto Ecomuseum, permaculture-inspired farming and water practices, RECs, participatory mapping of agro-photovoltaics, and biodiversity-supporting micro-practices in traditional agriculture. Their transformative potential of these initiatives depends on scaling low-cost techniques, strengthening social networks, and embedding participatory tools in governance. Early effects include soil regeneration, biodiversity gains, and greater civic oversight of energy siting. Equitable access remains a challenge, but these innovations collectively pluralise knowledge, support cultural recognition, and diversify local socio-ecological strategies.

³⁴ The *sulla coronaria* is a leguminous fodder plant that produces a striking red flower. Commonly found throughout the Mediterranean basin, it is known in Sicilian as *sudda*.

³⁵ The interlocutor is a livestock breeder from a seven-generation family tradition, who fears that he will be the last to continue this line of work. His farm has always been in the lower part of the river, near the Simeto Oasis, where the family operates both a livestock farm and a dairy. His concern is palpable, as is his constant reference to deeply empirical observations regarding the presence and disappearance of plants and animals in his surroundings.

4.4 Initial Mapping of Interventions

The interventions for transformative change identified in the BIOTraCes Italian case study of the Simeto valley build on niche innovators' actions and practices, which are actively shaping pathways toward socio-ecological transformation. Across the three interlinked research strands, we examine how farmers, cultural practitioners, and environmental stewards mobilise knowledge, practices, and infrastructures in ways that challenge dominant models and lay groundwork for systemic change. These interventions are not only responses to existing conditions; they are prefigurative practices that anticipate and prototype alternative futures for biodiversity, energy, and territorial governance.

Before detailing the initial interventions, it is useful to summarise initiatives enacted by niche innovators. Fieldwork shows that local cultural actors and environmental advocates are reclaiming the river as a multispecies ecosystem and multispecies homescape (Schuumarn 2024), narrating its history through extinction, ecological memory, and more-than-human agency. Since April 2024, regular meetings have supported a collaborative inquiry into the ecological and symbolic marginalisation of the river and its species. By recentring the river as a political and ecological actor, these innovators contest anthropocentric and extractivist paradigms—documenting loss while reclaiming space for the river within future visions of the valley.

Fieldwork also highlights the role of young farmers/dwellers—many of them niche innovators rejecting monoculture—in shaping biodiversity-supportive agricultural practices and reconfiguring water infrastructure governance. From May to December 2024, multiple encounters enabled close engagement with these farmers and their support networks. Their actions—rooted in agroecology, ecological repair, and collaborative experimentation—constitute a clear departure from dominant agricultural regimes while opening new spaces of community-making, care, and stewardship. A co-designed workshop at the June 2025 Simeto Festival will further refine these innovations and situate them within a broader territorial strategy.

Niche innovators are also active in energy, co-conducting with the UNICT research team a participatory mapping process. Members of two grassroots organisations (Troina and Belpasso) were involved from the earliest conceptual stages—co-shaping tools, categories, and modes of analysis. Through iterative workshops, the mapping has enabled cycles of reflection, imagination, and strategic planning. Beyond diagnosis, it functions as an infrastructure supporting territorial actors in contesting speculative land deals, visualising spatial inequalities, and advancing situated visions for a just energy transition.

Intervention 1 — Permanent Interpretation Center (Simeto Ecomuseum)

Together with the Participatory Presidium, we organised a permanent exhibition for the Simeto Ecomuseum. It will display archival documents (1889–1940s) on life of and along the river before heavy regimentation (weirs and dams), revealing interactions among human and more-than-human communities that are now invisible or lost. The core message—“there is and there has been a river”—responds to current seasonal disappearance due to droughts and withdrawals.

The centre includes fieldwork materials from the three research stands (photos, video, interview excerpts) to integrate and return research results to the Societal Partner and community. The Presidio enriched the exhibition with images and documents on the struggles that have enlivened the Valley and are part of a common political and social heritage (e.g., the 2002 protest against the waste-to-energy plant).

The exhibition aims to consolidate a place-based narrative, strengthen collective memory, and embed biodiversity awareness within a publicly accessible, permanent space.

Intervention 2 — Interactive Web Cartography (Agro-Photovoltaic Plants)

We are translating the collaborative mapping of industrial-scale agro-photovoltaics into an interactive online cartography. Designed as a public digital tool, it provides georeferenced information on the ecological transition in the Simeto Valley—specifically, data directly and indirectly related to agro-photovoltaic plants.

The map is intended to generate impact across three fronts:

- Research: consolidated evidence base.
- Local policymaking: support for territorial planning.
- Democratic participation: public oversight of land-cover changes linked to photovoltaic production.

Two access modes will be available: consultation and data entry. Registered/verified users will be able to report energy and non-energy objects, promoting active participation in monitoring processes.

Intervention 3 — Two-Week Festival (May 25 – June 8, 2025)

A two-week Festival connected themes emerging from research through the following programme:

- A debate on Ecomuseums as instruments to counter biodiversity and cultural-heritage degradation in the Simeto Valley.
- A multispecies Itinerary along the river's middle course (Santa Domenica ENEL's intake and agroecological farm) narrating more-than-human histories of co-ahabitation in and with the river. The itinerary connected socioecological relations to landscape transformations (agriculture, infrastructuring) by highlighting the complex and often conflictual relations with the river.
- A workshop on regenerative farming techniques (syntropic agriculture) focusing on historical/geographical specificities, and climate change impacts. Its goals were to strengthen solidarity networks among farmers, connect with experts on regenerative agriculture, share local knowledge supporting biodiversity, and link biodiversity to ways of inhabiting land.
- A day dedicated to Micro and Macro Water Infrastructure that explored the complex material and symbolic dimensions of water in the Simeto Valley. In the morning, participants engaged in a deep mapping session at an organic farm in Contrada Nicolò, led by a local activist. This activity focused on tracing the journey of water through its multiple infrastructures—both materials, such as canals and pipes, and immaterial, such as communication networks and local knowledge systems—revealing how these layers shaped ecological and social relations. In the afternoon, attention shifted to the macro-infrastructure of the Simeto River, examining their historical and contemporary impacts on biodiversity and socio-ecological interactions. Through discussions with experts, researchers, activists, and local authorities, the session outlined a political ecology of water in the Simeto Valley and presented the Passo Martino weir as a case study of potential dismantling, aimed at partially restoring the river's ecological continuity and re-establishing its role as a living, interconnected ecosystem.
- A day dedicated to the theme of energy as a space for reflection, debate, and planning on the relationship between energy production and the shaping of territory. In this context, the event wove together two key topics: large-scale agro-agro-photovoltaic plants and Renewable Energy Communities (RECs), using as a common thread the materiality, politics, meaning, and imagination of the ecological transition in Simeto and Sicily.

Concluding Remarks

These initial interventions translate niche innovations into tangible actions: a permanent interpretation centre anchors multispecies histories in a public space; an interactive cartography supports research, policymaking, and democratic oversight; and a territorial

festival activates shared learning on biodiversity, water, agriculture, and energy. Collectively, they challenge business-as-usual approaches by centring participation, memory, and situated knowledge. Their contribution lies in restoring relations between communities and ecosystems, re-politicising decisions on land and energy, and enabling equitable management of biodiversity. These interventions provide a practical springboard for the actions foreseen in Task 2.4, aligning experimentation with transformative governance.

4.5 Discussion

The analysis conducted in the Simeto Valley highlights a socio-ecological context deeply marked by tensions and discontinuities, yet also by opportunities for transformative innovation. The river and its basin constitute a space where contrasting agricultural practices, divergent visions of the human–nature relationship, and experiments in community governance intersect. These efforts seek to balance the pressures of intensive production models while resisting new forms of extractive exploitation of the territory. Within this framework, biodiversity emerges not merely as a threatened resource but as a field of political and cultural negotiation.

One of the most significant findings concerns the persistence of intensive agriculture, which continues to dominate large areas of the territory. This model produces a dual effect: on the one hand, it sustains segments of the local economy and maintains connections to national and global markets, thereby perpetuating logics of exploitation, marginality, and inequality—both economic and representational. On the other hand, it contributes to biodiversity loss, soil depletion, and aquifer reduction, while entering into a problematic dialogue with older landscape-care practices (Calcaterra, 1986; Lupo, 1990). While some farmers still retain synergistic relations with nature and local knowledge, the increasing mechanisation of agriculture has substantially eroded such traditional practices of care. The persistence of intensive farming should not be read merely as resistance to change, but as the outcome of an economic and political system that rewards high yields and global integration, making alternative paths costly and risky for most farmers.

Alongside this scenario, heterogeneous experiences of alternative farmers have emerged, introducing practices inspired by agroecology, permaculture, and rural multifunctionality. These actors—often returning migrants, urban dwellers, or individuals seeking to reconnect with the land—do not represent a purely marginal phenomenon. They experiment with models grounded in crop diversification, short supply chains, and direct relationships with consumer communities. Their presence carries transformative potential yet also generates tensions with traditional farmers. This friction manifests in multiple ways: while traditional producers may view “new” inhabitants as pursuing economically unrealistic practices, the latter often criticise established farms for their inertia and dependence on global market logics.

Such dialectics, far from being merely conflictual, also create opportunities for collective learning, enabling new forms of hybridisation and mutual contamination. Informal exchange networks, farmers’ markets, and community festivals demonstrate the possibility of alliances across different actor groups, even if these attempts have yet to consolidate into systemic change.

A further layer of complexity arises from the spread of agro-photovoltaic energy. While framed as a green innovation promising emissions reduction, in the Simeto Valley it often functions as a form of socioecological dispossession. Large-scale installations on agricultural land intensify pressure on biodiversity, transform landscapes, and reinforce extractive logics of resource appropriation. Community perspectives on such projects remain ambivalent: for some, they offer economic opportunities; for others, they embody a development model that sacrifices ecological and cultural values. The much-publicised coexistence of solar panels and crops is, in practice, minimal—given the industrial scale of these plants, the lack of community participation in decision-making, and the negligible agricultural role they allow. What emerges is not a linear transition toward sustainability

but a landscape of transformative frictions: intensive agriculture and agro-photovoltaic energy reproducing extractive logics on one side, and community-based and agroecological experiments seeking to rearticulate human–nature relations on the other.

Within this scenario, governance capacity becomes crucial. The Presidio stands as a key example of community-based institutional innovation, creating spaces for collective deliberation and recognising the political value of biodiversity and local knowledge (Saija, 2011). Its activities include concrete actions—supporting ecological restoration, resisting the expansion of energy infrastructures, and promoting educational and laboratory pathways involving schools, associations, and local communities. Yet these efforts remain constrained by limited resources and the constant need to mediate between divergent interests, often in tension with public institutions themselves.

An equally important role is played by the Simeto Ecomuseum, which operates as both an institutional and cultural innovation capable of expanding collective imaginaries around the river and rural landscapes (Pappalardo, 2021; Lambert-Pennington & Pappalardo, 2025). The Ecomuseum does more than valorise material and immaterial heritage—it acts as a cultural infrastructure linking memory, identity, and community experimentation, giving legitimacy to alternative ways of relating to biodiversity. Its contribution is twofold: it strengthens alliances among diverse actors (schools, associations, small producers, researchers), and it provides a narrative counterweight to the rhetoric of extractive development.

The mapped interventions—from experimental agroecological practices to environmental education, from energy-critical networks to community laboratories—demonstrate a plurality of local initiatives seeking to open spaces for transformation. Yet these initiatives often remain fragmented, lacking an overarching institutional framework capable of connecting them within a coherent strategic vision. This fragmentation limits their ability to challenge the economic and political structures sustaining intensive agriculture and extractive energy models.

From both a theoretical and practical perspective, the results suggest that transformative innovation cannot be understood as the mere introduction of new technologies or practices. It entails the construction of new social, institutional, and ecological relations. Biodiversity thus emerges not only as an object of protection but as a terrain of conflict and negotiation, where collective identities, political legitimacy, and development trajectories are redefined. Recognising the limits of this scenario is equally essential: alternative practices remain marginal in spatial and economic terms; public policies oscillate between support for industrial chains and fragmented funding for local projects. Moreover, internal fragmentation among community actors and difficulties competing with external capital risk are undermining the transformative potential of the most innovative experiences.

Nonetheless, the research identifies several key levers for future action: the cultural embeddedness of the river landscape; the growing awareness of the need for less destructive agricultural and energy models; and the capacity of community networks to bridge local practices with broader political claims. These elements provide the foundation for a genuinely transformative trajectory—one that moves beyond mitigation toward an alternative vision of ecological and social justice.

Ultimately, the Simeto Valley functions as a complex laboratory where tensions among agricultural models, energy pressures, and community initiatives delineate the concrete contours of socio-ecological transformation. The future of biodiversity in this territory will depend on the ability to turn these tensions into opportunities for convergence, rather than persistent division.

Concluding Remarks

The discussion underscores that biodiversity transformation in the Simeto Valley is inseparable from broader political, cultural, and economic negotiations. Intensive agriculture and agrivoltaics perpetuate extractive dynamics, while agroecological practices,

community governance, and cultural innovations—such as the Simeto Ecomuseum—offer relational and restorative alternatives. Yet fragmentation and resource scarcity limit their reach. Future interventions must therefore integrate dispersed efforts into coherent frameworks linking knowledge, governance, and ecological care. The valley’s challenge, and potential, lies in turning friction into collaboration, embedding justice and biodiversity within the same transformative horizon.

5. Social-ecological system analysis

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5.1 SES dynamics, interactions, co-dependencies and relations

SES impact on different actor group

The Simeto Valley socio-ecological system (SES) is shaped by a dense web of human and more-than-human interactions, structured through unequal power relations, economic dependencies, and divergent socioecological imaginaries. Within this system, multiple actor groups engage in complex relations of interdependence and conflict.

Conventional farmers represent the most influential actor group in land-use terms. They cultivate cash crops—mainly citrus and wheat—on holdings ranging from a few to several tens of hectares, generally employing monoculture and relying heavily on chemical fertilisers and pesticides. Their relationship with the SES is predominantly extractive: soil fertility is treated as a resource to be exploited for productivity under the constraints of wholesale markets that dictate prices and volumes. This dependency results in overuse of agrochemicals, soil depletion, and declining fertility, aggravated by chronic water scarcity and recurrent droughts intensified by the climate crisis. Low bargaining power and predatory pricing further reinforce their reliance on public subsidies, reproducing a cycle of environmental and economic vulnerability. The reliance on pesticides leaves visible traces across the landscape, though not all of them are immediately apparent; rather, most are revealed through conversations emerging from fieldwork. One such trace is, for instance, the exposed soil visible around orange trees. This feature holds particular significance for conventional farmers: maintaining bare soil between the trees is regarded as a sign of a “clean” field. Conversely, plots where grass is allowed to grow in the absence of herbicides are considered “dirty” (Garozzo 2024, Fieldwork notes).



Figure 18 - The “Ciappe Bianche” informal settlement of migrant workers in Paternò.
Ph. Domenico Pappalardo

In contrast, **alternative farmers and dwellers**—often small-scale producers managing plots of about two hectares—adopt practices that challenge the agro-industrial model. Few possess traditional farming backgrounds; instead, they engage in organic or agroecological agriculture, frequently uncertified, avoiding pesticides and focusing on soil regeneration, sustainable water management, and crop diversification. Their interaction with the SES is regenerative and adaptive yet constrained by the residual contamination of soils affected by decades of chemical use and by unequal access to irrigation water, which threatens the economic viability of small-scale farming as a livelihood option.

Migrant Agricultural Workers form a group that is composed mainly of young male labourers, predominantly from Maghreb countries, often employed under irregular or informal conditions. They represent a flexible and low-cost workforce that sustains both farming and livestock production across the Simeto Valley. Recruitment typically occurs through gangmasters (*caporali*), frequently of Italian or Eastern European origin, who mediate access to work and pay extremely low daily wages—sometimes under €20. Living conditions are precarious, with workers housed in temporary shelters, shanties, or abandoned vehicles near agricultural centres such as Paternò. Despite their invisibility and marginal social position, these workers occupy the frontline of the local agro-industrial system. Their relation to the Simeto socio-ecological system (SES) is marked by dependence and marginalisation. Occupying the most precarious positions in the agro-industrial chain, these workers face environmental degradation, unsafe conditions, and economic exploitation. Active mainly in citrus cultivation and seasonal harvesting, they operate within ecosystems already depleted by chemical use and soil exhaustion. Their labour sustains extractive agricultural practices—monoculture, pesticide reliance, and excessive water use—without any real decision-making power. This condition illustrates how biodiversity loss and labour exploitation are intertwined, reflecting the deep social and ecological inequalities that shape the Simeto Valley SES.

Water authorities, organised as irrigation and soil-improvement consortia, play a decisive role in managing access to and distribution of water resources. The largest, the Land Reclamation Consortium No. 9 of Catania, originated in post-war infrastructural interventions aimed at controlling the Simeto River and draining wetlands. Today, its operations are hampered by water shortages and institutional inefficiency. Smaller soil-improvement consortia, by contrast, rely on *water guardians*—local workers responsible for maintaining canals and regulating flow—whose local knowledge and hands-on maintenance make them comparatively more effective. Fieldwork conversations revealed that these water guardians act as de facto mediators between the resource and the farming community. In several informal exchanges, they described the intricate structure of relations that shapes local water distribution, emphasising that their work is not merely technical but also a form of social brokerage aimed at preventing conflicts, ensuring equitable access, and avoiding both waste and abuses. Beyond these relational skills, often described as the ability to “meet everyone needs, their role also depends on an intimate familiarity with the irrigation infrastructure, which in the smaller consortia still reflects a dense and fragmented medieval layout. This situated knowledge constitutes a second defining element of the effectiveness of these consortia and of local water governance. (Pappalardo 2025, fieldnote works).

Water infrastructure owners and managers include both public and private entities such as Enel, the Basin Authority, the Domain Authority, and the Regional Environmental Protection Agency (ARPA). Enel, which owns six hydropower plants along the river, controls most of the weirs and dams and thus acts as a de facto regulator of the water system. Public authorities, despite holding formal regulatory mandates, have struggled to counteract the valley’s ecological degradation, revealing longstanding deficiencies in governance and coordination. This fragmentation, exacerbated by an overly bureaucratised administrative system, emerged clearly during fieldwork. Following repeated drought episodes, a farmer attempting to request an extraordinary water withdrawal described the process with bitterness: “[...] to claim a basic right, to irrigate my own land, I need authorisations from three different offices. Everyone is responsible, and no one is responsible.” Although the regional government had formally enabled exceptional

withdrawals due to severe climatic conditions, the authorisation pathway had effectively become an obstacle course, shaped by overlapping requests, cross-vetoes, and conflicting mandates among the various authorities involved in river and water infrastructure management (Pappalardo 2024, fieldnote works). The configuration of the socio-ecological system (SES) reinforces these imbalances: hydropower operations, river fragmentation, and institutional compartmentalisation shape actors' capacities and priorities, limiting their ability to pursue integrated water management or biodiversity restoration, even where political or administrative willingness exists.

Photovoltaic energy companies and investors. This group includes all companies investing in the various segments of the photovoltaic energy value chain. Specifically, these actors comprise energy utilities, plant developers, and operation and maintenance companies. The socio-ecological system (SES) affects them primarily as the source of solar radiation to be converted into an energy commodity for sale and profit. Yet, on closer examination, these actors are also influenced by the chronic crisis of the local agricultural sector, which has made extensive farmland available at low cost for the development of industrial-scale photovoltaic plants.

Municipalities in the Simeto Valley are deeply affected by the territory's socio-ecological system, which continuously shapes their capacities and priorities. Environmental degradation, water scarcity, agricultural crisis and long-term budget cuts limit administrative action, forcing local governments to operate within conditions of ecological and economic vulnerability. At the same time, civic mobilisation and participatory experiments—such as the societal partner Participatory Presidio and the Simeto River Agreement—challenge municipalities to reorient their governance practices. The pressures and opportunities arising from this complex system compel local administrations to move toward participatory and biodiversity-conscious approaches that recognise ecological interdependence as a foundation for territorial well-being.

Finally, **civil society organisations**—diverse in scale and scope but united by an ethic of territorial stewardship—mobilise in response to the valley's degradation and its conversion into a sacrifice zone for extractive activities. The SES impacts these organisations in two ways: first, as the source of the ecological problems that legitimise their action, and second, as a space where they confront institutional inertia, illicit practices, and competing values that often render them marginal within the formal governance landscape.

Decision-making processes and power relations between relevant actor groups

The decision-making process over the Simeto Valley's socio-ecological system (SES) is mainly shaped by conventional farmers, water infrastructure owners and managers, photovoltaic companies and investors, and local institutions. These actors either make or enable key decisions on land use. Conventional farmers and, more recently, photovoltaic energy companies and investors determine the use and cover of extensive areas of land. As those who own or lease most of the Valley's productive terrain—whether for cultivation or for the installation of photovoltaic plants—these actors directly shape socio-ecological relations, influencing which human and more-than-human communities can inhabit and prosper in specific parts of the Valley. Water infrastructure owners and managers decide on the management and distribution of irrigation water, a resource that sustains agriculture. Local institutions also act as decision enablers, particularly for energy companies investing in photovoltaic infrastructures, since they preside over authorisation and permitting procedures for new plants.

Types of knowledge informing decision-making and biodiversity framing

The types of knowledge related to the biodiversity challenges in the Simeto Valley can be grouped into two broad categories. On one side are profit-oriented knowledge systems, grounded in a capitalist rationale that views the territory and its ecosystems as resources to be exploited for profit. Within this logic, socio-ecological relations are monetised and

translated into assets or liabilities in relation to investment opportunities. Biodiversity protection is not a central concern; it becomes relevant only when mandated by law or regulation. Agroindustry and industrial-scale photovoltaic energy exemplify fields of action shaped by such knowledge types.

On the other side are relational and non-extractive knowledge systems, based on coexistence with the territory and its ecosystems rather than their exploitation. Although these practices also involve agricultural and energy production, they do not prioritise profit-making as their primary rationale. Instead, they are grounded in collective dwelling—communities living among other communities, human and non-human alike. Because they do not rely on commodification or capitalisation of nature, these forms of knowledge are better positioned to legitimise and sustain biodiversity conservation. They are embodied in alternative agriculture initiatives inspired by permaculture, and in community-based renewable energy projects.

It should be noted, however, that these two categories represent ideal types that often coexist and overlap in practice. This is especially true for the second category, where biodiversity-oriented rationalities may coexist with limited, though not insignificant, profit-seeking tendencies. This tension is particularly pronounced in the case of farmers engaged in regenerative agriculture. Although many of them maintain parallel professional careers, they generally regard their relationship with the land and the possibility of growing their own food as both a politically “revolutionary” practice (Garozzo, interview with Giovanni, pseudonym, 27.11.2024) and an economic horizon to be pursued with considerable effort in the hope of eventually achieving an ideal of economic autonomy and full self-sufficiency (Lipari 2024, fieldwork notes).

Ecological functioning of the SES and direct drivers of biodiversity loss

The biodiversity of the Simeto Valley is critically compromised by a combination of interconnected factors. The main drivers include mismanagement of hydraulic infrastructures and flood-control systems, intensive citrus monoculture dependent on pesticides and agrochemicals, the uncontrolled expansion of agro-photovoltaic plants, and weak environmental planning. Together, these pressures have produced desertification, fragmentation, pollution, and the progressive degradation of agro-ecosystems.

Large-scale agriculture, excessive use of fertilisers, urban runoff, and inadequate waste treatment have altered river flows and degraded water quality. Waste mismanagement remains a major issue: scattered dumping, illegal burial, and open burning of domestic and industrial waste create “fire lands,” contaminating soils and groundwater. These practices reflect a broader structural disconnection between urban and rural areas.

The replacement of the historically diversified “Sicilian Garden” model with monoculture has eroded biodiversity, reduced soil resilience, and homogenised citrus landscapes. Recurrent droughts and structural agricultural crises prompt farmers to lease or sell their land to photovoltaic corporations, resulting in “silicon monocultures” with high ecological and social costs. It is worth noticing that there is a widespread perception amongst inhabitants of the Simeto Valley that it is the worsening of ecosystem health, including a reduction in biodiversity, that paved the way to investment in large-scale photovoltaic plants by rendering agriculture increasingly unviable as a business. This, in fact, casts large scale photovoltaic plants as an effect of biodiversity rather than as a cause.

Water resources are further stressed by dam mismanagement, unauthorised withdrawals for citrus irrigation, and illegal wastewater discharges, all of which diminish flows essential to aquatic and migratory species. Land abandonment increases wildfire and desertification risks, while urban expansion and limited public access further entrench the cultural and ecological marginalisation of the Simeto River.

Values underpinning decision-making processes

In the context of the Simeto River Valley, policy and decision-making processes are deeply shaped by a plural and often conflicting value system, reflecting enduring tensions between extractive development models and emerging paradigms of socio-ecological sustainability. At the core of dominant policy orientations lies a narrative resonating with colonial discourses, portraying marginal areas such as the Simeto Valley as “empty spaces”—abandoned, underdeveloped, and in need of modernisation. This framing legitimises external intervention, often justified in the name of efficiency and progress, while reinforcing perceptions of local communities as incapable, backward, or corrupt.

Such narratives have historically supported instrumental and utilitarian values that prioritise agricultural modernisation, resource commodification, and infrastructural expansion (Kaika 2006). Major interventions—such as river canalisation, large-scale hydraulic works, and the diffusion of intensive citrus monocultures—have been implemented through centralised, top-down policies overlooking the ecological complexity and cultural richness of the territory. More recently, the spread of large photovoltaic plants follows the same logic: the land is viewed as marginal and underused and therefore open to exploitation in the name of ecological transition, while continuing to reflect an extractive and technocratic approach to land use.

These dynamics have contributed to long-term socio-ecological degradation and have further alienated communities from their territories. In response, over the past two decades, new actors—ecologically conscious farmers, civic organisations, university-based initiatives, and returning or new rural residents—have mobilised to promote an alternative value framework grounded in relational, regenerative, and intrinsic principles. Within this perspective, biodiversity is not merely a resource but a vital component of identity, memory, and local resilience.

Initiatives such as the Simeto River Agreement and the community-based Ecomuseum embody these shifting values, seeking to institutionalise participatory and place-based forms of governance. Yet, despite their growing legitimacy, these alternative regimes continue to face resistance from dominant institutions. Governance remains conditioned by institutional inertia, power asymmetries, and weak mechanisms for value integration. Nevertheless, these contested arenas sustain the coexistence and potential co-evolution of more inclusive, biodiversity-oriented governance models rooted in local knowledge and ethics of care.

Political, cultural and institutional power dynamics

Political, cultural, and institutional power dynamics in the Simeto Valley case study play a decisive role in shaping what is recognised as legitimate knowledge, which values are privileged, and how governance narratives are constructed. Historically rooted in centralised, top-down policy traditions, local governance has been dominated by technocratic logics and a developmentalist imaginary. These frameworks prioritise technical and scientific expertise—particularly in hydraulic engineering, land-use regulation, and agricultural modernisation—while systematically excluding or devaluing situated forms of knowledge such as local ecological practices, cultural memory, and affective relations with place.

This asymmetry of knowledge mirrors a wider power structure in which efficiency, infrastructural expansion, and resource optimisation are presented as primary solutions to ecological and economic challenges. The longstanding valorisation of river canalisation and water control exemplifies this logic, symbolising progress through the transformation of a historically marginal rural economy. More recently, the proliferation of large-scale photovoltaic installations on agricultural land has reinforced an extractive and technocentric model of land use—promoted as green innovation yet often disconnected from local needs and ecosystems. These projects reproduce post-colonial narratives that frame the Valley as a “void space”—a marginal, underutilised, and even corrupt territory—thereby legitimising external interventions and further disempowering local actors. Interviews revealed that the nimbyism trope is widely used by investors to counteract

opposition or resistance to new photovoltaic plants. In a crucial interview, a local activist explained how the narrative that “opposition [to plants] only defends particularistic interests while harming collective interest in that plants would allegedly boost local development in what is an underdeveloped area” works actually as a rhetorical device delegitimising opponents by alleging their political shortsightedness, while hiding the fact that there no unique way to local development (interview with Salvatore, local activist, 10/01/2025).

Against this backdrop, grassroots initiatives such as the Simeto Ecomuseum and the Contratto di Fiume have emerged as counter-hegemonic efforts to reconfigure territorial governance. These initiatives aim to pluralise environmental decision-making by foregrounding alternative value systems grounded in care, reciprocity, and territorial stewardship. They foster collective learning and knowledge co-production despite structural vulnerabilities, including scarce institutional support and limited formal recognition.

Ultimately, navigating the governance of the Simeto SES requires confronting entrenched power asymmetries and epistemic hierarchies. Although dominant narratives remain resilient, new coalitions of farmers, civic actors, and engaged researchers are gradually opening spaces for more inclusive, place-based, and biodiversity-oriented governance practices.

Embedding the local SES in the high impact sector

In the context of the Simeto Valley, the institutions —conceived as the constellation of norms, rules, bureaucratic procedures, and dominant narratives—play an ambivalent yet decisive role in shaping the governance of the local socio-ecological system (SES). On the one hand, global and European commitments to biodiversity protection have introduced frameworks such as the EU Biodiversity Strategy 2030, intended to harmonise environmental priorities across scales and redirect local governance toward more sustainable and inclusive models. On the other hand, their practical impact remains limited due to the structural weaknesses of local institutions.

Local administrations are characterised by insufficient technical capacity, chronic underfunding, and a lack of strategic vision. These limitations impede their ability to interpret and implement complex supranational agendas, resulting in fragmented policies, implementation delays, and formal rather than substantive adherence to biodiversity objectives. Administrative cultures remain anchored in technocratic and growth-oriented approaches that leave little room for integrated, adaptive, or participatory forms of governance.

This institutional inertia is reinforced by political and cultural factors, including the persistent undervaluation of biodiversity as a collective and relational good. Dominant narratives continue to portray rural and marginal areas such as the Simeto Valley as empty, backward, or underutilised territories—thus legitimising top-down interventions, from large-scale infrastructure projects to industrial photovoltaic installations. Framed as efficient uses of abandoned land, these interventions reproduce extractive logics that neglect local ecological knowledge, social practices, and cultural attachments.

Against this backdrop, grassroots initiatives such as the Simeto Ecomuseum and the River Contract seek to counterbalance institutional shortcomings by fostering collective learning, co-production of knowledge, and place-based environmental governance. Yet their transformative potential remains constrained by weak institutional support and the absence of mechanisms for value integration and democratic accountability. Bridging this gap requires a paradigmatic shift in how institutions conceptualise and implement biodiversity governance—moving beyond compliance-based models toward participatory, relational, and multi-scalar frameworks capable of embedding biodiversity within territorial decision-making.

Economic structures' impact over the SES

In the Simeto Valley case study, economic structures play a decisive role in shaping the local socio-ecological system (SES), profoundly influencing land-use patterns, knowledge systems, and the distribution of power and value. The valley is increasingly defined as a production landscape, where economic activities are subordinated to the imperatives of capital accumulation and large-scale market logics. Two dominant and extractive trends—agro-industrial monocultures and industrial-scale photovoltaic development—are emblematic of this dynamic.

In agriculture, most farmers remain structurally bound to global value chains and large-scale distribution systems. Their production is geared towards standardised, low-priced goods, a model that erodes local autonomy and resilience. In this context, the act of purchasing—largely controlled by retail monopolies—becomes the mechanism through which markets suppress small-scale and diversified production. Fieldwork conversations further revealed how this dynamic operates through the system of intermediaries (*mediatori*) who negotiate between farmers and large distributors. According to several farmers, these intermediaries act with no ethical concern and consistently align with the interests of major retail groups. Their practices not only depress farmgate prices but also contribute to creating the conditions for the failure of small and medium-sized agricultural enterprises, enabling the subsequent acquisition of their land and the gradual reconstruction of new forms of latifundia. (Pappalardo 2025, fieldnote work). The weakening of traditional markets and the marginalisation of alternative circuits, such as direct sales or community-supported agriculture, make it increasingly difficult for new farmers and valley residents engaged in regenerative practices to succeed.

A growing concentration of land ownership further amplifies these inequalities. A “new latifundium” has re-emerged, with a few large landowners controlling hundreds of hectares and dominating local agricultural economies. Their influence extends beyond production, shaping policy priorities, public discourse, and the perception of land as an extractive resource. Fieldwork confirmed how these dynamics unfold across multiple scales. In one interview, a young farmer, who himself manages more than ten hectares, described feeling like a *small farmer* despite his relatively large extension of land. To survive in an increasingly hostile market, he explained, he had been compelled to expand his holdings by gradually acquiring plots from even smaller farmers, those cultivating less than three hectares. This incremental accumulation, he noted, is replicated at higher scales: medium-sized farmers absorb smaller ones, and large landowners then absorb them in turn. The result is a progressive reduction in the number of independent landholders, many of whom either abandon agriculture altogether or become employees of the very companies that purchase their land, perceiving salaried work as more stable than family-based farming. (Pappalardo 2025, fieldnote work). This concentration increases the vulnerability of smallholders, particularly those engaged in citrus monoculture or experimenting with innovative, place-based farming models. Similar mechanisms underpin the expansion of industrial photovoltaics, where financial and energy capital occupy agricultural land in the name of the green transition. Both agro-industrial and photovoltaic systems are reshaping the valley into a site of intensified value extraction, eroding ecological knowledge, local ties, and cultural values. Niche actors such as the Simeto Ecomuseum attempt to counter these dynamics, yet dominant market structures continue to constrain their transformative potential.

Assessment of biodiversity challenge and related biodiversity trends in the high impact sector

The biodiversity challenge in the Simeto Valley is recognised by multiple local actors, yet its assessment and monitoring remain partial, fragmented, and often detached from the socio-ecological context. At the institutional level, biodiversity evaluation is conducted primarily by technical agencies using standardised quantitative indicators derived from national and EU frameworks, such as ISPRA (Superior Institute of Environmental Protection and Research) and the Habitats and Birds Directives. However, these methods frequently

fail to capture local complexities, particularly those linked to agricultural practices, land-use transformations, and the erosion of traditional ecological knowledge.

In contrast, niche actors, including our societal partner, are experimenting with more inclusive and participatory forms of biodiversity monitoring. These initiatives encompass community mapping, shared field observations, citizen science, and the co-production of knowledge among citizens, farmers, and researchers. They generate a more situated and relational understanding of biodiversity, one often challenging dominant narratives grounded in efficiency and extractive logics.

Despite the existence of European policy frameworks advocating the integration of local knowledge into decision-making—such as the EU Biodiversity Strategy 2030—their influence on institutional practice remains limited. Data fragmentation, weak inter-institutional coordination, and the lack of formal recognition for bottom-up initiatives continue to undermine the effectiveness of biodiversity monitoring. Consequently, a dual system persists one based on detached technical indicators, and another emerging from efforts to anchor biodiversity assessment within the everyday social and ecological life of the Valley.

Current enablers and barriers for transformative change

The current socio-ecological system (SES) of the Simeto Valley simultaneously enables and constrains transformative innovation, revealing a complex interplay between opportunities and barriers. The territory remains deeply conditioned by entrenched extractive dynamics: large-scale agro-industrial monocultures and industrial photovoltaic plants define it as a “production site” subordinated to capital-intensive logics. This economic structure, reinforced by processes of land concentration and the resurgence of new latifundia, limits the autonomy of farmers and communities. Producers—whether tied to citrus monocultures or engaged in experimental farming—are subordinated to global value chains and retail monopolies that capture most of the economic value. These mechanisms act as systemic barriers, eroding ecological knowledge, fragmenting communities, and weakening the connection between production, culture, and territory. Institutional conditions further consolidate these constraints. Local institutions are fragmented, under-resourced, and often unable to translate European frameworks or national plans into locally adapted strategies. Ineffective governance structures allow external actors—large landowners, agro-industrial operators, and energy investors—to consolidate their dominance. This governance vacuum not only weakens institutional responsiveness but also legitimises narratives of marginality, portraying the Valley as underutilised and therefore open to external exploitation.

Within this constrained environment, several opportunities for transformative change nonetheless emerge. Niche innovators such as the Simeto Ecomuseum and local civic networks are experimenting with alternative governance practices, relational economies, and community-based management of common goods. These initiatives foster social learning, strengthen local capacities, and re-embed knowledge and values that counter extractive logics. The Valley’s biodiversity, cultural heritage, and strong sense of place attachment among residents represent further levers for transformation, sustaining narratives that link ecological care with social justice.

A key example of this counter-movement is the collaborative mapping of photovoltaic plants, developed through partnerships among researchers, citizens, and the societal partner. This participatory process makes visible the scale, distribution, and socio-ecological impacts of industrial photovoltaic installations across the Valley. By transforming technical data into collective knowledge, mapping reclaims public agency over land-use decisions and exposes the unequal distribution of costs and benefits associated with the energy transition. It functions both as a diagnostic and a political tool, enabling communities and municipalities to envision alternative, biodiversity-conscious pathways for renewable energy development.

Building on this foundation of collective awareness, Renewable Energy Communities (RECs) have emerged as a complementary and proactive response. Developed through collaboration among citizens, small producers, and local institutions, they reframe energy transition around principles of equity, participation, and territorial regeneration. RECs integrate social and ecological objectives, democratising energy governance while reducing dependence on external investors. By redistributing energy benefits locally and reinvesting surpluses in community welfare and ecological restoration, they demonstrate how renewable energy can strengthen rather than erode socio-ecological relations. Together, participatory mapping and RECs illustrate how territorial knowledge and civic innovation can converge to reclaim control over the energy transition and embed it within a broader agenda of environmental justice and biodiversity protection.

In this light, the Simeto SES can be described as both restrictive and generative: restrictive because economic and institutional configurations perpetuate dependency and value extraction; generative because it nurtures resilient niches of innovation capable of reorienting development trajectories. The Valley's transformative potential ultimately lies in consolidating these niches, enhancing institutional capacity, and building bridges between local knowledge systems and multi-scalar policy frameworks. The central challenge is whether these opportunities can overcome entrenched power asymmetries and reconfigure the Valley from a site of extraction into a laboratory of socio-ecological innovation.

5.2 Vision: What alternative SES could be?

Alternative imaginaries concerning the socio-ecological system (SES) in the Simeto Valley revolve around three interrelated domains: agriculture, energy, and water. These sectors form the analytical core of the case study and are deeply entangled with power asymmetries, marginalised knowledge systems, and regenerative potentials operating across both formal institutions and informal practices. A profound rethinking of these domains is urgently needed, as they are the spaces where the human–nature divide has produced the deepest fractures. The following sections explore how alternative SES visions emerge through socio-ecological relations, narratives, and frames of meaning, illustrating the BIOTraCes principles of pluralising, empowering, politicising, and embedding transformative practices within the local socio-ecological context.

Agriculture: Planting Past and Future

In the agricultural domain, alternative visions are articulated through agroecological experiences that contrast sharply with conventional monocultural practices. These imaginaries integrate multiple knowledge systems and ethical values that position biodiversity as a central socio-ecological principle. They express a re-embedding of humans within ecosystems, rejecting framings of the environment as a mere tool of production. This process of integration exemplifies the pluralising principle, as it brings together scientific, experiential, and traditional knowledges to reframe agriculture as a shared socio-ecological practice.

This reintegration unfolds through both material and ethical choices, shaping new configurations of human–nature relations and alternative SES narratives. Regenerative agricultural practices prioritise renewed relationships with soil, water, animals, and vegetation, reversing the extractive logic of monoculture. In contrast to citrus farming only intended to maximise nutrient uptake, regenerative approaches aim to return nutrients to the soil, shifting from extraction to reciprocity. Such reciprocity and care practices directly align with the empowering principle, strengthening farmers' agency to regenerate ecosystems and redefine their roles within the SES.

These practices also reveal a different relationship to time, enacted through specific spatial and temporal strategies. By reintroducing pre-monoculture species and restoring the "Sicilian Garden"—a diversified, year-round agroecosystem designed for subsistence—farmers perform an ecological and political act of selective remembrance, bringing a "good

past” into present practice. Simultaneously, they look forward by selecting species resilient to climate stress, responding to rising temperatures and water scarcity. These practices thus traverse past, present, and future, reweaving the fractured relationship between nature and humans. Through such regenerative cultivation, new interspecies relations emerge, engaging a wider range of non-human actors and enriching the SES with plural and dynamic relations. In doing so, these agricultural practices embed new socio-ecological ethics in everyday action, contributing to the long-term institutionalisation of biodiversity-friendly governance.

Energy

Energy has long been a structural dimension of the Simeto Valley, dominated by hydroelectric and, more recently, agro-photovoltaic infrastructures. Both forms of production have profoundly shaped the landscape, especially along the river axis, and reflect a legacy of technocratic engineering rooted in urbanisation and agro-industrial modernisation. The dominant framing views water as a resource and the river as a servant of human activity, privileging economic utility over ecological continuity.

Emerging alternative narratives challenge this utilitarian paradigm. While the shift toward renewable energy is widely acknowledged, the ecological legitimacy of existing infrastructures is questioned. Hydroelectric installations disrupt river connectivity, harm aquatic biodiversity, and externalise environmental costs to non-human actors. In this light, energy transition cannot proceed “at any cost”: its pursuit must be ecologically embedded and socially just.

Hydropower also exposes key governance asymmetries. The ENEL corporation—which manages most hydroelectric plants—exerts a dominant influence over the river’s governance, often in conflict with farmers and local institutions. Although formal authority lies with the River Basin Authority, ENEL’s power renders governance opaque and exclusionary. This reflects the necessity of politicising governance processes, a BIOTraCes principle aimed at confronting power asymmetries and fostering accountability in resource management. An alternative SES narrative reframes the river as a socio-ecological actor and energy as a co-produced good, aligning technological innovation with territorial care. This vision calls for hybrid, inclusive governance arrangements, where democratic participation is expanded to include civil society, farmers, associations, municipalities, and institutional authorities. Such inclusive arrangements illustrate the embedding principle, as they institutionalise participatory governance mechanisms that ensure long-term ecological justice.

Similar concerns surround photovoltaic and agro-photovoltaic installations, whose rapid proliferation—driven by the crisis of conventional agriculture and the entry of multinational corporations—has deeply transformed the landscape. These developments raise issues of democratic legitimacy, territorial extractivism, and decision-making opacity. Yet, through participatory research and collective mapping, local communities are gaining agency, demanding greater accountability from institutions and challenging dominant energy narratives. This empowerment of local actors reflects a practical application of the empowering principle, as knowledge co-production translates into community capacity to influence territorial governance. Within the Simeto Valley, energy transitions are thus inseparable from broader struggles for territorial justice, where power, ecology, and democracy intersect.

(Not Only) Water

An alternative SES vision necessarily includes water, though it is essential to distinguish between water and the river as distinct, yet interdependent non-human entities that co-constitute the Valley’s socio-ecological fabric. Dominant discourses tend to conflate them, reducing the river to mere “flowing water” and erasing its socio-ecological complexity. Such reductionism excludes other inhabitants—animals, plants, and human communities—from the symbolic and material dimensions of the river’s life.

Restoring the autonomy of the river as a subject, rather than a resource, means recognising its central ecological and cultural role, which is foundational for inclusive and regenerative processes. Focusing on water, an alternative vision highlights the informal networks that structure its use and access. Water provision across the Valley relies on consortia and micro-infrastructures sustained by everyday relationships among landowners, technicians, and farmers. These informal systems form a territorial knowledge network, an invisible yet vital socio-ecological infrastructure. This recognition of informal governance pluralises environmental knowledge, a direct application of the BIOTraCes principle of pluralising.

In an alternative SES, this distributed intelligence could be acknowledged as a collective actor, enriching plural environmental governance and producing place-based, situated knowledge crucial for adaptation to water crises. Regarding the Simeto River, an alternative SES framework must recognise power asymmetries and knowledge pluralisation. Grounding a new SES means understanding the river as a living entity, embedded in human and non-human relations. This entails rebuilding connections based on non-extractive principles and embracing its multiplicity. Conventional conservation frameworks, such as protected areas or Natura 2000 sites, remain insufficient to capture this relational ecology. Politicising environmental governance thus becomes essential to confront institutional inertia and address the hidden power dynamics shaping river management.

A broader biodiversity narrative must instead view the Simeto as a living common, connecting communities, livelihoods, and species—including marginalised and criminalised practices like fishing and riverine herding. Archival and ethnographic research shows how such traditional ecological knowledge has historically tied communities to the river and continues to persist. Recognising these practices as part of the living heritage of the SES affirms that biodiversity regeneration also depends on memory, reciprocity, and coexistence. Embedding these values within participatory institutions reflects the BIOTraCes principle of embedding, ensuring long-term transformative integration of biodiversity and governance.

Concluding remarks

The alternative SES visions emerging in the Simeto Valley articulate plural pathways toward transformative change. Through agroecological innovation, energy democracy, and water commons, local actors demonstrate that biodiversity regeneration is inseparable from participatory governance and collective learning. Together, these practices enact the BIOTraCes principles: they pluralise knowledge, empower local agency, politicise socio-ecological conflicts, and embed new forms of democratic governance. Rooted in care, reciprocity, and memory, they reveal how transformative change can be grounded in everyday practices, aligning ecological restoration with social justice and cultural renewal.

5.3 Discussion

The analysis of the socio-ecological system (SES) of the Simeto Valley highlights the complexity of interactions between agriculture, energy, water, institutions, and local communities, as well as the persistent tensions between extractive dynamics and emerging regenerative practices. At the heart of this SES lies a structural contradiction: while conventional agriculture, hydraulic infrastructures, and the expansion of photovoltaic energy reproduce logics of extraction and commodification of the territory, niche actors—including agroecological farmers, civil society organisations, and community initiatives—seek to reconfigure human–nature relations along more inclusive, care-oriented, and biodiversity-enhancing lines. The result is a contested socio-ecological landscape, where divergent values, knowledge systems, and governance arrangements both constrain and enable opportunities for transformative change.

A first key finding concerns the dominance of monocultural agriculture and its far-reaching socio-ecological implications. The so-called conventional farmers, who still represent the majority in the Valley, remain tied to the production model established in the post-war period. Citrus monoculture—once the economic engine of the region—continues, despite its growing economic and climatic unsustainability, to shape the Valley's landscape, practices, and multispecies relations. The SES thus remains anchored to this model, which exerts strong ecological impacts through chemical fertilisers, pesticides, and intensive irrigation. Evidence indicates that these practices perpetuate a cycle of soil depletion, disconnection from the river, and increasing vulnerability. This model also entrenches dependence on subsidies, accessible mainly to large producers who benefit from greater technical and bureaucratic capacity, thereby reinforcing local power asymmetries. In addition, large producers depend heavily on informal and exploited migrant labour, reproducing systems of social and ecological exploitation. The replacement of the diversified Sicilian Garden with monocultures has therefore entailed not only ecological degradation but also a cultural rupture, eroding relational modes of inhabiting the landscape and weakening practices of care.

By contrast, farmers adopting alternative practices—often younger and managing smaller plots—experiment with organic, regenerative, and diversified cultivation that challenges the dominance of monocultures. Although limited in scale, these initiatives act as socio-ecological innovations with the potential to transform the broader SES. They express inter- and multispecies ethics, conceiving agriculture as a regenerative practice grounded in reciprocity. In these experiences, the river acquires renewed importance as a non-human actor: rather than being treated as a resource to be exploited, it is recognised as a living element that sustains both biodiversity and community resilience. This worldview materialises in practices such as open-soil irrigation systems inspired by traditional saje channels, demonstrating how plural knowledge systems can support biodiversity regeneration and empower local agency.

Water more broadly constitutes a second central axis of the SES and one of its most contested fields. The mid-twentieth-century hydraulic infrastructures that regulate the Simeto River continue to shape relationships between humans, ecosystems, and institutions. The functioning of irrigation consortia and the network of water wardens reveals both the importance of governance structures and the extent of their informal operation. Smaller consortia, maintaining close relations with farmers, tend to ensure more effective management and maintenance than the larger Consorzio di Bonifica No. 9, whose bureaucracy often limits responsiveness to local needs. Alongside these bodies, ENEL's control over hydroelectric plants exemplifies how large economic actors dominate the management of natural resources, prioritising energy production over ecological continuity. These dynamics expose institutional weaknesses and the lack of participatory river governance, evidencing the need to politicise water management and embed plural governance models that integrate local and ecological knowledge.

The energy sector constitutes a third arena where extractive logics and transformative possibilities coexist. Large-scale hydroelectric and agro-photovoltaic plants, although framed as green solutions, often reproduce forms of ecological exploitation and territorial impoverishment. Hydroelectric infrastructure disrupts river continuity, while industrial photovoltaic plants convert farmland into silicon monocultures, intensifying land abandonment and agricultural crisis. These developments are justified by narratives depicting the Valley as an empty or backward territory available for large-scale interventions in the name of ecological transition. Yet these processes are increasingly contested by grassroots networks, civic organisations, and participatory research initiatives. Through actions such as community mapping of energy infrastructures, local actors are empowered to challenge extractive models, claim energy democracy, and foster transformative governance aligned with biodiversity protection.

Across these sectors, the findings confirm that narratives, values, and knowledge are decisive in shaping governance and enabling transformative change. Dominant discourses—rooted in modernisation paradigms—portray the Valley as underutilised or marginal, legitimising external interventions and extractive policies. By contrast, counter-

narratives articulated by farmers, associations, and civic movements emphasise care, memory, and identity, framing biodiversity as both a social and ecological good. This conflict of values lies at the heart of the SES: institutional inertia and power asymmetries sustain the status quo, while grassroots actors attempt to pluralise governance and embed more inclusive, care-based approaches.

The transformative potential of the Simeto SES is therefore ambivalent. Deeply entrenched economic and institutional structures continue to constrain innovation: land concentration reinforces inequality; global market dependencies restrict autonomy; and fragmented institutions fail to integrate local knowledge. Yet niches of innovation—including the Simeto Ecomuseum, Presidio, small agroecological farms, and community energy projects—demonstrate viable alternatives. These initiatives foster collective learning, place attachment, and plural knowledge exchange, offering tangible examples of the BIOTraCes principles in practice: pluralising knowledge, empowering communities, politicising ecological challenges, and embedding participatory governance.

Ultimately, the Simeto SES confirms that socio-ecological systems are contested arenas where power, knowledge, and values are constantly negotiated. Narratives of territorial marginality obscure ongoing social and environmental injustices, legitimising extractive interventions. Yet alternative framings—rooted in care, reciprocity, and biodiversity—are re-emerging from below, reshaping collective imaginaries of transformation. Institutional inaction remains a major obstacle to transformative change, but grassroots innovation continues to move through informal channels that sustain democratic experimentation.

Concluding remarks

The Simeto Valley SES exemplifies the tension between extractive dynamics and regenerative alternatives, between institutional inertia and grassroots innovation, and between dominant narratives of emptiness and emerging narratives of care and biodiversity. Agriculture, energy, and water appear not merely as economic sectors but as arenas of socio-ecological negotiation, where future pathways are co-produced. Strengthening innovation niches, addressing structural inequalities, and creating participatory governance arrangements that value biodiversity, local knowledge, and care are essential steps toward transformative change in the Valley and beyond.

6. Locally tested interventions

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6.1 Evaluation of strategies in action

Building on the socio-ecological system (SES) analysis, which revealed both structural constraints and emerging spaces for collaboration, this section presents the locally tested interventions developed through the partnership between the UNICT research team and the Participatory Praesidium of the Simeto River Agreement. These interventions did not arise from a linear plan but from an adaptive process responding to the valley's ecological and institutional dynamics. They translate the analytical insights of the SES into collective experimentation—through mapping, cultural events, and community energy initiatives—that tested how participatory governance can foster biodiversity stewardship and strengthen local capacities for transformative action.

The strategies and interventions implemented through the participatory action research (PAR) process in the Simeto Valley constitute concrete efforts to address the challenge of biodiversity regeneration. As detailed in other sections, the Valley remains exposed to multiple pressures—intensive agriculture, fragmented water management, the broken relationship with the river, and the unregulated expansion of photovoltaic plants. Within this context, ordinary administration does not include explicit biodiversity policies, nor is there a widespread institutional sensitivity to the issue.

One of the main challenges in planning strategies and interventions with the Societal Partner, the Participatory Praesidium, concerns precisely this gap. While environmental and ecological concerns have long been at the centre of the Presidio's activities, the process of placing biodiversity at the core of policy action and embedding it as a transformative value is still an objective to be achieved. This section critically evaluates ongoing strategies along three dimensions: their transformative change potential, their capacity to address indirect drivers of biodiversity loss, and their ability to replicate enabling factors while mitigating disruptors.

Transformative change potential

The strategies observed in the Simeto Valley reveal a persistent tension between niche innovations and consolidated socio-ecological arrangements. On one side, agroecological practices by local farmer-inhabitants, the Simeto Ecomuseum, and the participatory mapping of energy infrastructures provide tangible foundations for transformative change. These evolving practices, though limited in scale, have begun to modify ecological relations and promote biodiversity regeneration by proposing alternative models to extractive paradigms and territorial marginalisation.

However, their transformative potential remains constrained by structural and political limitations. Agroecological initiatives depend on informal networks and interpersonal collaboration, functioning as flexible socio-ecological infrastructures but lacking long-term stability. The continuity of these efforts is undermined by their marginal position within a territory still dominated by intensive agriculture and soil-exploiting practices.

Similarly, the Simeto Ecomuseum, despite its active presence, faces obstacles due to the absence of formal institutional recognition by the Sicilian Region. This uncertainty limits its capacity to consolidate as a transformative territorial actor within the Presidio's broader organisational framework. The same applies to the energy-mapping initiative, which holds high potential for community empowerment and public awareness but requires stronger institutional adoption and durable diffusion mechanisms to ensure continuity beyond the BIOTraCes project timeframe.

Management of indirect drivers of biodiversity loss

A second evaluative dimension concerns the ability of existing strategies to tackle the indirect drivers of biodiversity loss. In the Simeto context, these drivers are primarily socio-economic and political: dependence on global citrus markets, institutional weaknesses in water governance, external energy pressures, and the absence of integrated territorial planning. Through a guided reflection, participants of FG1³⁶ identified how biodiversity decline stems from historically embedded cultural, economic, and governance dynamics. A first theme concerns waste management, framed as both a cultural and ecological issue. The widespread practice of burning agricultural and household waste reflects deeply rooted habits and limited environmental responsibility, symbolising a persistent disconnection between care and cultivation. A second issue relates to water inequality. Access to irrigation water is fragmented and often privatised, reinforcing hierarchies among producers. Those able to afford private wells benefit from secure access, while small farmers remain vulnerable to droughts and scarcity, perpetuating a cycle that strengthens monocultural dependency. Monoculture itself—particularly citrus farming—was repeatedly described as both a symbol of identity and a driver of ecological fragility, reliant on pesticides and exposed to market volatility. Participants contrasted this with memories of the traditional “Sicilian Garden,” a diversified and resilient model now deemed economically obsolete. As one participant stated: “The classic Sicilian garden is the kind that, for those still lucky enough to have one today, saved you a trip to the greengrocer [...] ‘I grow my own eggplants’ (FG1). This quotation reveals how the perspective of self-sufficiency was crucial within the communities, and how it was ‘materialized’ through the agricultural and food biodiversity of the Sicilian garden. Finally, participants noted a deeper cultural disconnection from rural spaces and from the Simeto River, which has become invisible and inaccessible. Urban expansion, land privatisation, and pollution have reinforced this alienation, transforming the river into an absent presence in everyday life. This process was briefly but effectively described by one of the participants: “*What has been lost is a form of connection between the city and the countryside. My grandfather had small plots of land that allowed him to survive. Today you buy cheap pasta.*” This distancing has transformed the countryside into a functional periphery: *‘It becomes a periphery that can be used to dump waste, to do whatever one wants with it’* (FG1). These reflections carried on during FG1 demonstrate that the indirect drivers of biodiversity loss are embedded in cultural practices, social inequalities, and economic dependencies. Addressing them requires not only ecological restoration but also cultural regeneration, equitable access to resources, and the collective re-embedding of ecosystems as shared heritage. These initiatives are largely part of the societal partner action plan through a variety of tools such as environmental education in school or specific financed projects addressing cultural and ecological issues. Key examples include the *LIFE SimetoRES* project, which advances blue-green infrastructures and climate-change adaptation or school-based programmes such as Open Science and Students for Simeto, which integrate civic water monitoring with artistic and environmental education. Additionally, the *Biodistretto del Simeto*, though not a funded project, acts as a strategic network that connects farmers, promotes solidarity-based purchasing, and strengthens community participation around sustainable agriculture. Together, these initiatives foster new alliances among schools, farmers, municipalities, and civic groups, consolidating the societal partner’s territorial engagement. However, the possibility to manage the indirect drivers strongly lays on the continuity of the territorial and political action, which at the present moment represents a challenge for the societal partner’s future planning.

³⁶ It is important to clarify that two different focus group were held on March the 15th 2025. The first one (FG1) was focused on the indirect drivers of biodiversity loss while the second one (FG2) was about inconsistencies between regenerative policies across different levels of government and governance. The participants in FG1 and FG2 were primarily, though not exclusively, long-standing members and activists of the societal partner, several of whom also hold responsibilities within the governing board of the Participatory Presidium. All participants affiliated with the Presidio have played various roles over the past ten years, both within the societal partner and in public institutions, thereby engaging with territorial projects from different institutional positions.

Replication of enablers and reduction of disruptors

The strategies developed within the Presidio's network seek to replicate enabling factors for biodiversity regeneration and foster transformative change, but this process faces both political and practical challenges. From a political perspective, the main gap lies in the limited centrality of biodiversity in local policy agendas. Biodiversity remains perceived largely as a scientific or environmental issue, rather than a political and social priority. This hinders both the replication of enablers and the mitigation of disruptors, as transformative interventions require explicit political framing and institutional support. From a practical and organisational perspective, the Presidio's dependence on project-based funding mechanisms constrains continuity. Its activities rely on the availability of temporary public or private funding calls at multiple scales, producing structural discontinuity. This fragmentation undermines the consolidation of long-term processes such as social-network building, community empowerment, and participatory control over energy-related land transformations. Sustained continuity of engagement is essential to consolidate enablers and reduce disruptors. Without stable resources, even the most promising interventions remain vulnerable to interruption, limiting their capacity to trigger systemic and lasting transformations.

Despite these barriers, the case study does reveal meaningful contributions to collective learning and the emergence of a gradual mindset shift. Over the past two decades, a slow but steady cultural reorientation has been taking place: an increasing segment of the community, in particularly younger generations has begun to view the Simeto Valley and its river not as marginal or expendable spaces, but as territories requiring proactive care and protection. This shift has been nurtured through a plurality of collective practices, including mapping activities, rediscovery of local heritage, and participatory explorations, which have supported shared processes of re-learning and re-imagining the territory. While this transformation remains long-term, non-linear, and frequently challenged by persistent socio-cultural constraints, it nonetheless indicates that seeds of change are already rooted in everyday practices and community engagement.

Concluding remarks

The strategies implemented through participatory governance in the Simeto Valley demonstrate significant efforts to integrate biodiversity into territorial practice, yet they remain constrained by limited institutional recognition, funding discontinuity, and entrenched cultural patterns. Their transformative potential lies in fostering community empowerment, reconnecting culture and ecology, and embedding biodiversity in local governance. To enhance replication and impact, it is essential to strengthen institutional commitment, secure long-term support, and politicise biodiversity as a shared and strategic priority. These steps would consolidate the conditions for transformative change within the Valley's socio-ecological system.

6.2 Enablers and disruptors

Processes of biodiversity regeneration in the Simeto Valley do not occur in a vacuum but are embedded within a complex social, economic, and political landscape. Local initiatives seeking to integrate biodiversity as both a value and a practice, and to promote non-anthropocentric uses of the territory, face a combination of enabling factors that support their development and disruptive forces that limit their effectiveness or long-term sustainability.

This section analyses these dynamics along four axes: (1) the relationship between the local agenda and economic-sector interests; (2) the capacity to replicate enablers; (3) the ability to contain disruptors; and (4) the influence of national and European policies on local strategies.

Attunement and mismatch between the local agenda and economic interests

The local agenda for biodiversity regeneration is not yet supported by public institutions or local authorities. Instead, it is driven by civic networks, associations, and groups of alternative farmers. This agenda revolves around three main practices:

- Agroecological production, including crop diversification and the valorisation of landscape heritage.
- Cultural and ecological reconnection between the river and local communities, through both material interventions and immaterial practices led by the Simeto Ecomuseum.
- Opposition to agricultural desertification caused by the uncontrolled spread of agro-photovoltaic installations.

Although these practices resonate to some extent with broader European strategies for biodiversity regeneration, such as the Farm to Fork Strategy, they remain only partially aligned, as national and transnational policy frameworks continue to prioritise high-impact sectors. This partial mismatch, further discussed in the *Relation with policies* section, shapes how local initiatives interact with dominant economic trajectories. These objectives frequently collide with the interests of dominant economic sectors. Industrial citrus farming, though in decline, remains the backbone of local production and continues to favour monocultures oriented toward external markets, with severe impacts on biodiversity. Likewise, large energy corporations promote extensive agro-photovoltaic developments on agricultural land, accelerating ecological and social impoverishment.

However, a more nuanced picture emerges when considering smaller, locally rooted actors. Informal farmer networks supported by the Participatory Praesidium are advancing agroecological diversification and short food supply chains that directly strengthen biodiversity. Similarly, Renewable Energy Communities (RECs) are fostering local energy autonomy, aligning energy transition goals with biodiversity regeneration. Thus, while the biodiversity agenda remains marginal relative to globalised economic trajectories, it is substantively expressed through localised practices of smaller actors whose actions embody transformative potential.

Capacity to replicate enablers

Key enabling factors in the Simeto Valley include formal and informal civic networks, the Simeto Ecomuseum, and the emergence of regenerative agriculture. All are closely interlinked with the activities of the Presidio, which engages directly or indirectly through both permanent structures and project-based initiatives. Despite external and internal limitations, the Presidio strategically uses these enablers as launching platforms for new forms of civic participation and territorial co-management. An illustrative example is the Simeto Biodistrict, a network of small organic farmers coordinated with Presidio's support. The Presidio provides organisational and logistical resources to consolidate the Biodistrict and scale up its scope, thus enhancing the territorial reach of agroecological innovation. Similarly, the Ecomuseum and renewable energy communities act as laboratories of community empowerment, strengthening connections among associations, citizens, and local administrations. However, replicating these enablers remains difficult due to limited economic and temporal resources. Expansion depends largely on building alliances with institutions, universities, and external networks capable of providing visibility, funding, and recognition. Without such alliances, the sustainability and scaling-up of enablers remain uncertain.

Capacity to address disruptors

Several disruptive factors hinder the development of regenerative biodiversity strategies: the ecological crisis, farmland abandonment, disconnection from the river, increasing infrastructural control over water and agriculture, the pressure of external energy investors, and the weakness of local institutions. These long-term structural forces render the socio-ecological system fragile and constrain transformative interventions. The Presidio's capacity to counter these disruptors is fragmented. This results from limited financial and human resources, the absence of institutional interlocutors, and the project-based funding model on which it relies. Without stable financial continuity or long-term

planning tools, the Presidio struggles to engage disruptors structurally, limiting its ability to pursue durable transformative change.

Relation with policies

A major challenge for the Presidio lies in navigating the European policy framework for biodiversity and ecological transition. This issue was explored during FG2 of 15th March 2025, revealing key tensions between local visions and institutional instruments.

The 2015 Simeto River flood illustrates these tensions. The abrupt opening of the Ancipa dam, without prior warning, caused severe damage to local farmers and herders. The Presidio's response—organising a public assembly with farmers, ENEL, and the University of Catania—led to the idea of submitting a LIFE Programme proposal for participatory flood-management solutions. Although the project was reformulated after rejection, shifting its focus toward urban drainage infrastructure, the case revealed the disconnect between the transformative potential of EU programmes and their practical local implementation. A second example is the *Patto di Fiume Simeto* (Simeto River Agreement), inspired by the EU Water Framework Directive (2000/60/EC) and the UN 2030 Agenda. The Agreement sought to politicise and embed biodiversity governance through deliberative democracy and local knowledge. It empowered the Presidio to participate directly in the Assembly and Executive Commission, making local communities' constituent actors in territorial policy. However, the absence of regional legislation on participation limited this innovation: the Presidio's representation remained minoritarian, and the intended Laboratory—a space for autonomous operation—never materialised. Despite its recognition as an institutional innovation, the Simeto River Agreement (*Patto di Fiume Simeto*) remains a fragile experiment, constrained by the lack of enabling legal and financial frameworks. These cases highlight the gap between European directives and local implementation, underscoring the need for institutional structures capable of embedding participatory and bottom-up innovations within long-term governance.

Concluding remarks

The analysis of enablers and disruptors confirms that biodiversity regeneration in the Simeto Valley is a deeply political and contested process. Enablers—rooted in bottom-up networks, agroecological practices, and participatory governance—illustrate pathways of transformative change. Disruptors, however, remain largely structural, driven by global markets, institutional inertia, and concentrated power. Strengthening alliances, ensuring policy coherence, and embedding community-led governance within formal institutional frameworks are essential to consolidating biodiversity as a shared territorial value and advancing the BIOTraCes vision of empowered and plural socio-ecological transformation.

6.3 Failed and successful practices

Successful practices

In contrast, several successful or promising practices have emerged, each contributing to biodiversity regeneration and participatory socio-ecological transformation through different intervention domains. The first domain concerns the valorisation of cultural and ecological heritage. The establishment of the Simeto Ecomuseum in 2019 exemplifies how the recovery of collective memory—both material and immaterial—can be intertwined with the revitalisation of local economies and ecosystem care. Through participatory action research conducted by the BIOTraCes UNICT team, traditional techniques such as fishing and livestock raising have been reinterpreted as components of the valley's historical socio-ecological system, reframing biodiversity as a social and cultural relation rather than a purely biological indicator. Fieldwork and archival research revealed, in particular, how fishing, today practised only as a recreational activity, with no economic or subsistence purpose, historically constituted a dense relational practice through which local communities engaged with the river, learned its flows, and navigated its seasonal rhythms.

River fishing also created a tangible link between the fluvial area and nearby urban centres, where dedicated markets existed specifically for river fish. The gradual disappearance of this practice marks a widening distance between communities and the river, signalling not only cultural loss but also ecological degradation, as fishing has ceased largely due to the declining health of the waters. Similarly, livestock breeding once embodied a continuous relational interplay between humans, animals, and the riverine landscape: herders moved daily in search of water sources, possessed deep knowledge of spontaneous plant species, and lived for extended periods along the riverbanks in lightweight, temporary shelters built from *Arundo donax*, the typical river cane. These practices, therefore, reveal how biodiversity was historically embedded in everyday life, shaping social worlds as much as ecological ones. Building on this renewed understanding of the valley's socio-ecological past, the collaboration between UNICT researchers and the Ecomuseum has generated new spaces for public engagement and knowledge transmission.

This collaboration culminated in a permanent exhibition inaugurated in May 2025 at the Presidio headquarters in Paternò, presenting archival and ethnographic materials that illustrate human–non-human relationships along the Simeto River since the nineteenth century. The second domain concerns alternative agriculture. New farmers inspired by permaculture and agroecology are pioneering low-cost, small-scale innovations that counteract monocultural dependency. By creating micro-wetlands, reinstating open soil irrigation channels based on the traditional *saje* system, and eliminating pesticide use, these practices regenerate soil health and enhance biodiversity. The cultivation of oranges, olives, and nitrogen-fixing species reactivates the Sicilian Garden model, reconnecting contemporary agriculture to traditional ecological knowledge. Although currently limited in scale, these initiatives demonstrate the transformative potential of relational networks that link farming, biodiversity, and community life, reconstituting the Valley's socio-ecological fabric. The third domain involves scalable bottom-up innovations in the renewable energy sector. Since 2023, three Renewable Energy Communities (RECs) have been established, promoting the democratisation of energy governance through inclusive participation of citizens, associations, enterprises, and institutions. Parallel to this, the participatory mapping of agro-photovoltaic infrastructures, developed within BIOTraCes, enables collective analysis of how energy projects reshape the Valley's landscapes and livelihoods.

Grassroots organisations and individual participants collaborated in developing a critical and collaborative map of PV infrastructures and their interactions with biodiversity and cultural and archaeological heritage. Between September 2024 and January 2025, several informal meetings and two structured workshops were held to design this mapping process. Participants decided collectively to integrate their local ecological and territorial knowledge into a georeferenced dataset. From January 2025 onwards, multiple rounds of collaborative GIS-based surveys were conducted in the municipalities of Troina and Belpasso, in cooperation with Legambiente Ancipa and Sciara Viva. These activities exemplified the BIOTraCes principle of embedding participatory governance in research practice, transforming mapping into a tool for community empowerment and evidence-based advocacy.

This process generates shared knowledge and advocacy tools, addressing the absence of participatory mechanisms and weak institutional oversight in land-use planning. By revealing patterns of land expropriation, agricultural crisis, and ecological degradation, the initiative reinforces territorial awareness and strengthens community agency in negotiating the Valley's energy transition. Together, these bottom-up innovations demonstrate how participatory governance can bridge energy, ecology, and democracy, restoring public engagement in environmental decision-making while aligning energy transition goals with biodiversity conservation and local well-being.

Failed practices

Within the Simeto Valley socio-ecological system, several failed practices illustrate the challenges of achieving durable transformative change and embedding participatory governance in biodiversity strategies. A first case concerns the Simeto Ecomuseum, which,

despite its strong potential as an institutional and cultural innovator, faces internal challenges in communication and coordination. The Ecomuseum's structure includes a rich territorial network of antennas—local referents, experts, and nodal points across multiple municipalities—but its communication channels remain fragmented. This weakness is reflected in the irregular frequency and uneven participation in its itineraries and initiatives.

At the same time, the Ecomuseum regularly activates collective processes, such as community mapping, educational workshops, and co-designed territorial itineraries that engage residents in interpreting landscapes, sharing ecological knowledge, and planning forms of river and land stewardship. These practices link cultural heritage with biodiversity restoration by fostering shared learning and reinforcing community responsibility toward the Simeto Valley. Ecomuseum activities prove most successful when they are co-organised through participatory and collective processes³⁷, particularly in collaboration with other local organisations, as demonstrated by the *Facciamo la Valle! Festival* organized as part of the BIOTraCes intervention in late May-early June 2015. By contrast, initiatives promoted autonomously tend to achieve limited outreach and visibility. While these outcomes do not signify failure in absolute terms, they highlight the need to refine internal structures, strengthen community engagement, and consolidate the Ecomuseum's autonomy and recognition as a territorial actor. A second case of partial failure relates to participatory action research (PAR) with agroecologically inspired farmers. These farmer-inhabitants have developed strong internal bonds, continuously exchanging machinery, skills, and techniques to regenerate land and biodiversity. However, the high cohesion within this network also risks reinforcing a mechanism of self-isolation that separates "the good ones" — that is, young, often educated people practicing agroecology — from "the bad ones," meaning conventional farmers, who are older and generally belong to more socially vulnerable groups. As a result, the engagement with "conventional" farmers—those practising intensive or chemical-dependent agriculture—remains limited. Techniques such as permaculture and syntropic cultivation are still perceived as niche, reducing opportunities for cross-learning and pluralisation of knowledge. The absence of sustained bridges between conventional and alternative farmers has thus far prevented wider transformative diffusion across the agricultural system. A third failed practice emerged in the field of participatory mapping, the initiative aimed to engage citizens, associations, and municipalities in collectively mapping the spread of photovoltaic infrastructures and their impacts on the territory. While civic participation was strong, municipal administrations showed limited involvement, rarely assuming ownership of the process. Given that municipalities are directly responsible for authorising photovoltaic and agrivoltaics installations, their absence represents a critical gap. This limited institutional participation weakens the potential for community empowerment and reveals the difficulty of embedding participatory processes within local governance structures.

Concluding remarks

The analysis of failed and successful practices in the Simeto Valley underscores both the fragility and potential of transformative socio-ecological change. Failures highlight the limits of institutional engagement, internal communication, and cross-sectoral collaboration, while successes demonstrate the empowering role of participatory processes, collective learning, and locally grounded innovation. When supported by sustained institutional recognition and adequate resources, these practices can consolidate into replicable enablers of biodiversity regeneration and participatory governance,

³⁷ The Simeto Ecomuseum mobilises a variety of collective processes that combine community engagement, territorial knowledge, and participatory planning. These include community-mapping exercises, co-designed with schools, farmers, and local associations to document water systems, rural landscapes, and everyday ecological practices; intergenerational workshops and educational laboratories that bring together children, elders, activists, and researchers to exchange memories and ecological knowledge; and collective territorial itineraries such as *In Viaggio con Violetta*, which activate shared exploration and interpretation of riverine and agricultural spaces.

advancing the BIOTraCes vision of an embedded, plural, and democratic socio-ecological transformation.

6.4 Co-learning

The co-learning experience developed in the Simeto Valley case study represents a central component of the participatory action research (PAR) process promoted by the University of Catania within the BIOTraCes project. This process unfolded through a plurality of moments — partly connected to fieldwork and focus group activities and partly embedded in the collective design and implementation of the *Facciamo la Valle! Festival*.

Throughout the project, co-learning functioned both as a methodological framework and an epistemological horizon grounded in dialogical exchange between scientific, experiential, and community-based knowledge systems. It was conceived not as a consultative exercise but as a transformative process of knowledge co-production, sustained by negotiation of perspectives, collective reflexivity, and shared experimentation in socio-ecological regeneration.

Co-learning process on indirect drivers of biodiversity loss

Co-learning sessions among BIOTraCes research partners facilitated the creation of a shared vocabulary and interpretive framework around the indirect drivers of biodiversity loss. Internal discussions highlighted that these drivers are not purely ecological, but deeply rooted in institutional, cultural, and economic structures that perpetuate extractive territorial models.

In the Simeto River case study, collective reflection revealed how territorial marginalisation, short-term project-based funding, and the absence of institutional coordination weaken connections between public policy, local knowledge, and environmental regeneration. At the same time, the dialogue identified key enablers for transformative change: building trust-based spaces, reactivating ecological memory, and creating collective knowledge devices such as participatory mapping, environmental archives, and place-based artistic practices.

The research team adopted a comparative approach, analysing systemic configurations that either facilitate or constrain biodiversity regeneration. In the Simeto Valley, this involved exploring the river's dual role as an ecological and symbolic infrastructure, and as a contested space between extractive logics (agro-industrial, energy, infrastructural) and bottom-up practices of territorial care. This process fostered collective learning about the interrelations among governance, institutions, and socio-ecological transformation, laying the groundwork for sustained and reflexive co-learning.

Co-learning processes with the Societal Partner

During FG1 and FG2 (see footnote on the section "Management of indirect drivers of biodiversity loss"), researchers and members of the Participatory Praesidium of the Simeto River Agreement jointly analysed the tensions among social innovation, institutional dynamics, and biodiversity conservation strategies. These encounters produced critical co-learning insights that informed the design of local action plans.

The FG1 explored agroecological practices and the relationship between community and rural territory, focusing on biodiversity loss and regeneration in the Simeto Valley. Testimonies emphasised the affective and historical memory tied to the river and traditional agriculture, seen as foundations of local identity and resources for socio-ecological renewal. Narratives recalled a once-fertile valley where water, land, and biodiversity formed a shared equilibrium, while discussions addressed how economic and political transformations disrupted this balance through intensive agriculture and loss of community autonomy.

Despite these challenges, the group also identified emerging alternative visions, such as the Mediterranean garden model — a non-intensive, poly-cultural paradigm integrating ecological, cultural, and relational dimensions. Agroecological practices and environmental education projects were recognised as niche innovations, fostering collective learning and testing new ways of inhabiting the Valley alongside more-than-human species. The session thus operated as a reflective space to examine indirect drivers of biodiversity loss — economic marginalisation, institutional weakness, and socio-cultural disconnection — while advancing a transformative understanding of community–environment relations.

FG2 addressed the interaction between multi-scalar environmental policies (regional, national, and European) and their local implementation in the Simeto context. It examined how the Participatory Praesidium engages with regulatory frameworks and public institutions to pursue sustainability, biodiversity protection, and environmental justice. Participants highlighted a persistent gap between supranational policy frameworks and local operational capacity. Although the Presidio aligns closely with EU Water and Habitat Directives, these frameworks often fail to translate into effective local instruments due to fragmented governance and lack of long-term strategy.

Concrete examples — such as the LIFE Simeto RES project — illustrated both the potential and limits of these collaborations: bureaucratic delays, weak institutional coordination, and insufficient political continuity hindered implementation. The discussion revealed a dual dynamic: strong conceptual alignment with EU biodiversity goals but limited capacity for local translation. This recognition prompted a collective reflection on how to develop adaptive, cross-sectoral governance integrating local knowledge with institutional mechanisms.

Methodologically, the focus group functioned as a strategic dialogue between research and society. Researchers acted as mediators and facilitators, comparing the Simeto River case study with other European contexts. This comparative perspective illuminated institutional lock-ins—rigid procedures, hierarchical knowledge structures, and the separation of environmental and social policies—as major indirect drivers of biodiversity loss. Overall, the dialogue reinforced shared understanding of how policy frameworks can both reproduce and transform ecological crises, directing future collaboration toward multi-level governance and co-designed biodiversity strategies.

Further co-learning and exchange with the Societal Partner

The organisation of the *Facciamo la Valle! Festival* represented a pivotal stage in the co-learning process, integrating research, dissemination, and collective experimentation. Initiated in early 2025 with Participatory Praesidium of the Simeto River Agreement (Presidio Partecipativo), the festival acted as a distributed laboratory of situated learning, where BIOTraCes findings were reinterpreted through local memory and social practice.

Preparation for the festival involved weekly meetings, co-design workshops, and collective reflection sessions with researchers, local actors, artists, and citizens. These interactions explored connections between environmental crises, biodiversity loss, river memory, and civic activism. As a result, a very rich program was built. The "*Facciamo la Valle!*" Festival took place from **26 May to 8 June 2025** and was co-organized with the societal partner Presidio, in collaboration with local associations and under the patronage of the Municipality of Paternò. The festival main strands of activity were:

- An ethnographic exhibition featuring fieldwork materials and documents from the local archive.
- A series of artistic and musical performances.
- The implementation of ecomuseum itineraries.
- Seminars and workshops.

More specifically, the detailed programme of activities unfolded as follows:

- **May 26 - Inauguration of the ethnographic exhibition "Re-stitching the memory"**. Co-organized by the research team and the societal partner

the inauguration of the ethnographic exhibition "Re-stitching the Memory". Curated by Accademia Abadir and hosted at the former municipal slaughterhouse of Paternò, the exhibition presented archival materials, maps, and video-interviews documenting the socio-ecological transformations of the Simeto Valley. Drawing on the longstanding process developed by the Presidium, the exhibition highlighted community memory, historical water governance, traditional and alternative agricultural practices, and the collective struggle for environmental justice in the valley.

- **May 27 and May 30 - School visits to the exhibition.** Organized by the societal partner. These visits reflect the strong educational dimension of the Ecomuseum, which has engaged more than a thousand students in its activities and has promoted community mapping, heritage education, and intergenerational learning across the valley. During these days, several classes participated in activities inspired by projects such as "La Valle del Simeto in una Cartolina" further reinforcing the festival's pedagogical role.
- **May 30 - Public presentation of the exhibition and a talk on ecomuseology practices with leading experts and local representatives.** Co-organized by the research team and the societal partner. This day hosted the public presentation of the new Ecomuseum of Simeto visual identity, the result of a long community co-design process ("Forme del Simeto") involving schools, citizens, and local associations. The event aligned with the ecomuseum's trajectory as a civic, cultural, and territorial infrastructure, rooted in twenty years of community mobilization, participatory mapping, and shared planning. Workshops and discussions enriched the day, situating the exhibition within broader reflections on landscape, justice, and community-based museology.
- **May 31 - Evening artistic performance.** Organized by the societal partner the performance was part of the festival's artistic program, which also featured poetic actions and theatre workshops curated by artists such as Alessandra Pescetta, Giovanni Calcagno and the Batarnù company, animating public spaces through collective storytelling and ecological sensibility.
- **June 1 - Ecomuseum "Water Itinerary".** Organized by the societal partner these itinerary forms one of the most consolidated routes of the Simeto Ecomuseum, developed through years of community mapping, school projects, and field explorations. The walk retraced key locations of the valley's historical and contemporary water system, saje, gebbie, irrigation networks, and river crossings, reflecting the ecomuseum's long-term work on water governance, heritage, and collective territorial knowledge. The itinerary builds on previous educational and participatory activities, reinforcing the waterway as a cultural, ecological, and community anchor of the valley.
- **June 3 - Workshop with farmers: "Regenerating and Inhabiting the Valley: Techniques and Experiences for a Thriving Territory".** Held in Contrada Nicolò, Paternò (CT), at Munnu Farm and co-organized with: Jennifer Harumi Tanaka, farmer and researcher based in the Simeto Valley and Filip Micoletti (Vallone delle Pezze, RG), educator and expert in permaculture and syntropic agriculture. This workshop, hosted in the heart of the Simeto Valley, explored regenerative agricultural practices as a pathway to healing and revitalising both land and community. Led by Filip Micoletti the session offered both theoretical insights and hands-on experience. Together, we delved into the biodiversity and evolution of ecosystems, the social lives of plants, and the co-evolutionary processes between plants and animals. A central moment of the day was the practical session dedicated to sowing a MUVUCA—a diverse mix of seeds designed to regenerate soil and foster ecosystem resilience. Through this activity, participants gained a deeper understanding of what makes an agricultural system truly sustainable and alive over time. More than just a learning opportunity, the workshop marked an important step toward transformation: envisioning and practicing an agriculture that heals, regenerates, and creates abundance in synergy with nature. Discussions focused on micro-regenerative practices rooted in syntropic principles, tailored to the

Simeto Valley's unique ecological, historical, and cultural context—particularly in response to the growing challenges of climate change. The workshop also served as a moment of connection, aiming to strengthen networks of solidarity among farmers, foster collaboration with experts in regenerative techniques, and promote the sharing and amplification of local knowledge in support of biodiversity.

- **June 4 (morning) - Walking deep-mapping workshop “Inside the ‘saje’. Exploring Simeto water infrastructure”** | Organized by the research team. The activity took place in Contrada Buglio (Santa Maria di Licodia) and was structured in two main phases.

The first phase consisted of a collective exploration, conducted in three small groups, across the area. The walk began at the Fontana del Cherubino and at the first springs emerging from beneath the lava mantle, waters that not only feed the Simeto River but also sustain agriculture and livestock in the surrounding area. From these springs, participants followed three parallel routes that traced the local water infrastructures, focusing particularly on the network of saje and their intersections with gebbie and other distribution systems used for irrigation management. During the walk, participants collected personal observations, photographs, audio recordings, and objects intended for use in the subsequent workshop session.

The second phase took place nearby and involved a collective sharing of experiences. Participants discussed what they had observed and perceived during the walk, reflecting on how the irrigation infrastructure operates, what kinds of social and ecological relationships it generates, and how these systems shape the landscape. Through this exchange, the group examined the role of water and the river in the valley's agricultural practices, highlighting the deep interconnections between hydrological infrastructures, land use, and everyday forms of territorial life.

- **June 4 (afternoon) - Conference: “Interrupted Rivers: Infrastructure, Water Control, and the Continuity of Life”.** Held at Ex Macello in Paternò, with researchers and activists working on key BIOTraCes research themes and organized by the research team and the societal partner. The event aimed to explore the complex socio-ecological relationships between river systems and local communities. In particular, it addressed the threats posed by infrastructural developments to biodiversity and life along rivers, while critically examining existing governance models for river management—with a focus on the Simeto River.

Francesco Visentin, Associate Professor at the University of Udine, opened the discussion by highlighting how “waterscapes” are shaped by the ongoing accumulation of human interventions—both material and symbolic. His talk, bridging theory and practice, stressed the need for a hydrocentric perspective to reframe rivers not as infrastructures or utilities, but as vital elements of ecosystems and landscapes.

Giuliano Trentini, spokesperson for the Italian Centre for River Restoration (CIRF), focused on the biodiversity crisis and the role of river restoration in risk mitigation and sustainable management. He argued that restoring rivers is not only a technical challenge, but also a cultural and ecological one—calling for a rethinking of the human–river relationship. The static, utilitarian approach to rivers developed in the 20th century is no longer adequate; restoring vitality requires allowing rivers to move and flow—both longitudinally, by removing barriers, and laterally, by permitting natural meandering and expansion. Paolo Gruppuso, researcher at the Rachel Carson Center (Ludwig Maximilian University of Munich), offered a critical reflection on the disciplining of Sicily's most important river through infrastructure and embankments, and how this process has disrupted socio-ecological relations. Advocating for a new “river

literacy,” he called for a break with dominant narratives of engineered “progress,” and a renewed attention to once-central river-based practices such as fishing and herding. These, he argued, could play a key role in reviving the ecological and relational fabric of the Simeto Valley.

The debate continued with a contribution from Dr. Umberto Troja, director of the Simeto River Nature Reserve (RNO Oasi del Simeto), who highlighted the environmental pressures facing the reserve—from industrial development and illegal construction to the challenges of bird conservation and fish migration. He emphasized ongoing efforts to dismantle artificial barriers that prevent the natural movement of aquatic fauna.

Roberto De Pietro (engineer and independent researcher) and Antonino Duchi (biologist and independent researcher) presented a detailed case study of the Passo Martino weir, located within the Simeto River Nature Reserve. Built in the 1980s to serve the nearby industrial zone—but never put into operation—the structure interrupts the river's ecological continuity just 7 kilometres from its mouth, significantly harming aquatic life in an already highly modified watercourse. Drawing from both theoretical insights and case studies at national and international levels, the event made a strong call for concrete action: in particular, the dismantling of the Passo Martino weir to restore the Simeto's ecological connectivity from its mouth to Ponte Barca (Paternò). This aligns with the European Union's goal of restoring at least 25,000 kilometres of free-flowing rivers across Europe by 2030.

- **June 5 (morning) - Conference: “Energy and Community: Transformations, Conflicts, and Perspectives for the Territory and its People”.** Co-organized with local associations, experts, community members and the project Energy Commons. During the conference the researchers present also a first draft of the critical map of energy infrastructures.
- **June 5 (afternoon) - Walking workshop in Belpasso: “Energy and Future Perspectives”.** Organized with a local association the workshop served as a space for discussion, collective reasoning, and debate on renewable energy production and its relationship with territory and local communities. Starting from the case of the Simeto Valley—which simultaneously hosts some of Italy's largest photovoltaic plants and several Renewable Energy Communities—the conversation widened to include other Italian contexts. Through laboratory-style activities, scholars active in the national debate, local activists, and representatives of municipal institutions examined the dynamics of the energy transition, focusing on everyday practices, ecosystem exploitation, cooperation, and conflict within places of energy production. The workshop brought into dialogue two contrasting models: on the one hand, large industrial-scale renewable installations, where territories often find themselves caught between energy extraction and the marginalisation of local communities; on the other, Renewable Energy Communities, through which territories can instead become laboratories of virtuous cycles linking self-production, democratic planning, and community-building. Its overarching aim was to identify research directions and programmatic priorities capable of fostering meaningful cooperation among local communities, their organisations, institutions, and academia.
- **June 7 - Ecomuseum multispecies itinerary: “Lives Along the River: Stories of Eels, Concrete, and Peaches on the Simeto”.** Organized by the research team this itinerary invited participants to reflect on life in and around the Simeto River through two symbolic locations in the valley. The first stop was the Santa Domenica intake, a site along the mid-course of the river where we explored the processes of exploitation and violence the Simeto had endured, driven by a development model that separated humans from nature and viewed the river merely as a resource to be used. At Santa Domenica, we engaged in a conversation with environmental conservation experts who helped us understand what it meant to experience the Simeto from the perspective of non-human life,

such as fish and eels—species increasingly threatened by human management of the river. From Santa Domenica, we moved toward the Bronte area, where we met Samantha Pieraccini. Samantha managed a pistachio grove and a piece of family land where she cultivated fruit trees and vegetable gardens along the riverbank. She shared her experience of farming in the Simeto Valley in the context of a changing climate, discussing her crop choices and adaptation strategies. Together, we reflected on the beauty and challenges of living and farming next to a river that was constantly shifting and transforming.

- **June 7 (Evening) - Artistic performances.** Organized by the societal partner.
- **June 8 (Morning) – Historical itinerary.** Organized by the societal partner and led by SiciliaAntica (section Paternò). This itinerary is part of the routes designed by the Simeto Ecomuseum and co-constructed with the local community, in close collaboration with the association SiciliaAntica. Traversing the historical hill of Paternò, the itinerary not only showcases the area's architectural and artistic heritage but also reveals a medieval fabric that has persisted into the present. Along the route, participants encountered stories and historical land uses, including the former neighbourhood that once hosted the river-fish market and housed the families of river fishers, a profession now extinct. The itinerary further highlighted the deep relationship between the city, its inhabitants, and the Simeto River, emerging through the historical layers of churches, civic spaces, and the Norman tower overlooking both the river and the valley.

Re-stitching the Memory

A central element was the exhibition at the former Ex Macello of Paternò, jointly curated by the Presidio, the CNR³⁸, and other local partners. Combining archival materials, oral histories, and artistic productions, the exhibition created a shared environmental history of the Valley and a dialogic space across generations and knowledge systems.

Re-stitching the Memory ("Ricuciamo la MemoriA"), symbolised ecological and social reconnection. Through the collective creation of a large map of the Simeto River, sewn together from archival fragments and community contributions, participants performed an act of transgenerational and more-than-human learning. This participatory artwork made visible the lost interconnections between urban and rural spaces and between human and non-human communities, reframing the territory as a subject of knowledge rather than an object of exploitation.

Conferences, workshops and more

The thematic days dedicated to BIOTraCes research within the festival expanded co-learning opportunities through all the activities mentioned. These events fostered reciprocal learning between scientific knowledge and everyday practices, where researchers improved their in-depth understanding of the context thanks to local actors, and communities acquired analytical tools for collective action. The festival also highlighted the aesthetic and affective dimensions of co-learning, demonstrating that knowledge emerges not only through analysis but also through sensory, artistic, and performative experiences.

Concluding remarks

³⁸ The CNR (Consiglio Nazionale delle Ricerche) — National Research Council of Italy — is the country's largest public research institution. Founded in 1923, it operates under the Ministry of University and Research and coordinates multidisciplinary scientific activities across national and international programmes. The CNR conducts research, promotes innovation, and supports public administration and industry through applied science and technological development.

The co-learning process in the Simeto Valley redefined the role of research in fostering inclusive biodiversity governance. By revealing indirect drivers of biodiversity loss—from institutional fragmentation to cultural disconnection—while activating practices of socio-ecological reconnection, it bridged scientific and local knowledge in a shared learning process. These activities have generated collective reflexivity, empowered the Societal Partner, and provided a methodological model for future BIOTraCes interventions: one based on reciprocity, care, and the reactivation of ecological and cultural memory as drivers of transformative change.

6.5 Testing of interventions

The process of testing actions and intervention plans within the Simeto Valley case study represents both a collective learning pathway and a space for critical reflection, involving the research partners and the Societal Partner in a deeply integrated manner. This phase goes beyond evaluating the operational effectiveness of actions: it constitutes a moment of transformative co-evaluation, where field experimentation, participatory monitoring, and the joint restitution of results converge to construct new forms of territorial governance for biodiversity.

Throughout the research, the Societal Partner oriented much of its activity toward identifying and addressing the root causes of biodiversity loss, adopting a systemic perspective that links ecological, social, and institutional dimensions. Among the most significant strategies emerging from this process is the work on Renewable Energy Communities (RECs), conceived as a response to the threats posed by the uncontrolled expansion of industrial-scale agro-photovoltaic plants. These infrastructures—often imposed externally and embedded in extractive energy and land-use logics—pose major risks to biodiversity by transforming rural landscapes and undermining the ecological multifunctionality of soils.

A grassroots mobilisation against industrial-scale agro-photovoltaic plants has stimulated community-based discussion and action groups, which have found in the research team key allies both cognitively and technically. Through shared learning sessions and the creation of analytical tools—such as the participatory mapping of agro-photovoltaic plants—these groups have opened new arenas of debate and critical reflection on the Valley's future. The mapping initiative, one of the most significant pilot actions of the testing process, synthesises the co-production of knowledge between researchers and communities. It will be returned to the Societal Partner and citizens as an operational tool to counter unsustainable energy projects and as a basis for alternative development scenarios grounded in biodiversity and environmental justice.

In parallel, the RECs promoted through a bottom-up, participatory approach by the Societal Partner, in collaboration with citizens, small producers, and researchers, have emerged as socio-technical devices for ecological and social justice. They aim to build an alternative model of energy governance based on inclusion, equity, and participation. The co-design process of the RECs has been transformative not only in its material outcomes—renewable energy generation, emissions reduction, and local autonomy—but also in its pedagogical and community-building dimensions. It has diffused new knowledge, reinforced place-based belonging, and promoted a vision of the territory as a common good.

The testing of actions revealed that the Societal Partner adopts a dual and complementary strategy in confronting institutional barriers and governance lock-ins hindering ecological transition. On one hand, it acts in a reformist and proactive manner through continuous dialogue with local and regional administrations, seeking to establish collaborative grounds for experimentation. On the other hand, it cultivates resistance and cognitive autonomy, disseminating knowledge and creating public spaces for debate and participatory governance.

Although institutional dialogue remains limited by administrative fragmentation, low deliberative capacity, and a sectoral political culture, it nonetheless operates as a field of

transformative learning. Even small-scale initiatives—such as territorial laboratories, environmental education programmes, and rural regeneration projects—help to “stretch” institutional limits, demonstrating the feasibility of grounded alternatives. This incremental approach to transformation, based on the social prototyping of good practices, has been recognised by researchers as a key enabler for overcoming structural and cultural constraints that impede systemic change.

Concurrently, a reflexive civic component of action has consolidated, oriented toward the production of territorial knowledge as transformative power. Through environmental data collection, documentation of landscape transformations, and the valorisation of collective memories related to the Simeto River, the Societal Partner operates at the symbolic and cultural levels, rebuilding the relationship between community and environment. The Simeto Ecomuseum plays an emblematic role in this process: more than a cultural institution, it functions as a social infrastructure for learning and regeneration, translating principles of sustainability, inclusion, and care for the commons into everyday practices.

The testing phase has shown that the Societal Partner’s actions go beyond responding to environmental emergencies—they actively redefine governance logics and territorial narratives. Through advocacy, participatory research, and artistic and cultural practices, the alliance between community and research has influenced the representation of the Simeto Valley, challenging its image as a marginal space and reframing it as a laboratory of sustainability and social innovation.

The *Facciamo la Valle! Festival* and its related exhibition represented a key moment of symbolic transformation. Through installations, debates, and workshops, the festival staged the historical memory of the river and its connections to everyday life, reinforcing a collective awareness of the Simeto as a living socio-ecological system to be regenerated rather than a neglected margin. In this sense, the festival acted as an extended co-learning device, where research, art, and citizenship intertwined languages and visions, cultivating a new ecology of knowledge and participation.

Finally, the testing phase demonstrated that the relationship between researchers and the Societal Partner constitutes a practice of transformation in itself. The ongoing dialogue between methodological frameworks, local knowledge, and analytical tools has fostered co-production of knowledge, enhancing collective capacities for territorial interpretation and intervention. Activities such as mapping agro-photovoltaic installations, analysing water infrastructures and agricultural practices, and documenting rural landscape evolution illustrate how research–society collaboration generates tangible outcomes—benefiting both scientific inquiry and local governance.

Shared knowledge thus becomes a civic infrastructure, capable of supporting informed and inclusive decision-making. Through continuous dialogue, researchers and the Societal Partner not only produce data and tools but also contribute to building a shared horizon of meaning for the Simeto Valley—one in which biodiversity, socioecological justice, and ecological innovation are recognised as inseparable dimensions of transformative change.

Concluding remarks

The testing of interventions in the Simeto Valley exemplifies the BIOTraCes approach to embedding transformative change through participatory governance. By linking community initiatives, research experimentation, and institutional dialogue, this phase demonstrated how co-production of knowledge can reconfigure power relations and strengthen local agency. The outcomes—spanning from energy communities to participatory mapping—show that transformation emerges incrementally, through collective learning, shared responsibility, and the integration of biodiversity values into daily territorial practices. The experience positions the Simeto Valley as a living laboratory for just and plural socio-ecological transitions.

6.6 Discussion

The participatory strategies and interventions developed in the Simeto Valley constitute a living laboratory of socio-ecological transformation, where biodiversity regeneration is pursued through collective governance and situated experimentation. Across diverse initiatives—agroecological practices, the establishment of an Ecomuseum, renewable energy communities, and participatory mapping—their shared significance lies in the attempt to politicise biodiversity, embedding it within social relations, local identities, and institutional processes. The Societal Partner and its civic networks have gradually transformed the Valley's marginal condition into a site of reflexive innovation, linking ecological recovery with cultural heritage, energy democracy, and social solidarity. In this context, biodiversity emerges not as an abstract ecological metric but as a relational achievement: the outcome of co-produced knowledge, contested meanings, and everyday practices of care that reconfigure the relationships between communities, ecosystems, and governance structures.

A central insight concerns the transformative potential of these local practices. Initiatives such as agroecology, the Simeto Ecomuseum, and community mapping cultivate alternative socio-ecological imaginaries that challenge extractive paradigms. Agroecological farmers, for example, enact micro-transformations that reintroduce crop diversity, regenerate soils, and revalue traditional ecological knowledge. The Simeto Ecomuseum operates as a socio-cultural infrastructure that turns collective memory into an instrument of regeneration, framing biodiversity as the interplay between ecological integrity and social relations. These initiatives embody plural ways of valuing and inhabiting nature, opening new spaces for empowerment and experimentation. Yet, their transformative reach remains constrained by the absence of institutional recognition, project-based funding logics, and the dominance of monocultural economies. Despite these constraints, they function as "niches of transformation," demonstrating how place-based practices can prefigure more just and sustainable governance arrangements.

When viewed through the lens of indirect drivers of biodiversity loss, the Simeto Valley case underscores that ecological degradation is inseparable from socio-economic inequality, institutional fragmentation, and cultural detachment from the territory. Fieldwork and focus groups revealed that destructive practices—waste burning, monocultures, overexploitation of water—stem not only from ignorance but from long-standing political and cultural disconnections. Biodiversity loss, therefore, reflects the erosion of the social and symbolic bonds that once linked communities to their environment. In this sense, the Presidio's work to restore an ecological pact between people and nature acquires a deeply political meaning. Through participatory processes, educational initiatives, and particularly the collective mapping of energy infrastructures, the Societal Partner reframes the territory as a shared common. These activities nurture civic responsibility and encourage new understandings of nature as a co-actor within the Valley's socio-ecological system.

The analysis of enablers and disruptors further clarifies the dynamics of change. Enabling factors—such as trust-based networks, civic cooperation, and the revival of ecological memory—have emerged from the long-term engagement fostered by the Presidio. These enable the diffusion of regenerative practices, the consolidation of social alliances, and the co-production of situated knowledge. Disruptive factors, however, remain formidable: globalised agri-food markets, external energy investors, weak institutional capacity, and the volatility of project-based financing. The Societal Partner's ability to sustain enabling conditions in such a context is in itself an act of resilience. By mobilising social capital and forging partnerships with universities, municipalities, and grassroots organisations, the Presidio demonstrates that transformative agency can thrive even under systemic precarity. This empowering dimension—grounded in participation and mutual learning—represents a distinctive contribution to the BIOTraCes approach.

The attunement or mismatch between the Valley's biodiversity agenda and the trajectories of major economic sectors exposes both structural tension and opportunity. Industrial citrus farming and the uncontrolled expansion of agro-photovoltaic installations perpetuate

ecological simplification and territorial inequities. Conversely, small-scale farmers, civic associations, and renewable energy communities articulate an alternative model of development that reconciles production with ecological stewardship. The Valley thus epitomises Europe's wider challenge of aligning green transitions with territorial justice. Renewable Energy Communities illustrate how the energy transition can be pluralised and democratised: they reframe energy not as a commodity but as a social right, linking decarbonisation to participation and equity. By contrast, the top-down proliferation of industrial-scale agro-photovoltaic plants exemplifies the risk of reproducing extractive logics under the banner of sustainability.

Within this tension, the collective mapping of photovoltaic plants emerges as a crucial transformative device. More than a technical exercise, it functions as an epistemic and political intervention—making visible the territorial consequences of energy transition and transforming data into democratic agency. Through collaborative cartography, local actors, researchers, and municipalities jointly reconstruct the geography of power, revealing how land-use decisions reflect broader conflicts over biodiversity, livelihoods, and justice. The mapping process thus materialises the project's guiding principles: it politicises environmental knowledge, empowers communities to act, and embeds transformative practice in everyday governance. It stands as a flagship example of how BIOTraCes methodologies—participatory, reflexive, and transdisciplinary—can foster accountable decision-making and strengthen biodiversity governance.

From a policy perspective, the Simeto experience reveals both reinforcement and friction between local innovations and supranational frameworks. The *Patto di Fiume Simeto* (Simeto River Agreement) remains an advanced institutional experiment inspired by EU directives and the 2030 Agenda, which sought to embed deliberative democracy and socio-ecological justice in territorial governance. However, its potential has been curtailed by the absence of regional legislation on participation, fragmented competences, and limited administrative capacity. Similar dissonances affect the local implementation of European programmes such as LIFE, whose transformative aspirations often falter under procedural rigidity. The Simeto Valley, therefore, illuminates a broader systemic issue: transformative change for biodiversity depends not only on visionary frameworks but on embedding them within flexible, place-sensitive institutional architectures capable of sustaining bottom-up innovation.

A defining feature of the Simeto Case Study process has been the emergence of co-learning as both a methodological framework and a political act. Through focus groups, workshops, and the *Facciamo la Valle! Festival*, researchers and citizens co-produced interpretations of ecological crises and their social roots. These encounters blurred hierarchies between scientific and experiential knowledge, creating affective and dialogical spaces where new ecological imaginaries could emerge. The festival's performative act of "re-stitching the river," for instance, transformed research findings into a collective ritual of repair, demonstrating that transformation begins with shared imagination. Co-learning in this sense not only produced knowledge but also reconfigured relationships of trust and reciprocity, embodying the BIOTraCes principles of pluralising perspectives and politicising environmental practice.

Finally, the testing of interventions consolidated these learning dynamics into concrete governance experiments. The co-design of Renewable Energy Communities and the participatory mapping of agrivoltaics plants demonstrated how the co-production of knowledge can evolve into operational capacity. These initiatives reframed governance as an open, iterative process integrating data, memory, and foresight. The Presidio's dual strategy—maintaining dialogue with institutions while cultivating autonomous civic action—proved essential to sustaining transformative momentum under adverse conditions. Cultural infrastructures such as the Simeto Ecomuseum and civic events like the *Facciamo la Valle! Festival* amplified this process, transforming knowledge exchange into collective empowerment and contributing to embed biodiversity within a renewed sense of shared territorial responsibility.

Concluding remarks

Overall, the Simeto Valley case exemplifies how transformative change for biodiversity can take root through the interplay of social innovation, reflexive governance, and the co-production of knowledge. Its success lies less in measurable ecological outcomes than in its capacity to generate new forms of collective agency, territorial imagination, and socio-ecological solidarity. Despite structural constraints, the Societal Partner and its networks have forged a resilient civic ecology that bridges science, policy, and activism. Their experience demonstrates that biodiversity regeneration is inseparable from questions of justice, recognition, and participation. In this sense, the Simeto Valley does not merely test interventions—it performs transformation, offering a grounded demonstration of how plural, empowering, politicised, and embedded approaches can anchor the Theory of Transformative Change in the lived realities of European territories.

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UT Foodpark against industry

D2.5, The Netherlands

December 2025

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Funded by
the European Union

Summary

Foodpark Amsterdam is a grassroots organisation that aims to protect an area in the city of Amsterdam (the Lutmeeerpolder) from industrialization. Their approach consists of three interrelated strategies. The first strategy is protest. The movement protests against the plans to develop the area and build warehouses on them through banners and flyers and by using public consultation. The second strategy is to frame a broader narrative. In this narrative, they present the development plans as representing an unsustainable economic worldview that is based a separation between people and nature, overconsumption, and property, and they contrast this with an alternative worldview that conceives of land not as property but as commons and that considers humans as entangled with nature. The third strategy is prefiguring and building an alternative. Specifically, they aim to create a foodpark that will be governed as a commons and that will foster enhanced human nature relationships, and they also prefigure this model of the commons in the inner workings of the grassroots organisation. The case study demonstrates how these different strategies work together to not only protect a specific area, but also build an alternative, commons based, society.

This document reports on the results of a participatory action research (PAR) project on the case of Foodpark Amsterdam (FPA). Chapters 1 and 3 introduce the initiative and the context in which it is situated. Chapter 2 details the collaborative research approach that was employed. Chapters 4, 5 and 6 discuss the different actions, strategies, visions, and results of FPA.

1 Case Study Introduction

1.1 Justification of the importance of the case study

We selected Foodpark Amsterdam as our societal partner because of their ongoing activist work to retain a plot of land at the edge of the city as an agro-ecological commons. This allows us to follow in practice, on the ground, how transformative change might occur by exploring the PEPE principles of the BIOTraCes framework in relation to a specific example.

1.2 Explanation of the focus of the case study

[Foodpark Amsterdam](#) in its current form, exists since summer 2021. It is a citizen initiative that aims to turn a fertile piece of agricultural land, the Lutkemeerpolder, into a food commons; a place for urban agriculture, biodiversity, social recreation and justice. In their efforts, to turn 43 hectares of the Lutkemeerpolder into a commons-governed food park, the initiative Foodpark Amsterdam aims to reverse the municipality's current plans of turning the land into an industrial area for the building of distribution centres. The following organizations are listed on the website of Foodpark Amsterdam as co-initiators and represent important alliances: Grond van Bestaan, Voedsel Anders, Food Council MRA, Behoud Lutkemeer, Toekomst Boeren, Slow Food.

1.3 Research questions addressed by the case study

This report will address the following research questions:

How was participatory action research enacted in practice?

In what societal, institutional and environmental context is Foodpark Amsterdam situated?

What actions does Foodpark Amsterdam undertake to shift the present worldview and economic model and re-shape human-nature relations in the Lutkemeerpolder?

What social ecological dynamics can be recognized in Foodpark Amsterdam and are envisioned for the future?

What have been the results and implications of the actions and strategies that have been employed by Foodpark Amsterdam to achieve their goals?

1.4 Reading guide

Each research question will be answered in a separate chapter of this report. Chapter 2, will address RQ1, chapter 3 will address RQ 2, chapter 4 will address RQ 3, chapter 5 will address RQ4, and chapter 6 will address RQ5.

2. Research Methods and application of PAR

2.1 Roles of the Societal Partner

Foodpark Amsterdam [*Voedselpark Amsterdam*] is one of the largest biodiversity-related citizen initiatives in Amsterdam that was started in 2021. Their aim is to stop the building activities on the fertile soil of the Lutkemeerpolder and transform it into an agroecological commons for the long-term. They joined the action group Save Lutkemeer [*Behoud Lutkemeer*] that had been challenging the building plans within the Lutkemeerpolder for several years, Foodpark joined this struggle by proposing an alternative vision to the plans of the business park, namely a Foodpark Amsterdam.

At this moment, Foodpark Amsterdam consists of a core group of around 12-20 motivated citizens and around 25.000 supporters. They work to oppose the building plans, engage in political lobby, and undertake cultural and educational activities in order to gain more support for stopping the development plans and transforming the Lutkemeer into a foodpark that is based on a food commons vision. Since one year ago, this group has become a foundation. The core team of Foodpark Amsterdam contributes to the initiative largely on a voluntary basis. In some cases, small fees are granted for project-based or professional work. Their organizational structure is largely horizontal and thrives on the independent initiatives and actions of various individuals. Lively online communication and monthly meetings with the entire group ensure that the various activities remain somewhat coherent and targeted towards the aims of Foodpark Amsterdam.

The underlying idea of taking a PAR approach is an “orientation towards inquiry” to research that blurs traditional boundaries between researchers and researched and that is committed to connecting knowledge to just action (Reason and Bradbury 2008, 1, emphasis removed). This also means that as researchers, we respond to the issues our societal partner cares about and we joined the initiative for an extended time. As a consequence, it was often impossible to distinguish the role of the societal partner from our own roles. Below, we discuss our multiple roles.

Expert in the field

Perhaps the most general way to describe the activity of our societal partner would be to say that they are the experts within ‘the field’, with which we mean the local context of the Lutkemeerpolder, the historical and ecological background of the area, the different stakeholders, their positions and motivation, key actors within the neighborhood, the ongoing political conversations, and possibilities for intervention.

Expert in alternative economies

Besides having in-depth knowledge of the place, they also have a big vision for the future which is about economic transformations, which, from a Transformative Change perspective also addresses the root causes of biodiversity loss. Specifically, they have in-depth knowledge about the commons and governance models that take land out of the financial market in order to allow other social-ecological values to come to the foreground.

Expert in social organizing:

They also have accumulated great knowledge about the larger social network around the place and organize a plethora of activities inviting different kinds of stakeholders and participants.

Host in the field:

Next to being a well of information and insight, our societal partner also acted as a host to the research field, introducing us to the area, giving us the opportunity to get to the place in order to also make new connections ourselves.

Host to research problems:

Through their expertise, they also invited us to consider diverse research problems and relevant research questions. While our baseline of inquiry was something that was also

already formed through the Biotraces project and our research backgrounds and interests, our societal partner helped us to sharpen and specify this. They did this by letting us into all the information they already had, but also once in a while suggesting open lines of inquiries to us. We did not manage to follow all of them, in some cases because it was beyond our scope or expertise or did not fit our timeline. Our research became concerned with describing the FPA initiative and the limitations or obstacles to more transformative processes. This often happened in dialogue with the societal partner, asking for example whether it would be relevant to do a workshop on a certain topic. With time, they also got to know us better and knew for what kind of questions to approach us.

Host to a community:

In welcoming us, they also introduced us to other involved people, by introducing us to events, cc-ing us in emails, tagging us on social media posts. This not only allowed us to make connections with a larger network but also helped us to understand how other actors (including other grassroots initiatives and academic researchers) look at the initiative of Foodpark Amsterdam. This further gave us an idea of what ideas are wide-spread and what initiatives might require a new light.

Partner in research

The idea of PAR is that societal partners are also research partners. This does not mean that they answer our research questions, but that they also do research that produces knowledge which is of great benefit for addressing the problem and for our research.

Partner in dialogue:

Our societal partner is a great conversation partner throughout the process with which we could exchange and test ideas. Sometimes, for example, they would be able to say why a certain line of inquiry was slightly less productive, or they would appreciate new perspectives, they did not think of.

Partner in action:

Finally, we also organized actions together, this is in line with the idea of participatory action research and evokes a lot of conversations about strategy that otherwise would not have been part of the conversation. The process of co-organizing events was very important for gaining trust and to get a deeper understanding of what political organization means.

2.2 Collaborative Research and Application of PAR

Workshop-based methods

Throughout our PAR research, we conducted various workshops (see Table 13 for an overview). Some of these involved the larger network around FPA and some invited new interest groups. Some of these workshops used artistic and design methods (e.g. the speculative design workshop *Listening to the Soil* (W02), the *Ceramic Workshops* (W06), and the *Speculative Monitoring* workshop on biodiversity (W09)). Some workshops were also purposed for more low-threshold engagement (e.g. *Toolmaking to Reimagine Food Futures* workshop (W07) and *Ceramic Workshops* (W06)). Another series of workshops could be clustered around the topic of collaborating across different stakeholder groups (e.g. the *Postgrowth Cities* workshop (W04) and *Land Policy for Urban Agriculture* (W10)). Finally, some workshops were more about facilitating a structured conversation our societal partner wanted to have (e.g. *Land Lease and Food Initiatives* workshop (W03) and *Spatial Planning for Food within Urban Development* (W05))

Table 13 - Overview of Workshops

Number, Name & Date	Organizers	Participants	Description
W01: <i>Social Ecological Systems mapping with Foodpark Amsterdam</i> 28 June, 2023, at de Waag Futurelab	UT researcher	6 FPA members	During this workshop, in a three-step procedure, we mapped with our societal partner the Social Ecological System around Foodpark Amsterdam. Starting from the individual network and connections, we were further circling into issues of conflict, power, synergies and open questions and concluded with a formulation of challenges and potentials. During this workshop the key themes were identified, which included problematizing real estate development and its financial logic, community building and creating an appealing narrative for Foodpark Amsterdam.
W02: <i>Listening to the Soil,</i> June 2023, at the Boterbloem in the Lutkemeerpo lder	UT researcher & external artist with some assistance of Foodpark.	Around 40 15–16-year-old students from local (public) international school	The aim of the workshop was to stimulate deeper engagement with nature and imagination around alternative human-nature relationships through making speculative listening tools. For this purpose, we used white canvases and coloured pens for brainstorming; discarded and leftover crafting materials and electronics for making the tools. With this the pupils made speculative listening tools capturing more-than human needs in ways that could be experienced through human senses. Analysis of the workshop may be found in Baibarac-Duignan, C., & van den Eijnden, T. (2025). Designing for Transitions Through Co-created Artistic Methods: Gluing Affective “Rurban” Encounters. <i>World Futures Review</i> , 0(0). https://doi.org/10.1177/19467567251330153 .
W03: <i>Land Lease and Food Initiatives,</i> 27 Oktober, 2023, Urban farm Noord-Oogst	Foodpark member & Foundation for Urban Agriculture, UT researcher involved as report maker	15 participants, including civic servants, urban farmers, artists, etc.	The starting point of the conversation was a widely shared feeling that there is much motivation for urban agriculture, exemplified by still unrealized projects such as Foodpark Amsterdam. However, there are structural financial, legal and fiscal barriers that prevent such projects from being realized with difficulty, if at all. The goal of the workshop was to better identify these barriers, but also to gather strategies and courses of action for how we can collectively deal with these barriers and what the possibilities are for rearranging land ownership.
W04: <i>Postgrowth Cities workshop on collaboration</i> , 9 th	UT researcher, external researcher and FPA	2 X 25 participants, mostly researchers, 1 FPA member	During the <i>Postgrowth Cities Symposium</i> (see chapter 4.2), we also conducted a workshop with the aim of the workshop was to bring policymakers, researchers, commoners and urban agriculture practitioners together to reflect on the relations and collaborations between researchers, civic organisations, and

February 2024, at the Boterbloem in the Lutkemeerpolder			the municipality. These questions do not just bring us together around Foodpark Amsterdam but also resonate more widely with the broader field of urban agriculture. While generally, there is a lot of enthusiasm for these collaborations, it is also worthwhile examining how they take shape, what are good practices and where we need to improve our ways of working together to make them more equitable, impactful and generative. The aim of the workshop was twofold: to formulate general principles that can help us to make collaboration agreements and strategize about concrete actions we could take in the present.
W05: <i>Spatial planning for Food within Urban Development</i> , 21 June, 2024, urban farm NoordOogst	Foundation for urban agriculture, municipality of Amsterdam, UT researcher	Around 15 participants including architects, planners, civic servants, researchers	For a healthy, sustainable and resilient city, it is crucial that the food cycle is given space in new neighbourhoods. How can this be organized in the planning process? And what does this require from residents (networks) in adopting gardens and other communal outdoor spaces? We take the case of the area development for Havenstad and NoordOogst as an example.
W06: <i>Ceramic Workshops</i> , March-July 2024, at New metropolis, Bouwput, & de Boterbloem	External artist, Waag Futurelab, FPA, UT researcher	About 5-25 participants per workshop, mostly residents and clay lovers of Amsterdam	There were 8 clay workshops taking place between march and July 2024 in different locations in Nieuw West, including the Lutkemeerpolder. This happened as part of an artistic residency between FPA and Waag Futurelab. All workshops involved clay from the Lutkemeerpolder. In some workshops the focus was on harvesting the wild clay and cleansing it in others the focus was on making objects. Different artistic exercises were employed for this and inspiration was taken from ancient ceramic art from the Asia Minor region. This also provoked reflections on how ceramic art and clay connects us to the land, plants, and food. Results include an artistic catalogue, a short documentary on "The Gold of Amsterdam" and an open air exhibition.
W07: <i>Toolmaking to Reimagine Food Futures</i> , 14 June 2024, at de Boterbloem	UT Researchers, Rurban Futures Collective, FPA	10 participants	In this workshop, we aimed to explore and reimagine 'rurban' food futures for the neighbourhood of Nieuw West through toolmaking at the present site of Foodpark Amsterdam. The workshop was an experimental format, conceived as a low-threshold mode of engagement with the site at Lutkemeerpolder by making it accessible to participants from groups outside the academic or artistic realms. Tools allow us to work the land, harvest and prepare food. They connect soil and seeds, skills and knowledge, humans and nature.
W08: <i>Bioblitz</i> , June 2024, in de	UT Researchers & FPA	n.a.	Through biologically surveying the site where the Foodpark is presently located, we will make visible the biodiversity value of the land and explore potential futures where various species

Lutkemeerpo lder, cancelled due to lack of available volunteer ecologists			thrive. The aim of the workshop was to bring to the fore the biodiversity specific to this land and to explore potential tensions between how biodiversity is normally conceived (e.g., as unique and/or protected species) and everyday / mundane illustrations of biodiversity of a land under threat of redevelopment for lack of biodiversity significance. While in the end we had sufficient citizen participants that were eager to participate, we did not manage to find enough ecological experts that would have been able to instruct the citizens and bring the tools for proper examination.
W09: <i>Speculative Monitoring Workshop,</i> 24 July, 2024 at de Boterbloem	UT researcher, FPA Amsterdam, External curators	20 artists, curators, and activists from Open Call: de Appel Curatorial Programme Summer School - de Appel Amsterdam	In this workshop, we speculatively monitored the life of the polder above and below the surface of soil, water, and empirical reality. We did this by imaging what the polder smells, feels, and looks like for different moments in time that slip through current monitoring practices. In doing so, we wanted to expand our attention to biodiversity beyond limiting notions of biodiversity that dominate in the present and think about other ways of conceiving the richness of the living world. By bringing together different speculative accounts on what biodiversity might be, we wanted to open up a conversation about what biodiversity would mean if we conceived of it as a potentiality rather than a reality. And lastly, what are the implications in terms of landownership, if we look at land as potentialities for life rather than a measurable reality?
W10: <i>Toward a desirable land policy: Visions and routes for collaboration</i> , 4 December 2024, at urban farm NoordOogst	UT researcher, FPA, Foundation for urban agriculture	25 participants, including urban farmers and municipal employees	The workshop was conducted during the Day of Urban Agriculture in Amsterdam organized by the Association of urban agriculture in Amsterdam. Approximately 25 people were anticipating in the workshop, among which two core members of Foodpark Amsterdam, and one researcher, one student who are also involved in the case. Among their participants were urban farmers (among which at least one who is currently collaborating with Foodpark Amsterdam): Leading questions were: What are the desirable visions for the future of land policy? Is land a resource, or should it be considered a commons, meaning that the land is unsellable? What are the challenges and opportunities from the perspective of officials and council members as we move toward desirable land policy? And how can we collaborate effectively at the interface of research, policy and civic engagement? This workshop is "hands-on": we started with big ideas and then worked toward concrete proposals for collaboration. The workshop provided different insights on vision on land and principles of collaboration.

Field-based Research



Our PAR started with a period of around six months during which one of our team members joined the Foodpark Amsterdam (FPA) team and participated in meetings, group conversations, and events. Towards the end of this six-month period, we had with the larger Twente team and core members of the FPA as Social Ecological Systems mapping workshop (W01, see Table 13) during which we also identified important topics and potential research questions³⁹. We collectively proceeded to explore these questions through doing research or by receiving help from other researchers and experts. As such, FPA is continuously doing research, both together with the UT team or independently. The research is deeply informed by everything that is already going on, trying to make sense of these activities and aimed to draw out lessons about the FPA initiative, and the limitations or obstacles to transformative processes.

Engaging as partners in collaborative actions

This concerned various types of action, some of them were more activist (organizing a protest march, joining and supporting protest actions, coordinating a volunteer group in writing letters to enterprises, and municipal employees). Some of them were more about generating academic reflection and output (societal partner joining consortium meetings, co-organizing a symposium, and co-authoring a conference presentation). And some were more artistic (the co-production of a narrative for the International Architecture Biennale Rotterdam, co-coordinating an artistic residency). These collaborative actions helped to concretize and specify some of our ideas.

2.3 Triangulation

We used diverse context specific methods to simultaneously co-create and validate findings. In this, our aim has been to make space for partial and plural perspectives. Our intention was to use creative design, futuring, and storytelling methods which would allow us to challenge dominant paradigms, including about land and biodiversity and to foster plural visions of the future. Examples of such creativity-based engagements were the *Listening to the Soil* workshop (W02), the *Toolmaking to Reimagine Food Futures* workshop (W07), the *Ceramic Workshop* (W06) series on clay, and the *Speculative Monitoring* workshop (W09). Since these were direct engagements, they enabled the generation as well as validation of insights.

Close collaboration meant that we continuously created opportunities for sharing and feedback that could serve as 'reality checks'. Thus, there is always already a negotiation of meaning within the process of generating knowledge and interpreting materials (for example, the collaboration with the *Ceramic Workshop* (W06) artist was conducted with de Waag Futurelab, the *Toolmaking to Reimagine Food Futures* workshop (W07) with the Rurban Futures Collective, and the land policy workshop (W10) was documented by an external researcher and stakeholder. These engagements offered the opportunity of direct and informal sharing and validation of insights. The postgrowth symposium we co-organized in February 2024 offered a more structured place to discuss and reflect on the case since it brought different researchers on FPA together to discuss the case (see also chapter 4.2 on the symposium, for workshop during the symposium see W04, Table 13).

³⁹ The research questions included "1) What is the social and ecological value of Foodpark for people, nature, wellbeing, health? 2) What is the justification for why Foodpark is not possible? What is this so-called damage plan for example? 3) What is the actual economic case for industrialization, what is the need for the distribution centers? 4) What can we learn from the Barcelona case, how was this made into a success? 5) How can we connect with the concerns of the residents? 6) How can we keep track of our achievements?" From our internal workshop report "Social Ecological Systems mapping at Foodpark Amsterdam" written after the workshop on the 28 June, 2023, Amsterdam, de Waag.

3. Case Study Contextualization

3.1 Multidimensional Presentation

Foodpark Amsterdam in its current form, exists since summer 2021. It is a citizen initiative that aims to turn a fertile piece of agricultural land, the Lutkemeerpolder, into a food commons, a place for urban agriculture, biodiversity, social recreation and justice. The Lutkemeerpolder, used to be a lake until 1864. In fact, “lutke” means small in old Dutch, “meer” means lake, and polder refers to the typical Dutch landscape that results from the draining of land – historically through ditches, windmills, and later steam-powered pumping stations. When digging a whole into the soil of the Lutkemeerpolder, one can find many porous shells which attest to its ecological history. This history also makes the soil rich in lime and good for water and nutrient retention. Ever since its drainage it has served as farmland.

Foodpark Amsterdam’s started with the ambition to turn a 43 hectares plot within the Lutkemeerpolder into a commons-governed food park. In such a way it aims to reverse the municipality’s current plans of turning the land into an industrial area for the building of distribution centers. The ambition of Foodpark Amsterdam was changed throughout the years of our Participatory action research, as building activities started in early 2024 and it has become impossible to save the entire plot. Nonetheless, they continue to struggle for all remaining hectares. Besides, they made a tender submission for an adjacent plot of land of 9,5 hectares (which anyways, was going to be saved for urban agriculture). The aim is here to already show on a smaller scale, how different entrepreneurs (ranging for food foresters, to urban farmers, to herbalists, and cooks) that are in search for how land can cooperate and share the land as a commons for the neighborhood and other engaged participants.

Affordable access to land for small ecological entrepreneurs is a very important aspect of the mission of Foodpark Amsterdam, which is particularly relevant in the context of the Netherlands. This is because, today, the Netherlands has the highest land prices for agricultural land within Europe and in fact also worldwide.⁴⁰ More specifically, it is about eight times above European average.⁴¹ The reasons of this all relate to the intensification of agriculture. Changes like “Land consolidation, increasing fertilizer use, concentrated feed and the advent of specialized pesticides provided decades of ever-increasing production”, which were factors that contributed to the high land prices as investigative journalist Joosten explains.

The export of agricultural goods of the Netherlands becomes even more astonishing if one considers not only its surface, but also its population density. The Netherlands has one of the highest population densities on a European comparison, and the metropole area around Amsterdam certainly belongs to the more densely populated areas of the Netherlands. All

⁴⁰ “Nowhere in the world is agricultural land more expensive than in the Netherlands” (Joosten 2024, own translation). In a footnote Joosten nuances this, conceding that certain agricultural lands for luxury grapes for culturally protected brands exceed this price, as well as small plots of land in dense urban areas (Joosten 2024). Joosten continues, “According to figures from the Land Registry and Wageningen Economic Research, the average price of a hectare of farmland broke the 95,000 euro mark for the first time in August. Ten years earlier it was about 53,000 euros. That’s an increase of 80 percent. By comparison, the general inflation rate during the same period was 27 percent. In Flevoland, an acre of arable land now costs almost as much as a Porsche 911” 2024, Translated with DeepL).

For more information see: *Agrarische grond—Actuele vastgoedcijfers—Kadaster.nl zakelijk*. (2025, October 22). <https://www.kadaster.nl/zakelijk/vastgoedinformatie/vastgoedcijfers/vastgoeddashboard/agrarische-grond>.

Also see *Agricultural land prices and rents—Statistics*. (2025, January).

Eurostat. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Agricultural_land_prices_and_rents_statistics, , *Agricultural land prices: Huge variation across the EU*. (2025, November 30). Eurostat. <https://ec.europa.eu/eurostat/web/products-eurostat-news/-/ddn-20211130-2>. This shows, that nationally, the Netherlands certainly have the highest land price. It also has the regional highest land price, if island regions are not included.

⁴¹ For this, Joosten also uses this source: *Agricultural land prices and rents—Statistics*. (2025, January). Eurostat. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Agricultural_land_prices_and_rents_statistics.

this gives a general picture about how green areas are under pressure in the Netherlands, particularly green spaces that are not used in intensive ways and make space for biodiversity. In this context, we may also understand that worldwide and on a European level, the Netherlands also registers low in terms of biodiversity. In the Netherlands, “most protected species and habitat types that fall under the birds and habitats directives are currently not in a favorable conservation status” (Balans van de leefomgeving 2023, 74). This includes the loss of fauna in agricultural areas (Balans van de leefomgeving 2023, 75). Moreover, while during 2011 and 2022, there was a small increase in organic farming, the current percentage of 4 % of all agriculture is far below European average (Balans van de Leefomgeving 2023, 87). Finally, the use of resources by the Dutch economy has devastating environmental impacts abroad (see e.g. [Balans van de Leefomgeving 2023](#), p. 57).

This combination of high land prices and high environmental degradation within an area that is densely populated makes agroecological urban agriculture all the more urgent and difficult. Agroecology is also not supported while unsustainable forms of farming are incentivized among others by means of subsidies. In this context, it is the aim of Foodpark Amsterdam to counter this imbalance, support small scale agroecological urban agriculture by taking the land out of the market and turning it into a commons. This is not only to support the farmers, but also to ensure that locally grown, organic, and healthy food is accessible for everybody and not just for elites. This ambition would also be beneficial for the neighborhood near the Lutkemeerpolder. Savini describes the neighborhood as “Peripheral relative to central Amsterdam, the site adjoins one of the city's poorest neighbourhoods, Nieuw West. The area covers a business park for SMEs (Business Park Amsterdam Oosdorp, phase 1) of 26 hectares, a graveyard of 30 hectares and 42 hectares of agricultural land” (Savini 2025).

3.2 Key Actors and their Impact on Worldviews

While there are various actors involved, it helps to focus on two key groups of actors (while acknowledging there are more actors and that for every group there are internal differences): Voedselpark Amsterdam and the municipality, specifically the section of Land and Development [*in Dutch Afdeling Grond en Ontwikkeling*], and the associated links with SADC (the Schiphol Area Development Company). In many ways, Voedselpark Amsterdam and the municipality of Amsterdam do not have oppositional goals, as both care for the public good of the residents of Amsterdam. Yet, they conceptualize this good in different ways that reflect different worldviews. On the one hand, there is a modernist worldview, that understands nature as something that can be calculated and managed, that provides instrumental values and that needs to be balanced against human and economic interests. On the other hand, there is a relational worldview, that recognizes that humans are part of nature and that prioritizes non-extractive and exploitative relations. As we will show below, these worldviews are often nested into each other.

When it comes to the Lutkemeerpolder, we see a prevalence of the modernist worldview. This becomes most evident in the positions held by the section of Land and Development of the municipality of Amsterdam. For instance, the Lutkemeerpolder has been a place of organic farming since is drainage in the 19th century and it is not recognized as ‘nature’. Moreover, the view that is proposed by the section of Land and Development that an expanding city requires and expanding economy that self-evidently will be at the cost of nature further adds to the modernist worldview. The modernist worldview also considers biodiversity as something that can be designed. The way in which the business park is presented as a green solution is a case in point. As often mentioned by the project developers, they were awarded an excellent BREEAM label⁴² (The Building Research Establishment Environmental Assessment Method), which is about sustainability in

⁴² Achtergrondinterview BREEAM-Outstanding certificering Business Park Amsterdam Osdorp fase 2. (2025, January 7). SADC. <https://www.sadc.nl/ontwikkeling-business-park-amsterdam-osdorp-fase-2-krijgt-breeam-outstanding-certificering/>.

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building. Yet, this label focuses on details like a water fountain that oxidates water and does not offer a holistic vision of sustainability and ecology. Thus, this modernist worldview is able to justify the creation of a business park that seals off fertile soil and fragments patches of green that before were connected.

Foodpark Amsterdam presents an alternative relational view on nature and land as commons. In the vision of Foodpark Amsterdam, it is a fundamental mistake to understand land as something that can be owned by humans, even by an institution like the municipality of Amsterdam that is about the common good of its residents. They propose to 'give the land to itself', as FPA sometimes refers to it in their presentations. The governance model for the commons that they propose for this is the community land trust. The idea of a community land trust is that the land is put into a trust, ideally for ever or for seven generations. Practically, this means that the ownership of the land is organized in a trust which prevents the selling of land, ensures that the use of the land is respectful and regenerative. The usership is organized separately and provides autonomy and creativity to the people that will use the land, as long as they keep the land intact.

These stakeholders include the farmers that work in the place and who will harvest the fruits of their labor and the land. As long as they respect the land and do not extract it but sustain it, so future generations can benefit from it, there will be no intervention from the trust holder of the land. Importantly, while the farmers share the land and different tools, they also have room for creativity and freedom to conduct their enterprises as they see fit. They also include a third party that represents the larger community around the land will make sure that the entrepreneurs can do their work in the best possible way (e.g. through subsidies, sharing networks, coordinating distribution). The latter is the role Foodpark Amsterdam imagines for themselves.

A further instance of Foodpark Amsterdam's relational worldview is its emphasis on agroecology. An agroecological perspective seeks to combine the agricultural work with caring for local ecologies. While monocultures and industrial farming extract the soil of nutrients that is not sustainable in the long run, an agroecological approach aims to regenerate the landscapes where it is situated, returning nutrients to the soil and making space of a diversity of species.⁴³ Human food, in this way, can be a catalyst for complex ecological flourishing. As such, an agroecological perspective intervenes in the traditional idea of biodiversity, that separated humans from nature and thought the only way to preserve nature so exclude humans. As such, it further exemplifies a relational worldview.

To promote their vision, FPA engages in numerous activities. For example, there are regular guided tours around the areas, that not just explain what is around but also allow participants to build connections with the land. A *Ceramic Workshop* (W06) series conducted by a local artist residency provides another example of a workshop opportunity that allows to engage people to connect with the land in a literal and haptic way through the clay, but also a more metaphysical way by exploring forms and meanings that sometimes more or less directly emerge from imagining a relation to that land. For a more detailed description and assessment of the series of the workshops see section 4.5.

However, while Foodpark Amsterdam has a relational worldview at heart, within public conversation with the municipality, this is not always foregrounded in their arguments. In these occasions, it often seems more strategic to also employ a modernist logic to convince the municipality of the relevance of protecting the Luttikhuisvelder. This involves

⁴³ As Colin Anderson, Ernesto Mendez, Patrick Mulvany and Faris Ahmed write on Agroecology Now on December 14, 2022: "The evidence from FAO, IPBES and IPCC has clearly established that agriculture and land use change are among the main drivers of biodiversity loss. Large scale, monocultural, industrial agriculture threatens 86% of the 28,000 endangered species. In the last century we have also lost most of our genetic diversity in crops and livestock on industrial farms.

Currently, only 12 plant species and 5 livestock breeds make up 75% of the world's industrial food system, with just 3 species (wheat, rice and corn) providing half the calorie intake" Anderson, C., Mendez, E., Mulvany, P., & Ahmed, F. (2022, December 14). Agroecology – A promising alternative to the Biodiversity crisis in Agriculture and Industrial Food Systems. *AgroecologyNow!* <https://agroecologynow.net/agroecology-alternative-to-biodiversity-crisis/>.

arguments about why economically, environmentally and socially the most rational thing to do is to keep the Lutkemeerpolder as a place for urban agriculture. For example, they will explain that the business park has logistics and infrastructure problems and is economically inefficient, or they will emphasize the ecosystem services that the Lutkemeerpolder provides, ranging from urban cooling, employment opportunities, health benefits, etc.

While at this moment, parts of the Lutkemeerpolder are being industrialized, there are also achievements. There are signs of a shift in thinking taking place at the municipal level and more and more voices speak out in support of Foodpark Amsterdam.

3.3 Biodiversity Loss Factors

Today, in the case of the Lutkemeerpolder, land-use change is the biggest direct driver of biodiversity loss. It is important to note that in the past centuries, this landscape has been subject to many drastic land use changes. As it changed from peat, to a lake, and then in the 1860s to farmland. However, the land use change Foodpark Amsterdam is concerned with today is about the change from agricultural land which was farmed mainly organically throughout the generations, to an industrial area. The biodiversity that is lost not only concerns the rich soil cultures that are the result of agroecological farming, the diversity of species that are cultivated by agroecological farming and are the byproducts of it,⁴⁴ but also the open fields, low ditches, and trees that mark boundaries between fields have been a home to a host of other species with no direct relation to farming, such as a plethora of insects and meadow birds.

Industrialization can also have impacts beyond the direct location of the Lutkemeer. Land use change has severe impact also on the local ecology, including the local climate. With the rising temperature, it becomes more and more important to implement nature-based solutions for urban cooling. Water bodies and green spaces play an important role here. Increasing the built surface within the city, by contrast, will increase the local climate, which may be seen as a contributing factor to biodiversity loss due to climate change. Also, the Lutkemeer can function as an emergency flooding zone.

It is important to note that industrialization will also cause environmental pollution due to increased traffic in the area, including air pollution, microplastic from tires, and Co2 emissions.

Moreover, the industrialization of the Lutkemeer offers a powerful illustration of the continued role of all three underlying root causes of biodiversity loss. It represents a powerful political economic system that promotes overproduction and overconsumption and that treats nature, and land, as fungible objects that can be exploited, bought or sold. Moreover, the accumulation of land as capital contributes to a concentration of power and wealth that keeps this system in place. Foodpark Amsterdam regularly refers to the industrialization plan as an example of “the old economy”, that is driven by growth, extraction, and over production and consumption.

⁴⁴ “The evidence from *FAO*, *IPBES* and *IPCC* has clearly established that agriculture and land use change are among the main drivers of biodiversity loss. Large scale, monocultural, industrial agriculture threatens 86% of the 28,000 endangered species. In the last century we have also lost most of our genetic diversity in crops and livestock on industrial farms.

Currently, only 12 plant species and 5 livestock breeds make up 75% of the world’s industrial food system, with just 3 species (wheat, rice and corn) providing half the calorie intake.” Anderson, C., Mendez, E., Mulvany, P., & Ahmed, F. (2022, December 14). Agroecology – A promising alternative to the Biodiversity crisis in Agriculture and Industrial Food Systems. *AgroecologyNow!* <https://agroecologynow.net/agroecology-alternative-to-biodiversity-crisis/>.

3.4 Culture-Based Dynamics

As we have seen in section 3.2, we can distinguish two competing worldviews that are underpinned by specific values. In addition, we can mention two reports that were created by conducted by the Science shop of Wageningen University and Research and that present research findings about the different values of the Lutkemeer. The first report '*Discovering the values of the Lutkemeerpolder*' from June 2019 identifies five values: the agricultural value, the natural value, the recreational value, its care function, and its educational function. The second report from 2020 report, *Valuing nature*, further elaborates on this and presents the following values⁴⁵:

- Agriculture (117.600-196.400 €/year)
- Air quality (270.000-915.00 €/year)
- Aesthetics (450-1.800 €/year)
- Pollination (18.200-26.500 €/year)
- Carbon Sequestration (11.800-47.200 €/year)
- Care Services (52.000-83.200 €/year)
- Irrigation (1700-7.200 €/year)
- Biological Pest Control (11.500-16.100 €/year)
- Recreation (1.5-7.5 million €/year)
- Water Retention
- Spiritual
- Habitat
- Water Quality
- Educational Services Raw Materials

These two reports aim to provide arguments to protect the Lutkemeer polder. As this list of values illustrates, the two reports frame nature in instrumental terms, that is in terms of the different values that nature provides and how humans benefit from these values. As such, even if they also discuss relational values like spirituality and care, the reports largely represent a modernist worldview. In so doing, they provide modernist arguments to counter a modernist plan; they do not reflect the relational alternative worldview of FPA.

Still, these reports from an important part of FPA's strategy when it comes to their engagement with the municipality because policy makers often ask for such value calculations and it contributes to the image of FPA as a serious partner. However, so far, it has not been sufficient to convince policymakers to change their plans, particularly not within the section of Land and Development, as all these values that are created will not help them with their budget problems.

3.5 Identity-Based Dynamics

Identity based dynamics have not played a prominent role in Foodpark Amsterdam case study, and we are not in a position to say how or to what extent they have influenced biodiversity challenges. We can only share these two brief examples. First, in one of the team meetings we had, somebody jokingly said something along the lines 'within Foodpark Amsterdam people are either woman or they male and come from rural areas from the

⁴⁵ Both reports can be found via this link: [De waarde van ecosysteemdiensten in de Lutkemeerpolder - WUR](#). Bos, E., van Ekeren, M., Fesel, K., Dutour Geerling, E., Pagabo, G., Winarendri, J., & de Baat, M. (2019). *Discovering the values of the Lutkemeerpolder*. WUR. And: Diele, M., van Gaalen, J., Georgopoulos, K., Reichert, M., Struthoff, P., Walboom, A., & Wijnants, B. (2020). *Valuing nature* (Seedling Consultancy). WUR.

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Netherlands'. Indeed, there is a strong presence of individuals that identify as female in FPA. An example is the LinkedIn comment below (Figure 18).⁴⁶



Figure 19 - Foodpark Amsterdam post on women's participation sustainability through Foodpark

Second, the members of FPA are generally highly educated and also already have professional experience which they can put to use within Foodpark Amsterdam. Finally, all enjoy (quite varying) degrees of economic and social stability, which gives them capacity to contribute to the initiative on a voluntary basis, even as project based expert services are compensated.

3.6 Political/Institutional Dynamics

In section 3.3, we have reported on the factors that cause loss of nature and biodiversity and that support industrialization. One way in which they do that is through policies and institutions. In fact, there are many policies that would support the initiative of Foodpark Amsterdam, on a European, national and municipal level⁴⁷ because they support green and civic initiatives. A good example is the 2022 ministerial decision to make soil and water leading factors in spatial decision about where and what to build.⁴⁸ However, these policies have not been able to reverse industrialization most of the building permits had been already granted. More generally, these green policies run the risk of being ineffective without further institutional and legal changes. Some people see new opportunities in the new [De Omgevingswet](#), the Dutch Environment and Planning Act that is handled since 2024 or in the initiatives around the *Right to Challenge*.

It is difficult to evaluate whether the inability to reverse industrialization is a matter of policy or of political will. The alderman [*in Dutch wethouder*] of spatial planning [*in Dutch Ruimtelijke Ordening*] - roughly the municipal equivalent of a minister on the national level -, in theory, has the power to reverse decisions that have been made. One reason for this

⁴⁶ The screenshot shows a comment under a post from LinkedIn on the 7th of May 2025.

⁴⁷ In 2024 an FPA volunteer made a 22-page internal document relating FPA to almost 20 policy frameworks in which it would fit very well. Most of them concern the municipal level, but some also refer to the national and international one.

⁴⁸ *Kabinet maakt water en bodem sturend bij ruimtelijke keuzes*. (2022, November 25). [Nieuwsbericht]. Rijksoverheid; Ministerie van Algemene Zaken. <https://www.rijksoverheid.nl/actueel/nieuws/2022/11/25/kabinet-maakt-water-en-bodem-sturend-bij-ruimtelijke-keuzes>.

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that we have seen is that the municipality wants to come across as a trustworthy government [*in Dutch betrouwbare overheid*]. This means, that there is strong pressure for current aldermen to not overturn decisions and deals that have been made. In the case of the Lutkemeerpolder, these are decisions that have started in the 1980s and that were tweaked and changed throughout the 2000s. The municipality also expects that they will be forced to compensate companies if they would change the plans for the land and forbid them to build.

This seeming absence of political will is striking because since 2022, Amsterdam has a GreenLeft Mayor, and a governing coalition that includes GreenLeft, the Labor Party and the Liberals D66. All these parties support green politics and social causes, combined with supporting local entrepreneurs and job opportunities, all of which is part of the FPA plan. However, each time, it turns out that while nature⁴⁹, sustainable food⁵⁰, and alternative visions on the economy⁵¹ are considered to be important, this does not result in the protection of the Lutkemeer and the realisation of the vision of FPA.

Municipalities have little say over their budget – including what they should spend money on how they can gain income. Further budget cuts are also expected. It is expected that in 2027, an average municipality that until then would have received 137 euro per inhabitant will only receive 47 euro per person.⁵² In this precarious situation, land is a source of income that municipalities cannot risk losing. And this means that in practice, the municipality sides with powerful actors that have a vested interest in industrialization. This is all the more concerning when considering the infamous history of how these industrialization interests became so strongly embedded in the municipality. Worth mentioning here is that the municipality decided to invest more land into the SADC (“Bestemmingsplan Lutkemeer” 2022, p.7-8), which was then administered through a separate legal person, namely the Area development Corporation *Gemeenschappelijke Exploitatie Maatschappij* (GEM) Lutkemeer. This increased the interests of the municipality to get financial return on investment and it reduced the power of the municipality to exert influence on what kinds of enterprises would be able to settle in the area (“Bestemmingsplan Lutkemeer” 2022).

⁴⁹Volg het beleid: Groen. Amsterdam.nl; Gemeente Amsterdam. Retrieved November 20, 2025, from <https://www.amsterdam.nl/bestuur-organisatie/volg-beleid/groen/>

⁵⁰ Volg het beleid: Voedselstrategie Amsterdam. Amsterdam.nl; Gemeente Amsterdam. Retrieved November 20, 2025, from <https://www.amsterdam.nl/bestuur-organisatie/volg-beleid/duurzaamheid/voedselstrategie-amsterdam/>

⁵¹ Amsterdam Donut Coalitie. Amsterdamdonutcoalitie.nl. Retrieved November 20, 2025, from <https://amsterdamdonutcoalitie.nl>

⁵² Bekkers, H. (2022, May 4). Gemeenten op rand financieel ravijn. Binnenlands Bestuur. <https://www.binnenlandsbestuur.nl/financien/omgevingswet/gemeenten-op-rand-financieel-ravijn>.

4. Transformative Biodiversity Innovations

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4.1 Analysis of Inclusion/Exclusion Mechanisms

In the Amsterdam case, we note a structural dominance of a modernist worldview resulting in the exclusion of the relational worldview that is at the core of Foodpark Amsterdam. Urban agriculture farms, such as for example CSA (Community Supported Agriculture) Pluk and the Stadsgoenteboer, advance relational perspectives on biodiversity and have considerable popular support and scientific endorsement. Nevertheless, they remain marginalized in practice. This marginalization happens not only vis-à-vis economic plans and actors, but also in relation to green policies and actors.

Foodpark Amsterdam's vision of an agroecological commons offers a radically different worldview to the modernist one. The latter either follows a standard economic perspective centered on financial value that depends on economic growth on a finite planet, or follows a standard green perspective based on a separation between humans and nature. This green perspective deems the agricultural nature of Lutkemeer not 'natural' and valuable enough to be protected for ecological reasons.

To counter this dual marginalization, Foodpark Amsterdam has worked on developing and applying the idea of broad wellbeing [*brede welvaart*]. In doing so, it aims to respond to the focus areas of the National Program Together Nieuw West [*in Dutch Nationaal Programma Samen Nieuw-West*] that was designed to address various social challenges in the Amsterdam Nieuw-West neighborhood.⁵³ Specifically, Foodpark Amsterdam aims to respond to the topics of "living environment, opportunities for the youth, job and social security, community wealth building, sustainability, culture, and education".⁵⁴ This notion of broad wellbeing [*welvaart*] encompasses diverse values. In a document from 2024 titled "Sociale paragraaf" that was also shared with the municipality, Lucie Snoeker, one of the Foodpark volunteers details how Foodpark Amsterdam contributes to creating eight values which include 1) subjective wellbeing, 2) health, 3) consumption and income, 4) education and professional training, 5) Spatial cohesion and quality, 6) economic capital, 7) natural capital, and 8) social capital.⁵⁵ In contrast to the metric of GDP (Gross Domestic Product), broad wellbeing [*brede welvaart*] offers the opportunity to think about place-based co-production processes that recognize the specific needs, desires, and potentials of diverse social-ecological communities, in this case the neighbourhood of Nieuw West. This alternative logic of valuation places an emphasis on material and embodied values that are meaningful to specific places / people / communities rather than on universal standards and metrics. However, some of these values are hardly quantifiable in financial terms, and thus they lose out against standard value assessments. Nevertheless, after Foodpark Amsterdam presented these eight values at the municipality, they were asked to participate in a workshop organized by the municipality in connection to the National Program Together Nieuw West.

It should be noted that FPA is an initiative with very scarce resources. It is mostly volunteer-run and community building typically requires a lot of time and dedication. They organize several activities that aim to engage with the municipality, promote FPA, and connect with the neighbourhood. These include guided walks, events at local libraries, film screenings in local cinema, participating in (festive) markets, offering *Ceramic Workshops* (W06) in the neighbourhood, joining and organizing campaigns and protests, joining other ongoing cultural activities in the neighbourhood, organizing cultural activities, joining local political conversations, and collaborating with local social initiatives, like the free

⁵³ See *Nationaal Programma Samen Nieuw-West*. Samen Nieuw-West. Retrieved November 20, 2025, from <https://www.samennieuw-west.nl/>.

⁵⁴ Translation from Lucie Snoeker's "Sociale paragraaf: wat kan Voedselpark Amsterdam betekenen voor Nieuw-West?" (2024). For more information, see *Sociale paragraaf - Wat kan Voedselpark Amsterdam betekenen voor Nieuw-West*.

⁵⁵ See *Sociale paragraaf - Wat kan Voedselpark Amsterdam betekenen voor Nieuw-West*.

supermarket for people with low incomes and the foodbank. The volunteer character of FPA restricts their capacity to engage with actors that are fully paid for their time, for example the municipality and economic actors. It also restricts their capacity to build relations with inhabitants of the neighbourhood and has, so far, not resulted in neighbourhood inhabitants joining the core team of Foodpark Amsterdam for extended periods. For Foodpark this is an issue that is often brought up during meetings.

Despite the limitations of being a volunteer run organization, Foodpark Amsterdam makes great effort to reach out and build relations with diverse people and actors. Moreover, it offers a space and community that empowers its members to do work that is meaningful to them. This can have positive effects on their lives by providing a sense of community, a sense of expertise on a topic, experience, etc. The organizational structure of Foodpark Amsterdam provides a 'workplace experience' that to some extent prefigures the bottom-up and commons-based democratic decision-making processes that they are advocating for. Within Foodpark Amsterdam, anybody who has an idea for doing something can in principle go ahead, but they are expected to consult others before execution. This gives everybody a sense of ownership of their own work, freedom and creativity. At the same time, the community consultation ensures broad support and improvement of plans, which can help smaller initiatives. While there are specific people that are in charge of the budget (in terms of organizing payments and applying for funds), the budget is transparent and everybody who would like to initiate a project can put forward a proposal.

A further way in which inclusion is promoted, we can mention the PAR approach itself. Being part of a research project (BIOTraCes) has enabled Foodpark to expand their already extensive relations. This creates visibility for the initiative and for the knowledges and experience of small-scale farmers and activists. More specifically, in the case of Foodpark, such a research approach supports knowledge generation around commoning activities, which is still regarded as a marginal economic practice. The post-growth cities symposium (2024), a research symposium dedicated fully to Foodpark Amsterdam, was a moment in which this academic support was publicly showcased. During this symposium, 10 well-established and successful academic researchers from various disciplines spoke in front of an audience of around 100 mostly other academic researchers (although policy makers and urban farmers were also invited). The symposium was a strong signal of mutual solidarity between the academic community and Foodpark, highlighting the power of the ideas and movement around their commons-based vision.

4.2 Niche Innovators and Key Players

Many members of Foodpark Amsterdam are connected to other movements, which links them to wider networks and initiatives that search for radical alternatives to the current modernist worldview and political economic system. However, we do not think that the term innovator is appropriate in our context, and we prefer not to use it for two reasons. Firstly, the term's prevalent interpretations related to new solutions. Such understandings promote a progress narrative that lies at the heart of the modernist worldview and associated ideas of economic growth and technological expansion, both of which have been identified as underlying causes and indirect drivers of biodiversity loss. By placing an emphasis on the 'new', the mainstream understandings of "innovation" place it in opposition to what may be perceived as old and traditional, even implying "a lack of imagination" (Bollier and Helfrich 2019). Second, the terminology of "niche innovators" risks to depoliticize projects, as they are not understood to engage with structural issues and pre-existing power relations. Niche innovations are part of a wider trend to organize policy and governance in terms of pilots, or experiments. While this has advantages because such pilots and experiments are bounded, this boundedness also means that they

are depolitized and detached from wider institutional and power dynamics (Turnhout et al. 2020).⁵⁶

Both reasons show why FPA does not fit well with mainstream interpretations of innovation. FPA's focus on commoning is not new. Commoning and commons have a very long history, and they are the backbone of vibrant social-ecological communities across the world. Claiming 'commoning' as an innovation would be inappropriate and would not only dismiss this history but also ignore the ongoing commoning practices that are going on in many parts of the world. Second, commoning is explicitly political. It challenges existing institutions of land use and ownership and proposes an alternative institutional form, the community land trust. Moreover, FPA engages in diverse networks related to alternative economies, food and art. These are outlined below.

Economic Initiatives

Foodpark Amsterdam is aligned to other initiatives and movements interested in themes like commons, alternative economies, and degrowth. This includes the Stichting Grond van Bestaan, Schumacher center for new economics, Waag Futurelab, And the People, the Commons Network, the MeentCoop, etc. What ties these themes together is a shared understanding that the accumulation of capital, financialization, and profit maximalization ultimately undermine relational values, and social-ecological justice and flourishing. The underlying logic regarding biodiversity is that if you take away the financial incentives of profit maximizing, other values are given a chance to flourish, including ecological values, such as biodiversity.

Also, within the municipality of Amsterdam there is an increasing recognition of FPA' ideas. The municipality now even has its own commons program. Nonetheless, it seems to be the case that the municipality is mostly enthusiastic about cooperative modes of organization, while putting land that is in the property of the municipality into a trust is not yet on the agenda.

Food Initiatives

Second, Foodpark Amsterdam is connected to initiatives and movements that aim to change our food system in the way food is produced and processed. This includes the Slowfood movement, 'Futurefarmers' [*in Dutch Toekomstboeren*], the Foundation for urban agriculture [*in Dutch Stichting Stadslandbouw Amsterdam*]. All of these initiatives understand the close relationship between biodiversity, food, and culture. While they differ largely in their geographical reach (from international to local) they remain very much at the margins of the Dutch food system.

Arts Initiatives

Third, Foodpark Amsterdam is connected to arts movements that also challenge the way art has been traditionally thought and practiced. This includes most relevantly the artistic residence with Waag Futurelab (2024), the Lumbung Curatorial Program (2024-2025), de Appel Curatorial Programme (2024), and the International Architecture Biennale Rotterdam (2024). For these different artistic initiatives, FPA serves a place of using natural materials of the polder, most significantly the clay, a place for learning and dialogue. Perhaps, most interestingly, it also serves as a place to rethink the meaning and purpose of art and artistic practice.

⁵⁶ Turnhout, E., Metze, T.A.P., Wyborn, C., Klenk, N. & Louder, E. (2020). The politics of co-production: participation, power, and transformation. *Current Opinion in Environmental Sustainability*, 42, 15–21. <https://doi.org/10.1016/j.cosust.2019.11.009>.

This becomes most explicit in the Lumbung Curatorial Program that aims to understand art and curation as lumbung – which is a kind of commoning. To them “The lumbung practice enables an alternative economy of collectivity, shared resource building, and equitable distribution. Lumbung is anchored in the local and based on values such as humor, generosity, independence, transparency, sufficiency, and regeneration.”⁵⁷ This was developed in during documenta 15 and now is offered as a 2-year master program and training and thus has also received significant institutional recognition. The impact of Lumbung on biodiversity conservation is not necessarily linear, as not all artistic collectives are dealing with issues that are directly about biodiversity. Yet, in a more general sense it provides another entry into practicing and imagining an alternative economy, which can make space for biodiversity to flourish.

The International Architecture Biennale Rotterdam (IABR) *Nature of Hope* (2024)⁵⁸ involved Foodpark Amsterdam to show how architecture and its practice need to be rethought. Instead of thinking of architecture in terms of new built environment, there needs to be more focus on the relation between building and the environment.

4.3 Scalable Bottom-Up Innovations for Transformative Change

For the same reasons as explained above (e.g., connection to notions of progress and development of ‘new’ technologies or products associated with a modernist worldview detrimental to biodiversity), also within this section we will refrain from using the terminology of ‘innovation’. Moreover, the notion of ‘scaling’ itself has been met with some critique, seen to reflect the modernist project, and promote certain problem framings and visions of the future that benefit some powerful actors while sidelining others (Pfotenhauer et al, 2021).⁵⁹ Scaling also tends to point to solutionism (i.e. ‘scalable solutions’) which does not appreciate the time needed for forming relationships, learning and co-creation in bottom-up experimentation, and especially for the broader narrative and societal shifts that FPA is working towards.

Instead of developing testable and scalable solutions, the strategies and activities of FPA can better be characterized as a continuous process and struggle. This includes spreading their commons-based vision and economic alternatives and connecting with other people, networks, organizations and movements. Instead of the notion of scaling up as is used in common understandings of innovation, where local initiatives can scale up to the policy or regime level, this approach aligns better with ideas of scaling out and scaling deep (Moore et al., 2015).⁶⁰ Scaling out because the focus is not necessary on governmental actors but on connecting with comparable initiatives and organizations. Scaling deep because the focus is not only on protecting a specific place and changing a specific plan but on challenging the dominant paradigm and narrative that underlies the plan to develop the Lutkemeerpolder and current regulations and policies that enable the financialization and private ownership of land, and that is the underlying root cause of biodiversity loss more generally.

Within the case of Foodpark Amsterdam, scaling deep could be seen through artistic collaborations which are also part of some of the workshops, including *Listening to the Soil* (W02), *Ceramics Workshops* (W06), *Rurban Toolmaking* (W07), and *Speculative Monitoring* (W09). But also the collaboration around the International Architecture Biennale Rotterdam (2024) provides an example of a deeper transformative learning.

⁵⁷ Lumbung. *Documenta Fifteen*. Retrieved November 20, 2025, from <https://documenta-fifteen.de/en/lumbung/>.

⁵⁸ *Nature of Hope 2024*. IABR. Retrieved November 20, 2025, from <https://content.iabr.nl/en/biennales/nature-of-hope>.

⁵⁹ Pfotenhauer, S., Laurent, B., Papageorgiou, K., & Stilgoe, and J. (2021). The politics of scaling. *Social Studies of Science*, 52(1), 3-34. <https://doi.org/10.1177/03063127211048945>.

⁶⁰ Moore, M.-L., Riddell, D., & Vocisano, D. (2015). Scaling Out, Scaling Up, Scaling Deep: Strategies of Non-profits in Advancing Systemic Social Innovation. *The Journal of Corporate Citizenship*, 58, 67–84. <https://www.jstor.org/stable/jcorpciti.58.67>.

4.4 Initial Mapping of Interventions

An overview of the different activities and collaborations undertaken by Foodpark Amsterdam in the context of this project can be found in table 13. The activities can be grouped into three approaches:

1. Problem mapping
2. New perspectives on biodiversity
3. New tools for collaboration

Problem Mapping

Two workshops have been mostly concerned with mapping a salient problem within the field of biodiversity loss. This concerns firstly the Social Ecological Systems workshop (W01). During this workshop, we used three-step procedure. First, we mapped our individual network and connections. Second, we collectively mapped common issues of conflict, power, synergy, third we developed main questions challenges, and potentials. During this workshop the key themes were identified, which included problematizing real estate development and its financial logic, community building and creating an appealing narrative for Foodpark Amsterdam. Another example of problem mapping was a workshop on *Land Lease and Food Initiatives* (W03) that was led by a FPA member and documented by a UT researcher during the first day of urban agriculture in Amsterdam. The aim of the workshop was to map barriers to urban agriculture but also strategies and action roots to address the barriers collectively. The main barrier in question was the way land ownership is currently handled. What both workshops on problem mapping have in common is that they do not address biodiversity directly but help identify an environment that allows biodiversity to flourish by addressing underlying causes of biodiversity loss.

New perspectives on biodiversity

This involved workshops that aimed to provoke alternative perspectives and imaginaries on biodiversity. For instance, for the *Listening to the Soil* workshop (W02), the aim was drawing attention to the invisible soil life and imagine knowledge could be exchanged between humans and soil. For the *Speculative Monitoring* workshop (W09), the aim was to open up perspectives on biodiversity beyond the biodiversity that can be currently measured to what it was and what it could be. Finally, for the *Ceramic Workshop* (W06), it was more generally a way of relating to nature through the medium of clay and also archetypical subject matters of clay, such as flora and fauna, fertility, and nourishment-related artefacts like bowls, cups, and plates for food.

These alternative perspectives on biodiversity are important for several reasons. They counter biodiversity as a purely 'natural science' issue and how this is also something that comes alive in cultural imaginaries. Moreover, they help to challenge the modernist worldview and associated technocratic visions of nature that are also entangled with dynamics of extraction and mechanization. For instance, understanding the soil as something that can be listened to and communicated with allows to see soil as full of life rather than non-specific matter (i.e. mud).

The *Speculative Monitoring* workshop (W09) helped to historicize biodiversity, as something that came into being through specific land uses and decisions rather than having been naturally like this forever. This, at the same time, also opened up diverse perspectives on biodiversity for the future. Instead of assessing landscapes merely in what kind of species they are hosting now, they could be viewed in terms of their potential for future life.

New tools for collaboration

Other workshops were around the topic of collaboration, which is an essential strategy for small scale initiatives to survive within a system that privileges collaborations with powerful actors and organizations. During the *Toolmaking to Reimagine Food Futures* workshop (W07), led by a member of the Toekomstboeren network together with a UT researcher, collaboration was about peer-to-peer knowledge-sharing between different farmers and gardeners. It focused on exchange of knowledge around tools, what can be done with them, and how they can be repaired or adjusted to specific purposes. For other workshops, the focus was on collaborations between different urban agriculture advocates that brings together activists, researchers and municipal employees. Collaboration that goes beyond tokenistic consultation would be an impactful intervention into how many spatial planning processes take place, particularly around issues of urban agriculture. Here, collaboration is also about finding common goals despite differences in values or perspectives, and ways to work towards them. Examples for this are the *Postgrowth Cities* workshops on collaborations (W04) and the workshop *Spatial planning for Food within Urban Development* (W05).

4.5 Discussion

In this chapter, we have reflected on different dynamics that drive or block transformation in various ways. We discussed the dominance of the modernist worldview as one of the main barriers for more relational ideas on wider prosperity to be taken serious at a policy level but also how volunteer run initiatives struggle to find volunteer support when basic needs are not yet fulfilled (section 4.2). Nonetheless, we also noted, that precisely here it is of great importance to build community relations and alliances. Researchers that take a PAR approach can actively support this, not least by recognizing and emphasizing its importance (section 4.2).

We also discussed the significance of the commoning focus on Foodpark Amsterdam for the larger project of transformation, and how this spans a network that involves alternative economies initiatives, food initiatives and artistic initiatives (section 4.3). Our research is then precisely located at the intersection of these three domains where we participated actively. We also discussed the issue of scalability and highlighted the importance of making horizontal connections to related initiatives (section 4.4) like those mapped in section 4.3. Finally, we provided a brief overview of the most important workshops that we conducted in the past two years and discussed how they contribute to either mapping the problem, offering new perspectives on biodiversity or offering new tools for collaboration (4.5).

To conclude, this section has shown that transformative approaches to biodiversity require a shift in worldviews. This has very practical implications, including what are important domains for biodiversity, how to make impact and how we as researchers can contribute with transformative interventions.

5. Socio-Ecological Analysis

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5.1 SES dynamics, interactions, co-dependencies and relations

SES impact on different actor groups

The primary actor for our research has been the initiative Foodpark Amsterdam. The original aim of Foodpark Amsterdam is to reverse the municipality's current plans of turning the land into an industrial area for the building of distribution centres and transform it into an agroecological commons. The aim is to show how different agroecological entrepreneurs (ranging from food foresters to urban farmers, to herbalists, and cooks) can cooperate and share the land as a Commons and make it a place for learning, food, culture, and recreation for the neighbourhood and other engaged participants.

The most important cluster of counter players are the municipality, the Schiphol Area Development Company (SADC), and the Gemeenschappelijke Exploitatie Maatschappij (GEM) company. In practice, this means that for Foodpark Amsterdam the focus is often on the municipality, specifically the section of land and development [*in Dutch Afdeling Grond en Ontwikkeling*], since the municipality is part of the Schiphol Area Development Company – together with Schiphol airport, the municipality Haarlemmermeer, and the province of Noord-Holland. The Schiphol Area Development Company, on its turn is part of the Gemeenschappelijke Exploitatie Maatschappij company (GEM BV) – together with the municipality of Amsterdam.⁶¹

Besides these actors, during a workshop held in summer 2023 in which we mapped the Social Ecological System with seven members of the initiative FPA, the following stakeholders were identified:

- organic and agroecological enterprises that are located in the Lutkemeerpolder (e.g. CSA Pluk, the Stadsgroenteboer, Alies Natuurlijk and the Boterbloem)
- residents of the neighborhood Amsterdam Nieuw West
- cultural organizations in Amsterdam, e.g. Waag Future Lab
- IVN (a Dutch nature education organization)
- the Tuinen van West (adjacent area to the Lutkemeerpolder).
- Grond van Bestaan
- Toekomstboeren
- Aardpeer
- Land van Ons
- Lenteland
- the Donut coalition
- the Schumacher Center for new economics
- community land trust networks (which mostly focus on housing)

Another way in which stakeholders can be mapped, can be found in a report that was written by Foodpark Amsterdam member Natasha Hulst together with Annelies van Herwijnen and David Bollier.⁶² In this report they address the issue of multivalue creation, which at the same time gives an important insight into a type of stakeholder classification. As can be seen in the figure below that is taken below from the said report, here they classify stakeholders as earth, municipality, entrepreneurs, and citizens. We could understand this classification of stakeholders as a classification that concerns various civic

⁶¹ An explanation of the SADC and the GEM (and more) can be found on the Behoud Lutkemeer website: [Save the Lutkemeer polder! – Behoud Lutkemeer!](#)

⁶² The report is titled "Building a financial ecosystem for thriving commons in Amsterdam" published on the [openresearch.amsterdam](#) platform, research is shared with civil servants in collaboration with knowledge institutes in Amsterdam. For more information on [openresearch.amsterdam](#) see [Nieuw platform deelt onderzoek en kennis over Amsterdam | Website Onderzoek en Statistiek](#).

roles stakeholders can fulfil. Perhaps most relevantly, this shows that the earth is recognized as an important stakeholder within this social-ecological system in Amsterdam.

MULTIVALUE CREATION IN URBAN AGRICULTURE IN AMSTERDAM

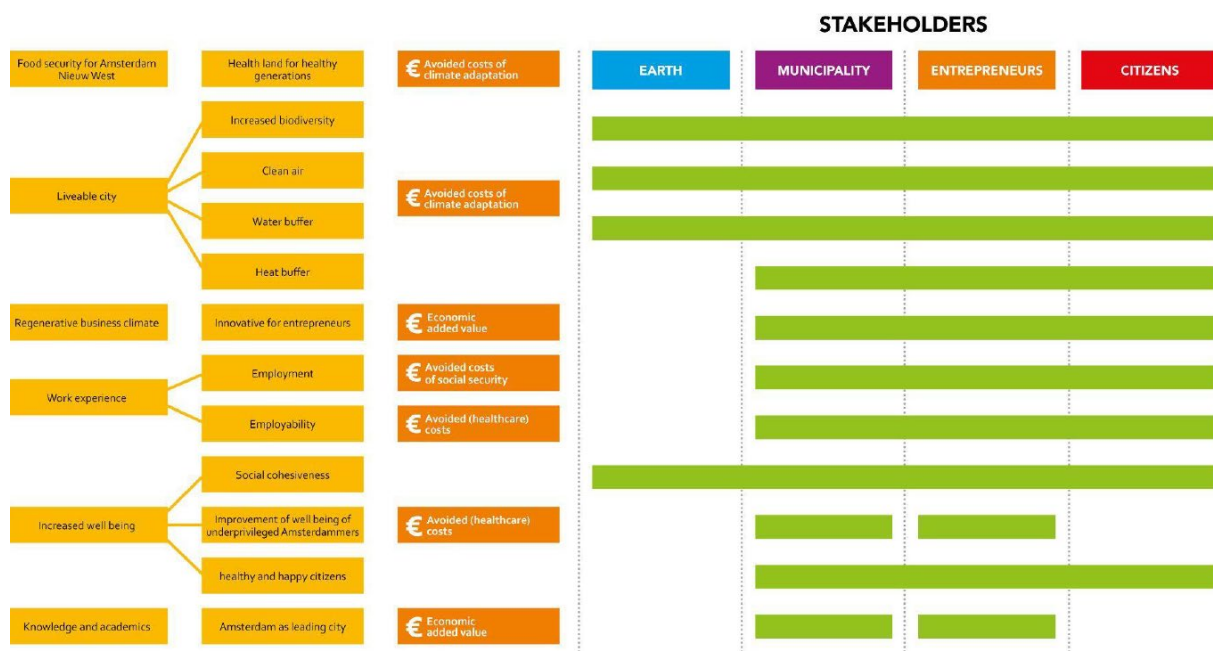


Figure 20 - Categorization of Stakeholders from “Building a financial ecosystem for thriving commons in Amsterdam” (2024)

We categorized relevant partners into Economic Initiatives, Food Initiatives, and Arts initiatives. For more detail see chapter 4, what follows is just a summarized list:

Economic Initiatives

- Stichting Grond van Bestaan
- Schumacher center for new economics
- Waag Futurelab
- And the People
- the Commons Network
- the MeentCoop
- commons agenda of the municipality

Food Initiatives

- the Slowfood movement
- Futurefarmers [*in Dutch Toekomstboeren*]
- the Foundation for urban agriculture [*in Dutch Stichting Stadslandbouw Amsterdam*]

Arts Initiatives

- Waag Futurelab
- Lumbung Curatorial Program
- de Appel Curatorial Programme
- International Architecture Biennale Rotterdam, *Nature of Hope* exhibition

To sum up, there are different ways to think, categorize and map the different actors relevant for the case of the Lutkemeerpolder. It becomes clear that Foodpark Amsterdam is exceptionally well-connected with other organizations in the immediate neighbourhood and nationally. Moreover, their network involves a broad spectrum of types of

organizations and partners, that simultaneously show the multidimensionality of the initiative Foodpark Amsterdam.

Decision-making processes and power relations between relevant actor groups

While we have seen above that various actors are involved, when it comes to decision making processes and power dynamics, it helps to focus on two key (groups of) actors. On the one hand, we have Voedselpark Amsterdam, on the other hand, we have the developers of the Business Park Amsterdam Osdorp, the SADC, which, as we have shown above, involves the municipality in multiple ways, specifically the section of Land and Development [*Afdeling Grond en Ontwikkeling*]. As the municipality is a democratically elected organization that stands for the public good of its residents, the main focus of FPA has been to convince the municipality of their alternative plan for the place.

The conflict around the Lutkemeerpolder is in fact a conflict of power around the issue who is able to decide what happens with the 'green environment' within Amsterdam. Land prices are an important factor in how decisions regarding the social ecological system are being made and implemented. For the municipality it is one way to receive money from lease contracts. As the municipality – almost per definition – will always struggle to manage their budget (there are always important investments to be done on a municipal level), there is a strong incentive to lease out the land for a high price.

Affordable access to land for small ecological entrepreneurs is a very important aspect of the mission of Foodpark Amsterdam, which is particularly relevant in the context of the Netherlands. This is because, today, the Netherlands has the highest land prices for agricultural land within Europe and in fact also worldwide.⁶³ It is about eight times above European average.⁶⁴ Such high land prices make the hurdle for starting agroecological farmers who did not inherit land very high. This in fact limits the decision-making power of aspiring agroecological farmers as it firstly limits their access to land and secondly provides very strong incentives to engage in intensive farming to make ends meet.

It is the aim of Foodpark Amsterdam to counter this imbalance and support small scale ecological, regenerative urban agriculture by taking the land out of the market and turning it into a Commons. This is not only to support the farmers, but also to ensure that locally grown, organic, and healthy food is accessible for everybody and not just for elites. In such a way, Foodpark Amsterdam is looking for ways to increase the autonomy in terms of decision-making power for agroecological entrepreneurs and ultimately also the residents that will benefit from being able to choose locally grown organic and healthy food.

Types of knowledge informing decision-making and biodiversity framing

In the case of the Lutkemeerpolder, there are two dominant – and largely opposing types of knowledge on biodiversity, namely a modernist perspective and a relational perspective. The modernist worldview understands nature as something that can be calculated and managed, that provides either intrinsic or instrumental values and that needs to be

⁶³ "Nowhere in the world is agricultural land more expensive than in the Netherlands" (Joosten 2024, own translation). In a footnote Joosten nuances this, conceding that certain agricultural lands for luxury grapes for culturally protected brands exceed this price, as well as small plots of land in dense urban areas (Joosten 2024). Joosten continues, "According to figures from the Land Registry and Wageningen Economic Research, the average price of a hectare of farmland broke the 95,000-euro mark for the first time in August. Ten years earlier it was about 53,000 euros. That's an increase of 80 percent. By comparison, the general inflation rate during the same period was 27 percent. In Flevoland, an acre of arable land now costs almost as much as a Porsche 911" 2024, Translated with DeepL). For more information see: [Agrarische grond - actuele vastgoedcijfers - Kadaster.nl](https://www.kadaster.nl/nl/actuele-vastgoedcijfers) [zakelijk](https://www.kadaster.nl/nl/zakelijk). Also see [Agricultural land prices and rents - statistics - Statistics Explained - Eurostat](https://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&code=sdg-12.2.1), [Agricultural land prices: huge variation across the EU - Products Eurostat News - Eurostat](https://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&code=sdg-12.2.1). This shows, compared to other countries, the Netherlands certainly have the highest land price. It also has the regional highest land price, if island regions are not included.

⁶⁴ For this, Joosten also uses this source: [Agricultural land prices and rents - statistics - Statistics Explained - Eurostat](https://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&code=sdg-12.2.1).

balanced against human and economic interests. Within the case of the Lutkemeerpolder, instrumental values provide the dominant lens according to which the Lutkemeerpolder is evaluated. In other words, the polder is not understood as a valuable in itself, but as a resource to be used in the most efficient way. Within the dominant standard economic paradigm, what is then 'the best use,' is primarily evaluated in financial terms. As we have seen above, for the municipality more income is gained from leasing land to industry.

During a Joint FactFinding session in February 2024, Foodpark Amsterdam and the municipality both explained and challenged each other's vision on the Lutkemeerpolder. When making the case for the necessity of a business park, the municipality was referring to the growth of the city as providing the imperative for industrial expansion. As they explained, this growth of the city is about population growth and job opportunities and it is the growth of job opportunities that is growing quicker than expected (Joint Fact Finding report 2024, p. 2, 12).⁶⁵ Implicitly, the growth of job opportunities (that is the prospect – not the actual reality – of more jobs) serves as the major reason for industrial expansion. In other words, more job opportunities require more opportunities for industry. This then presents the circular logic of capitalist growth, where the prospect of more economic growth continuously requires also more resources. There is discussion on the nature of the jobs and how this would benefit society.

Yet, even as the business park exemplifies a modernist logic of value extraction and expropriation, they simultaneously do not want to be seen like this. This becomes clear in the way they appeal to the natural and social values of the Business Park Amsterdam Osdorp. During the Joint Fact Finding meeting, the municipality, for instance, was appealing to the public good of more municipal revenues. They also go into great detail explaining their vision on biodiversity emphasizing the ecological experts they have been working with.⁶⁶ In an interview that celebrates the "outstanding" certificate for spatial planning by the Building Research Establishment Environmental Assessment Method (BREEAM) the Business Park Amsterdam Osdorp has received, Hein Veldmaat, Business Leader sustainability and urban development at the advisory and engineering office Technisch Adviesbureau van de Unie van Waterschappen (TAUW) says about biodiversity within the business park:

Biodiversity is often viewed primarily as something that looks nice and has some useful functions. Soil biodiversity receives little attention in this regard because knowledge about it is limited and it is less visible. Therefore, it is often skipped when designing and managing.

The construction of business parks often assumes "dead soil," using sterile soil and planting standard plants. This leads to boring business parks that contribute little to biodiversity and disrupt the landscape. It is also unsustainable because few ecosystem services are provided. We wanted to do that differently.

By using the original soil, we not only preserve the identity of the area, but also ensure a good start with the existing soil biodiversity. This matches the soil types and habitats in the wider environment.

This requires courage, because we are increasingly discovering how important soil life is for everything that grows above it, while we still understand little about it. We are taking a progressive approach, focusing on the preservation and restoration of the original soil (2025, DeepL assisted translation).⁶⁷

⁶⁵ The Joint Fact Finding report (2024) can be found here: [Joint Fact Finding - Voedselpark Amsterdam](#).

⁶⁶ For instance, they write: "In close consultation with experts, such as the city ecologist, soil life specialist from Naturalis and the landscape manager of Spaarnwoude, we searched for robust and diverse biotopes for the originally arable land in the area" (DeepL assisted translation). For the full interview, see [Achtergrondinterview BREEAM-Outstanding certificering Business Park Amsterdam Osdorp fase 2 - SADC](#).

⁶⁷ They are also proud of the impact they make on water quality: "In the water park – a high-quality urban park that includes aqueducts- the rainwater from the roofs and grounds converge and an ecological design provides increased water quality. Strategically placed groups of trees, with their foliage, not only provide meeting places with light and shade, but also form the route for bats in the connection between Westgaarde Cemetery and the western nature reserve the Green Axis. Which again is a very nice walking route for people, with bridges and beautiful native plants and trees. Instead of building traditional hard infrastructure like storm sewers or frame

In such a way, and nearly analogous to the arguments of Foodpark Amsterdam, the business park assumes almost the role of a guardian of the marine clay soil of the Lutkemeerpolder. Moreover, they foresee an important social role of the Lutkemeerpolder. According to project manager Sheila van Vliet:

...we also looked at how this business park can contribute to social cohesion in the area. How does the area fit into the environment and how can we design it so that it becomes a place where much more happens than just work? That it becomes a place where people like to come together and are a logical part of it? And how do we connect existing local initiatives like 'Gardens of West' with the entrepreneurs who are here? Those are questions that the design really answers beautifully (2025, DeepL assisted translation).⁶⁸

Veldmaat further adds

Partly to achieve this cohesion and connection between people, we designed the public space as a fruit orchard with 1,500 fruit trees and created a water park as the heart and meeting place" [...] "The fruit trees provide a meeting place to pick and shape a community process (2025, DeepL assisted translation).

The sincerity of these ambitions may be doubted as no business park is necessary for this purpose. Organic farming has been a great way to sustain and nurture the marine clay for many generations, and there already exists an orchard and community within the Lutkemeerpolder, which are now erased from the plans of the business park. This then presents a clear instance of greenwashing. As mentioned in section three of this document, Vanessa Machado de Oliveira understands modernity as something that is unevenly distributed. In light of the rhetoric of the project developers of the business park Amsterdam, something similar could be said about a rationalist view. While the business park clearly represents the dominant logic of modernism, the way 'dresses up' with relational values as well (concerning soil and social life) shows the complex entanglement of these incompatible worldviews. Even if this rhetoric is merely strategic and not connected to a relational practice, it demonstrates that 'modernist project' on its own is considered to be shallow and as such needs to appropriate other than economic values to thrive.

While businesses use mostly empty green language in the hope they can continue as much as possible with 'business as usual,' we can note instances where Foodpark Amsterdam is doing the reverse, adopting a modernist language to make themselves heard within the modernist framework, and in such a way unleash 'unusual business'. For instance, Foodpark Amsterdam argues that the business case of the business park is limited, because it does not take into account the suboptimal infrastructural location of the business park, with no highway exit close by and a road system that was not built for heavy traffic from a distribution centre (Joint Fact Finding report 2024, p. 10).⁶⁹

Besides, Foodpark Amsterdam also employs the logic of instrumental values to point to other socio-ecological values that are often referred to as ecosystem services. Oftentimes, the value of these ecosystem services is evaluated in financial terms. However, the risk of such financial evaluation is that it makes nature substitutable, because different financial values can be weighed against each other. A good example of such a view of nature are the two scientific reports that were written by the science shop of Wageningen University and Research and were issued by Behoud Lutkemeer, in many ways the predecessor of the initiative Foodpark Amsterdam. The first report '*Discovering the values of the Lutkemeerpolder*' from June 2019 identifies five instrumental values: the agricultural

walls to hold back water, we use Nature Based Solutions. These are flexible and have the ability to adapt to changing environmental factors, such as extreme weather conditions" (DeepL assisted translation). For the full interview, see: [Achtergrondinterview BREEAM-Outstanding certificering Business Park Amsterdam Osdorp fase 2 - SADC](#).

⁶⁸ See full interview here: [Achtergrondinterview BREEAM-Outstanding certificering Business Park Amsterdam Osdorp fase 2 - SADC](#).

⁶⁹ For more information on the Joint Fact Finding report, see here: [Joint Fact Finding - Voedselpark Amsterdam](#).

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value, the natural value, the recreational value, its care function, and its educational function. The second report from 2020⁷⁰, further expands on this and provides exact numbers of diverse kinds of values as has been shown in section 3.4 of this report.

This shows, that Foodpark Amsterdam strategically employs scientific knowledge and terminology that is well-accepted in science-policy circles. Vis-à-vis the municipality, this helps them to strengthen their claim that their resistance against the distribution centre is not a 'mere' case of 'not in my backyard' but in fact an instance of opposing the dynamics of biodiversity loss – a matter that has real costs.

Nonetheless, even as Foodpark Amsterdam is capable of convincingly employing an instrumental values perspective on biodiversity, they are also very critical of it, especially when ecosystem services are quantified into financial revenues. Firstly, they have seen that these quantifications of nature always lose out against business, even if on paper they would be higher as the industrial activities that will now take place in the Lutkemeerpolder. The reason for this is that the diverse financial returns that flow from 'ecosystem services' are often more distributive in nature and what Bollier (but also the article by the municipality) thinks of as inalienable.⁷¹ To put it simply, a flourishing nature will benefit the neighbourhood in many ways – ranging from health to community. But the money that is 'gained' in such a way is distributed among various actors of the socio-ecological system.⁷² If for instance within 30 years, a person needs less medical treatment because they live in a greener environment, move more on a daily basis, eat more healthy food and have a caring community around them that can take care of them when they won't feel well, certainly a lot of money is saved. Yet this money is distributed and a long-term investment. It won't provide immediate cashflows to the municipality nor any other pocket.

Secondly, the concept of ecosystem services is problematic since it financializes values belonging to the land, as the 2020 report *Valuing nature* by the Science Shop of Wageningen University and Research demonstrates⁷³: And so, while on some occasions they may employ the language of ecosystem services for strategic purposes, on a more fundamental level they actually oppose it. This is because they object to conceiving of the land in financial terms, overshadowing and extracting all other kinds of values. In fact, their idea of turning the land into an agroecological commons presents an alternative to the financialization of land.

FPA presents an alternative to the modernist worldview and a relational vision on the Lutkemeerpolder that is based on land as a Commons. In this vision, land is not a property of humans, but something that humans can take care of to provide for their material existence. This alternative foregrounds mutual dependencies and reciprocity. Agroecology is central to the FPA vision because it emphasizes locally situated human-nature-food relations and interdependencies. The yellow cucumber that is now cultivated and promoted

⁷⁰ Both reports can be found via this link: [De waarde van ecosysteemdiensten in de Lutkemeerpolder - WUR](#).

⁷¹ Inalienability, as it is also written in the report on "Building a financial ecosystem for thriving commons in Amsterdam" by Natasha Hulst, Annelies van Herwijnen and David Bollier is a key attribute of the commons. As they put it: "*Inalienable Non-extractive Shared Wealth*: In commons, shared wealth is considered inalienable in perpetuity. There are no intentions to liquidate common assets or "cash out" in the future, a feature that ensures their longevity and sustainability. Commons and the value and wealth they create, are not designed to yield financial gain." (Hulst, Herwijnen and Bollier 2024, p. 2). This is an idea that Bollier and colleagues have been developing already over many years, see for instance also [Free, Fair and Alive. The insurgent power of the Commons \(2019\)](#).

⁷² The issue of health was an issue that came up several times during the *Day of Urban Agriculture 2023* and also was critically reflected on by Foodpark Amsterdam members. The distributed value, as exemplified by increasing the general well-being within one neighbourhood is also something that Hulst, Herwijnen and Bollier recognize and discuss as a major challenge. In this context they raise the issue of "avoided financial costs". As they put it: "Invisible secondary avoided costs: non-financial value that is created oftentimes results in avoided financial costs in a different realm or sector. This is especially true when the non-financial value is created through destruction of financial value. An example: by cutting the number of river cruise boats coming through Amsterdam, the city will lose 63 million of revenues and approximately 700 workplaces. However, cutting the number of cruise ships will result in cleaner air and a more livable city, reducing long term health care costs for residents and avoiding costs that pollution causes" (Hulst, Herwijnen and Bollier 2024, p. 8).

⁷³ Both reports can be found via this link: [De waarde van ecosysteemdiensten in de Lutkemeerpolder - WUR](#).

by some of the core members of the Foodpark Amsterdam team is an example of reviving local knowledges.⁷⁴

To sum up, when it comes to the Lutkemeerpolder, there are opposing worldviews and values at stake, that can be divided into a modernist vs. a relational paradigm. However, even as these paradigms are incommensurate, this does not mean that they are neatly separated within political dialogue. Foodpark Amsterdam, for instance employs a modernist language to convince the municipality of the value of the Lutkemeerpolder. At the same time, the efforts of the project developers to present the integrated greenness of the business park as an outstanding virtue of the park also shows – perhaps – an effort to ‘buy into’ the values of a relational framework. This, however, remains an empty discursive rapprochement and importantly does not make the business park in any way less instrumental and modernist.

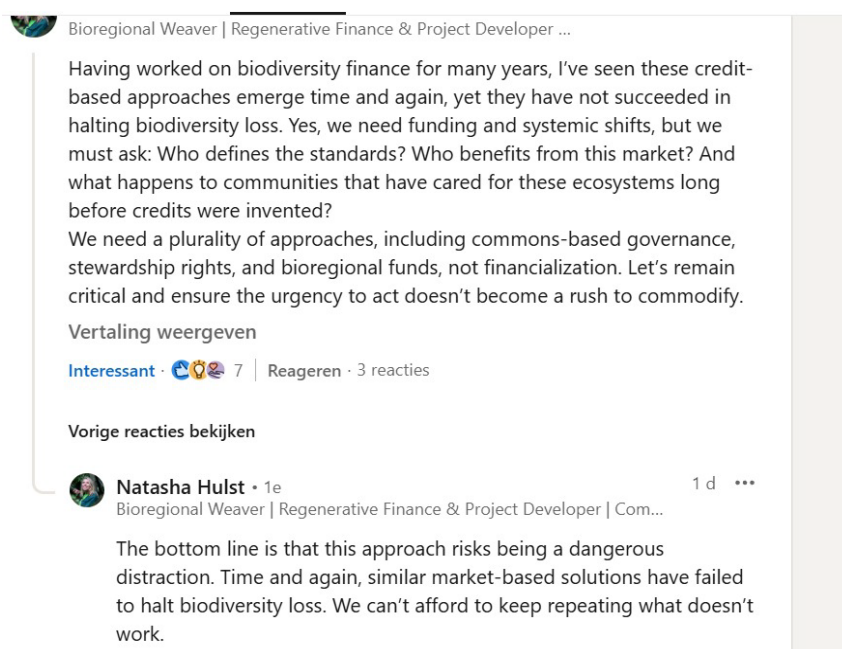


Figure 21 - LinkedIn post (July 2025)

Ecological functioning of the SES and direct drivers of biodiversity loss

Today, in the case of the Lutkemeerpolder, land-use change is the biggest direct driver of biodiversity loss. It is important to note that in the past centuries, this landscape has been subject to many drastic land use changes. The Lutkemeerpolder changed from peat to a lake, and then in the 1860s to farmland. However, the land use change Foodpark Amsterdam is concerned with today is about the change from agricultural land, which was farmed mainly organically throughout the generations, to an industrial area. The biodiversity that is lost not only concerns the rich soil cultures that are the result of agroecological farming, the diversity of species that are cultivated by agroecological farming and are the byproducts of it,⁷⁵ but also the open fields, low ditches, and trees that

⁷⁴ For more information see: [De terugkeer van de Gele Komkommer - Slow Food](#).

⁷⁵ In 2023, for instance, Colin Anderson, Ernesto Méndez, Patrick Mulvaney, and Faris Ahmed write: "The evidence from FAO, IPBES and IPCC has clearly established that agriculture and land use change are among the main drivers of biodiversity loss. Large scale, monocultural, industrial agriculture threatens 86% of the 28,000 endangered species. In the last century we have also lost most of our genetic diversity in crops and livestock on industrial farms."

mark boundaries between fields and have been a home to a host of other species with no direct relation to farming, such as a plethora of insects and meadow birds.

However, it is important to note that that this land use change did not happen 'on its own' but is driven by the dominant modernist worldview that seeks to make the revenues of nature ever more efficient. First agricultural land was more profitable than a lake and now an industrial park is more profitable than agriculture.

Values underpinning decision-making processes

As we have seen above (and also in section 3.2 on "Key Actors and their Impact on Worldviews"), we can distinguish two competing worldviews that are underpinned by specific values. The struggle of Foodpark Amsterdam is to move between these two worldviews and the values associated with them. One challenge is that the values of a relational worldview are poorly understood within a modernist worldview. It is for this reason that Foodpark Amsterdam is balancing continuously between making themselves understood within the modernist worldview, while also showing the limitations of this worldview and creating space for relationality. However, as we have seen in the case study, relational values often loose out against modernist values. Not necessarily because they provide less value but because relational values are more distributed among various social-ecological actors (including the human and more than human world) and because they inalienable and resist exchangeability. As Foodpark Amsterdam initiator and allies Hulst, Herwijnen and Bollier (2024) write about the commons in Amsterdam:

...current frameworks, including markets, property law, and regulatory structures, often fail to grasp the value and complex dynamics of commons, undermining their potential for development. The reason for this lack of understanding is that commons operate in a completely different realm from the current frameworks: the value created by commons is typically not transactional or translatable in monetary terms (e.g. fresh air, safe communities, reliable information), (Hulst, Herwijnen and Bollier 2024).

Foodpark Amsterdam members are collaborating with municipal actors to seek solutions. For instance, some Foodpark Amsterdam members participated in 2024 in a pilot led by the municipality of Amsterdam on general prosperity scan [*brede welvaart scan*]⁷⁶. As Foodpark Amsterdam activists reported, the aim of the pilot was to discuss the assessment framework for evaluating a business vs. Foodpark.⁷⁷ Moreover, Foodpark Amsterdam also wrote a 'social paragraph' in September 2024, after the Joint Fact Finding report was discussed in the commission for spatial planning on July 3, 2024 and they received the question about what the Foodpark would mean for the neighbourhood of Nieuw West.⁷⁸

Foodpark Amsterdam is now also participating in the Community Wealth Building program of the 'National Program Together Nieuw West' [*Nationaal Programma Samen Nieuw-West*]. According to Foodpark Amsterdam initiator and allies Hulst, Herwijnen and Bollier

Community Wealth Building (CWB) emerges as a significant intermediary between commons and traditional corporations. Community wealth building

Currently, only 12 plant species and 5 livestock breeds make up 75% of the world's industrial food system, with just 3 species (wheat, rice and corn) providing half the calorie intake." For more information see: [Agroecology – A promising alternative to the biodiversity crisis in agriculture and industrial food systems - resilience](#).

⁷⁶ More information on how the municipality understands general prosperity can be found here: [Brede Welvaart Scan - openresearch.amsterdam](#).

⁷⁷ According to a Foodpark Amsterdam activist, the organizers said that the results will be shared with the commission for spatial planning. Yet it is unclear whether that happened. Moreover, they had some doubts about the methodological rigour of the pilot.

⁷⁸ For this purpose, gathered for 27 point son what Foodpark Amsterdam could mean for Nieuw-West and categorized the into the eight indicators for general prosperity as defined by the three planning offices in the Netherlands. More information on the work of Foodpark Amsterdam on general prosperity can be found here: [Voedselpark Amsterdam: Brede welvaart en Nieuw-West - Voedselpark Amsterdam](#).

(CWB) is a people-centred approach to local economic development, which redirects wealth back into the local economy, and places control and benefits into the hands of local people. Local needs are met by local entrepreneurs, thus eliminating local wealth extraction. CWB initiatives in Amsterdam seek to integrate community interests into economic activities. The main potential distinction between CWB and commons lies in their approach to ownership and wealth distribution. In CWB, ownership structures may resemble traditional corporations, where activities can be sold or profits distributed to owners - who are local entrepreneurs and the employees. Conversely, commons always operate on a self-owned basis, ensuring that wealth generated remains within the collective domain (2024, p. 4).

Hulst, Herwijnen and Bollier see community wealth building as one of the practical solutions to make transitions (which Bollier also refers to as *OntoShifts*⁷⁹) from business as usual of a standard economic practice to a commons economy. This then can work as a strategy of transvestment, “the deliberate transfer of value from conventional capitalist circuits of money into commons-based circuits of value” (Hulst, Herwijnen and Bollier 2024, p.17).

Political, cultural and institutional power dynamics

As has been shown before, institutional and political power lie primarily with the municipality of Amsterdam, including the GEM company (Gemeenschappelijke Exploitatie Maatschappij bv) and the SADC (the Schiphol Area Development Company), the latter of which on its turn also involves the municipality of Amsterdam. Culturally, these power dynamics show a dominant worldview that prioritizes specific instrumental knowledges and values, which so far we have presented as a modernist worldview.

For the purpose of an exhibit at the International Media Architecture Biennale (2024) *Natures of Hope*, we theorized these different kind of power in terms of *‘Managing Green Infrastructures’* vs. *‘Commoning Green Intimacies’*. The following narrative was originally submitted to be displayed at the show:⁸⁰.

‘Managing Green Infrastructures’ articulates a sterile and technocratic vision on planning and managing land and sees nature as something that is detached from humans, commensurable, and fungible. Its value can be assessed and compared through standardized metrics. This narrative considers green to be important but holds that green infrastructures should be efficiently designated and managed to optimize functionality and balance economy and ecology. In this vision, Lutkemeerpolder is dismissed as inefficient, messy, and mundane; an area that can and should be sacrificed for industrialization, specifically the building of warehouses.

‘Commoning Green Intimacies’ foregrounds intimate and place-based, relations and principles of commoning and sees nature, land, food, and people as entangled. In this vision, The Lutkemeer is not exchangeable but irreplaceable and unique. Its value is not expressed in standardized metrics but resides in its unique qualities and affordances. These include the diverse human-non human relations that it makes possible, its future potential and contribution to human-ecological wellbeing, and its specific historical and cultural dimensions, such as the unique fertility of the marine clay that has been organically farmed for multiple generations and the socio-economic context of Amsterdam Nieuw West.

⁷⁹ *OntoShift* is an important concept of in Bollier and also informs how Foospark Amsterdam members think about transition and transformation. Together with Helfrich, he writes about it in the book *Free, Fair and Alive* (2019), where they defines it in the following way: “So to truly understand the dynamics of the commons, one must first escape the onto-political framework of the modern West. One must make what we call an “*OntoShift*” — a recognition that relational categories of thought and experience are primary” (p. 58).

⁸⁰ The version that was displayed in the show is a shortened version of this text.

In the juxtaposition of these two narratives, Foodpark Amsterdam serves as both a hopeful alternative vision and a grassroots movement that prefigures this alternative vision and that engages in struggle to challenge the prevailing technocratic, managerial and economic logics and values that threaten Lutkemeerpolder.

In spring 2025, Foodpark Amsterdam has won a tender competition for a 9,5 hectares piece of land, adjacent to the land they are fighting to protect. This victory gives Foodpark Amsterdam the opportunity to prefigure on a larger scale their vision on collaboration and collective care for land. At the same time, it is an indication that the municipality recognized Foodpark Amsterdam as a serious party whose relational vision and ideas around commoning green infrastructure are inspiring while at the same time, they could make a serious business and development plan that ultimately could compete and win over a commercial party. Yet so far this shift in the image of FPA, did not lead to revisions of the business park, which remains the ultimate goal of Foodpark Amsterdam.

Embedding the local SES in the high impact sector

FPA intervenes most significantly in the impact sector of urbanization. The case reflects the more generally conflicting dynamics that are met within the sector of urbanization, such as the expansion of urban centres, the (perceived) need for economic growth to make the city attractive and profitable, and simultaneously the need to keep cities liveable by allocating enough space for green and maintaining space for small and local enterprises to flourish instead of privileging multinationals. There are some indications, that the latter is becoming more and more important in urbanization processes. In a report written by Foodpark Amsterdam initiator and allies Hulst, Herwijnen and Bollier (2024) published on the *openresearch.amsterdam* platform that is connected to the municipality of Amsterdam write:

In the heart of Amsterdam, a quiet revolution is underway. Amidst growing disillusionment with traditional market mechanisms, an increasing number of residents are gravitating towards collective initiatives known as commons. These endeavors, from community gardens to shared childcare and public space management, prioritize community well-being over profit, while at the same time avoiding bureaucratic complexities. (Hulst, Herwijnen and Bollier 2024, p.1).

Foodpark Amsterdam's vision of an agroecological Foodpark also reflects a more general international trend that recognizes the value of urban farming for biodiversity, food sovereignty, community building, and community wealth building, urban cooling, etc. Prominent examples from other European cities involve the R-Urban network in Paris, including the urban farm Agrocité,⁸¹ Paris' general greening program,⁸² another prominent example is the city of Barcelona, that generally promotes urban gardening and also is connected to the big Parc Agrari del Baix Llobregat.

Economic structures impact over the SES

Affordable access to land for small ecological entrepreneurs is a very important aspect of the mission of Foodpark Amsterdam, which is particularly relevant in the context of the Netherlands. This is because, today, the Netherlands has the highest land prices for agricultural land within Europe and in fact also worldwide. More specifically, it is about eight times above European average⁸³. The reasons of this all relate to the intensification of agriculture. Changes like "Land consolidation, increasing fertilizer use, concentrated feed and the advent of specialized pesticides provided decades of ever-increasing production",

⁸¹ For more information see: [AGROCITÉ | R-Urban English](#).

⁸² For more information see: [Paris aims to plant 170,000 trees to keep the city cool | World Economic Forum](#).

⁸³ see: [Agricultural land prices and rents - statistics - Statistics Explained - Eurostat](#).

which were factors that contributed to the high land prices as investigative journalist Joosten explains. This is how it is possible that the Netherlands still constitutes the second largest agricultural exporter worldwide⁸⁴ after the United States while being about 237 times smaller⁸⁵.

The export of agricultural goods of the Netherlands becomes even more astonishing if one considers not only its surface, but also its population density. The Netherlands has one of the highest population densities on a European comparison, and the metropole area around Amsterdam certainly belongs to the more densely populated areas of the Netherlands. All this gives a general picture about how green areas are under pressure in the Netherlands, particularly green spaces that are not used in intensive ways and make space for biodiversity. In this context, we may also understand that worldwide and on a European level, the Netherlands also registers low in terms of biodiversity. In the Netherlands, “most protected species and habitat types that fall under the birds and habitats directives are currently not in a favourable conservation status” (Balans van de leefomgeving 2023, 74). This includes the loss of fauna in agricultural areas (Balans van de leefomgeving 2023, 75). Moreover, while during 2011 and 2022, there was a small increase in organic farming, the current percentage of 4 % of all agriculture is far below European average (Balans van de Leefomgeving 2023, 87). Finally, the use of resources by the Dutch economy has devastating environmental impacts abroad (see e.g. Balans van de Leefomgeving 2023, p.57)⁸⁶.

This combination of high land prices and high environmental degradation within an area that is densely populated makes agroecological urban agriculture all the more urgent and difficult. Agroecology is also not supported while unsustainable forms of farming are incentivized among others by means of subsidies. In this context, it is the aim of Foodpark Amsterdam to counter this imbalance, support small scale agroecological urban agriculture by taking the land out of the market and turning it into a commons. This is not only to support the farmers, but also to ensure that locally grown, organic, and healthy food is accessible for everybody and not just for elites. This ambition would also be beneficial for the neighbourhood near the Lutkemeerpolder. Savini describes the neighbourhood as “Peripheral relative to central Amsterdam, the site adjoins one of the city's poorest neighbourhoods, Nieuw West. The area covers a business park for SMEs (Business Park Amsterdam Oosdorp, phase 1) of 26 hectares, a graveyard of 30 hectares and 42 hectares of agricultural land” (Savini 2025).

Assessment of biodiversity challenge and related biodiversity trends in the high impact sector

While generally speaking, greening cities and fostering relations between city inhabitants, nature and sustainable food are increasingly recognized as important, the critical question is how this is done. What we have seen in our case is that the Lutkemeer is not seen as a sufficiently valuable green area to protect. The municipality plans these green spaces and food spaces in a managerial way that ignores the local and historical relations involved in the Lutkemeer.

Current enablers and barriers for transformative change

As we have discussed, the current SES is characterized by opposing and conflicting dynamics underpinned by specific worldviews and values. The ways in which modernist values, and vested interests including the market and the financialization of the land are given prevalence forms a serious barrier to transformation. An increased understanding of alternative ways to govern the land may open up opportunities for change. In other parts

⁸⁴ See: [Top exporters of agricultural goods worldwide by country 2020 | Statista](#).

⁸⁵ See: [Size of Netherlands compared to United States \(mylifeelsewhere.com\)](#).

⁸⁶ [Balans van de Leefomgeving 2023](#)

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of this deliverable, we have discussed the different activities and strategies that FPA employs to this end. Here we would like to illustrate this potential opportunity using the role of GreenLeft politician, Marieke van Doorninck as an example.

As shown in the [Documentary: The last Farm of Amsterdam \(2023\)](#) – for the activists of Behoud Lutkemeer (the older sister initiative of Foodpark Amsterdam) Marieke van Doorninck became the face of municipality that ultimately sided with the business interests. Exactly in the period when Behoud Lutkemeer was involved in many public action and resistance (2018-2022) she was alderman for spatial development and sustainability. The documentary showed well the conflict she was facing, since as a GreenLeft politician she had sympathies for the case of Behoud Lutkemeer but saw herself forced to execute the plan of the business park. The documentary ends with a moment of reconciliation between Trijntje, the farmer who used to work on the land where the building activities are now taking place and Marieke van Doorninck, as they found a solution that three hectares of the original farm will be saved. Nonetheless, for many of the activists and supporters who often were themselves affiliated to the GreenLeft party, it was still a disappointment that not even a GreenLeft alderman could change more radically the fate of the Lutkemeerpolder. However, three years later, in 2025, Marieke van Doorninck was one of the main organizers of The Day of Community Economy [*in Dutch Dag van de Gemeenschapseconomie*], an event that brought together various commons initiatives in the city of Amsterdam. It is quite notable that Foodpark Amsterdam was specifically invited to be present with a market stand.

While this is a small step and far removed from the structural changes in the governance of land that Foodpark Amsterdam is advocating for, this example demonstrates how even within the municipality, radical rethinking can take place. All in all, we have seen increased openness to alternative forms of land governance (commons), a dissatisfaction with economic and governance systems, and a recognition that other worldviews might have something to offer. These are powerful leverage points for transformation.

5.2 Vision: What alternative SES could be?

While the current trend within the social-ecological system of the Lutkemeerpolder is mainly characterized by increased industrialization, the alternative vision would be that building activities stop right away. This alternative social-ecological system explores, which other trends would be foregrounded if the building activities would now come to an immediate halt. Lutkemeer would become a space where energies for urban agriculture can be bundled and materials and infrastructures can be shared. It would give agroecological, community-supported urban farming the chance to prove itself as mature and robust alternative option in the food economy, that makes a difference in terms of food sovereignty and capable of catering to a wide range of incomes and tastes. Already today, at the margins of the Lutkemeerpolder, there are two organic CSA farms,⁸⁷ one organic horticulture enterprise,⁸⁸ and one organic care farm with farmer's shop⁸⁹.

In this scenario the landscape of the polder would become more diverse than it has been over many centuries. Today, the land that is destined to become a business park is a fallow meadow that used to be arable and for organic grain and potato monocultures. The adjacent piece of land is currently still a corn monoculture that until last year heavily employed glyphosate and (after Foodpark Amsterdam complained) this year used other pesticides. Against this background, a agroecological food park managed by different entrepreneurs would radically diversity and regenerate the landscape.

⁸⁷ [De Stadsgroenteboer](#) and [boterbloem - plukcsa](#).

⁸⁸ [AliesNatuurlijk – Voor Ecologische Kringlooptuinen](#).

⁸⁹ [ecoboerderij de boterbloem](#).

We can imagine that within the expanded food park of the alternative social-ecological system, there would be more vegetable gardens and fruit and nut trees.⁹⁰ Maybe, there will be people that would like to grow hemp for bio-based and CO₂-negative building materials?⁹¹ Probably, there will be also a glasshouse or poly-tunnel dedicated to the growing to exotic produce, like plantain, casava, and okra. There would be also some more secluded spaces that do not serve any immediate purpose to humans but allow different species to find their habitats. For instance, insects, birds, and amphibians would flourish near shallow waters, which is why previously involved landscape architect put much emphasis on drawing shallow shorelines of the ditches.

The Lutkemeerpolder would also become a place for social healing and dialogue, including in relation to slavery and colonialism. There are strong historical indications that the lake of the Lutkemeer was drained with money from compensatory payments after the abolition of slavery in Surinam ⁹². This illustrates how the industrialization of agriculture of the Netherlands was financed through the exploitation and industrialization of people and nature in the colonies. This makes the Lutkemeerpolder a very suitable place to hold broader conversations about coloniality, exploitation, and social justice.

Within the alternative social-ecological system, the current unpopularity for businesses to settle in the Lutkemeerpolder would remain.⁹³ Already today, many of the distribution centers remain empty and are hired out below the market price according to Foodpark Amsterdam activists.⁹⁴ Some of the already existing distribution centers could be repurposed by Foodpark Amsterdam, serving as tool barns, labs for processing local food (pickles, fermented produce, wine, beer), producing other plant products (tinctures, ointments, soap, cloth), growing mushrooms and managing local food distributions to the local farmer's market and affiliated kitchens.

We can imagine that in the future entrepreneurs would sometimes struggle with the increasingly irregular seasons that characterize ongoing climate change. Sometimes, there would be intense rainfalls and then extended periods of dryness and heat that used to be quite atypical for the area. Yet, we can imagine that, provisions will be taken to store water during rainy days that could be used in dry periods. Moreover, refraining from heavy tilling and the diverse vegetation of the polder increases in general its capacity to retain water and prevent soil erosion. In times of extreme wetness, the agroecological farmers are happy that they do not depend on heavy machinery that would get stuck in the mud.⁹⁵ We could even imagine that the farmers set up a solidarity and insurance system among each to ensure that if one entrepreneur would suffer great losses due to weather extremities, they could be supported by the other entrepreneurs since dryness and wetness will affect the different entrepreneurs

⁹⁰ As one Foodpark Amsterdam activist often reminds us, the high stem fruit orchard next to the Boterbloem can already be seen on maps from 1870. Today it serves as the main place for social outdoor gatherings. For a 50 hectare Foodpark, we can imagine that another place like this will be welcomed.

⁹¹ One of the Foodpark Amsterdam members works in sustainable buildings and often makes the case for this.

⁹² For more information see [De verborgen geschiedenis van de Lutkemeerpolder: een nieuw perspectief - Voedselpark Amsterdam](#).

⁹³ Behoud Lutkemeer writes about the emptiness of distribution halls [Leegstand – Behoud Lutkemeer!](#).

⁹⁴ They came to this conclusion after having done a search for real estate larger than 10.0000 m² on Funda, (the main websites for renting and buying real estate in the Netherlands) and used a radius of 10 km around the location of the Lutkemeerpolder.

⁹⁵ The CSA farmers now settled in the Lutkemeerpolder do not use any powered machinery.

differently. It is in such ways, that we can imagine that the farmers and agroecological entrepreneurs make the park climate adaptive.

The Lutkemeerpolder would also become a test ground for generating locally relevant ecological knowledge in collaboration with educational institutions ranging from primary school to vocational training to scientific research as it does already today.⁹⁶ Educational and research activities would address topics like soil life, intercropping, reviving almost forgotten heirloom species, and old and new techniques in food-processing.⁹⁷ There would be a broad interest from artists and students in social sciences and humanities to document processes of transformations, support the



Figure 22 - Advertisement board reads 'For rent', November 2024. Image by Tamalone van den Eijnden

community-processes of the place, and imagine alternative futures for the place. It would also not be unusual to see politicians, journalists and research teams to come on tours around the Lutkemeerpolder. Within the alternative social-ecological system, Foodpark Amsterdam has become one of the flagship initiatives for the municipality of Amsterdam that is prolifically used in their PR. Quite likely, the municipality will present Foodpark Amsterdam as *their* idea and vision. While this may raise some eyebrows among members of Foodpark Amsterdam, they also welcome this shift in thinking and rhetoric.⁹⁸

When cycling to the Lutkemeerpolder, it would be usually easy to spot the people that are just coming from the place, as their bike bags would be filled with fresh vegetables and more. Sometimes, you would see them cycle on rented electronic cargo bikes, when they have extraordinarily much to transport. On market days of the market on Plein 40-45, at the center of the neighborhood of Nieuw West, there is an electronic truck that brings produce from the different entrepreneurs to the Voedselpark Amsterdam market

⁹⁶ Foodpark Amsterdam has close ties with all kinds of educational institutions locally and nationally for all age groups and educational directions. Students come for fieldtrips and internships, and researchers conduct all kinds of research.

⁹⁷ Like for instance the yellow cucumber, which has been already initiated by current FPA associates, see for instance [De terugkeer van de Gele Komkommer - Slow Food](#).

⁹⁸ To some extent this is already happening with Foodpark Amsterdam after they won the tender and other related initiatives, where it took citizens much time and effort to convince the municipality to take a certain course of action.

stand to bring the food close to the people. On its way back and forth, the truck also immediately shuttles less mobile people back and forth to the Lutkemeerpolder.

In order to sufficiently support and accompany the work of the agroecological entrepreneurs, Foodpark Amsterdam would need to professionalize, particularly for the first period. They would need a project manager that would be employed for four days a week for at least four years. Moreover, a dedicated fundraiser would need to be hired. After the first labour intensive years, the Foundation Foodpark Amsterdam would slowly become less important because now the entrepreneurs are capable of running the place on their own.⁹⁹ With new time on their hands, the Foodpark Amsterdam activists would then see where else they could support the growing of agroecological commons. Perhaps in another neighborhood in Amsterdam...perhaps in a neighboring town or village.

The establishment of the foodpark in the Lutkemeerpolder would not put an end to disagreements in the Lutkemeerpolder, but it would change the nature of the disagreements. Some agroecological entrepreneurs may find that the area has become too busy and advocate for reduced visiting hours and quiet hours on the nature camping. Others may find the diverse landscape to be too messy. There may be discussion about what kind of machinery could be allowed to use on the place (e.g. whether electronic, motorized or purely mechanical). Another controversial topic are bonfires. They are seen as unwelcome by some due to Co2 emissions, air pollution, and risk of wildfire. Yet, they are also valued as cozy and they offer a convenient form of waste removal. Moreover, we can imagine that the last word has not been said on what non-native species should be invited into the ecology of the polder. Another point of discussion will be whether or not there should be space for farm animals, and if so, which ones. Moreover, some entrepreneurs more than others, would struggle to make a minimum wage with their work and it would take a long time and many creative solutions to find a stable enough market for their products. All these issues would be discussed once a month during the general assembly of the cooperation for all the agroecological entrepreneurs.¹⁰⁰ In advance, people expected that it would be impossible to also make time for this assembly next to their working schedule, but they soon got a routine for this. We can imagine that assemblies will be often combined with a simple vegetable stew and freshly baked bread. These monthly meetings would help to forge strong solidarity ties between the different entrepreneurs.

5.3 Discussion

In this brief sketch of the social-ecological system around the Lutkemeerpolder, we have discussed the dynamics and conflicts, around a contested piece of land. Given the active communication strategy of Foodpark Amsterdam and the Lutkemeerpolder being located within the city boundaries of the capital city, it is perhaps not surprising that this piece of land involves a large diversity of actors and networks that range from the neighborhood level, to the municipal level to the national and even international one.

The different actors and networks relate to the Lutkemeerpolder and more specifically the vision of the Lutkemeerpolder as articulated by Foodpark Amsterdam from different angles, such as their vision on alternative (commons) economies, their vision on agroecological food, and their vision on the importance of understanding change processes as deeply rooted in culture – and thus the necessity to implicate and involve cultural movements and artists in sustainability transformations.

⁹⁹ The activists that are now running the Foundation Foodpark Amsterdam, see themselves primarily in the role of helping to get an agroecological commons started. They do this through their political work, moderating and accompanying the processes of forming a community, organizing the legal support and administration, financial support, etc. Ideally, they would like to become irrelevant as soon as possible.

¹⁰⁰ Also within the current tender plans, the agroecological entrepreneurs that will be working within the Lutkemeerpolder will form a separate cooperation that is independent from the Foundation Foodpark Amsterdam.

Despite this diversity of involved actors, the main conflict within the Lutkemeerpolder remains a conflict between Foodpark Amsterdam and the municipality (extended through the Gemeenschappelijke Exploitatie Maatschappij (GEM) Lutkemeer and the Schiphol Area Development Company). The issue at stake are two opposing ideas on land, where Foodpark Amsterdam holds that land (here the Lutkemeerpolder) should be dealt with as an agroecological commons and the municipality defends the position where land serves as an economic commodity that is in service of the growth of the city.

This conflict, at its core is a conflict between a modernist and a relational worldview – two worldviews that are fundamentally incommensurate but in political daily practice and strategically mixed into each other. Even as it is increasingly widely recognized that the modernist view plays a large role in biodiversity loss, it still wins over the relational one on an institutional level, since it produces financial value that can be easily channelled to people but also municipal budgets. The relational model, while providing plenty of value, loses out as its value is more distributed within a wider human and more than human socio-ecological system, as such it hardly makes individuals rich and also does not fix municipal budgetary problems, particularly not in the short-run.

These conflicts and dynamics take place within the impact sector of urbanization. Yet interestingly, also within urban development we do note that there is increasing recognition that a narrow capitalist-economic perspective is not sufficient for keeping cities liveable. We see efforts across European metropolises to green cities and support urban and other citizen-led agroecological grassroots initiatives. The fact that Foodpark Amsterdam has won a tender competition for an adjacent piece of land where they can start a small Foodpark perfectly fits into this trend. We are still far from a reality where a relational worldview is applied more structurally within urban development, yet, there are small indications that slowly recognition of the limitations of the current systems start to grow. Time will tell, whether these positive signals will be the first glimmer of more structural and transformative change or whether they ultimately will be incorporated into a greenwashed modernist worldview. This is why Foodpark Amsterdam continues its struggle.

6. Locally tested interventions

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6.1 Evaluation of strategies in action

One of the great strengths of Foodpark Amsterdam is that they constantly employ a large variety of strategies. Their strategy can be described as playing on various chessboards, yet these chessboards can be defined in multiple terms.

Firstly, it should be noted that Foodpark Amsterdam often refers to a just transition framework that understands transition as the double movement of stopping the bad and building the alternative. As we described in the summary of this deliverable, they engage in protest, they aim to change the narrative, and they prefigure and build the alternative. On a slide that is often used by Foodpark Amsterdam for internal reflection but also outwardly they outline the following four steps:

1. "Break": Focus on disruption, on opposing plans and complicit institutions, direct action, legal action
2. "Push": Advocacy, seeking better policies from those in authority & institutions
3. "Building the alternative": Imagining Voedselpark Amsterdam addressing the socio-environmental problems in a direct way, experimentation
4. "Grow": connecting & networking, mobilizing for a cause, organizing & campaigning, growing the movement.

Foodpark emerged as a complementary and successor initiative of Save Lutkemeer [*Behoud Lutkemeer*], the original action group that resisted the coming of a business park in the Lutkemeerpolder. The initiative Save Lutkemeer [*Behoud Lutkemeer*] had very strong tactics of opposing the building of the business park, as such their focus was on the first step of "break". They engaged in demonstrations, non-violent direct action including civil disobedience. For this purpose, they were also collecting an impressive array of information, uncovering the untransparent web of decisions around the business park, including reports of the corruption.

Foodpark Amsterdam was founded from within Behoud Lutkemeerpolder but adjacent to it and with new people to show that the activism in the Lutkemeerpolder was not only about opposing existing plans but also about providing an alternative vision. In this sense, Foodpark Amsterdam was brought to life to embark on the second step of the model of pushing better policy. They were following the spirit of the famous quote by Buckminster Fuller "You never change things by fighting the existing reality. To change something, build a new model that makes the existing model obsolete." Yet, especially in the periods that Save Lutkemeer [*Behoud Lutkemeer*] became less active, Foodpark Amsterdam integrated the first step of resistance into their strategies. They generated media attention around the Lutkemeerpolder through media campaigns, regular online posts, and making an effort to get into touch with local press,¹⁰¹ public events, getting engaged in all kinds of public conversations. Moreover, in 2024 Foodpark- together with Save Lutkemeer – organized a campaign that put the main emphasis on protesting against the building plans.

Foodpark Amsterdam's strategy has also always involved elements of "building the alternative" in multiple ways. Firstly, within their own organization they are prefiguring to some extent commons-based modes of collaboration that allows for democratic participation and decision making.¹⁰² Foodpark Amsterdam is also involved in 'building the

¹⁰¹ *Nieuw in Amsterdam-West - De Westkrant* – Online news from the larger westside of the city of Amsterdam, Online news concerning the direct neighbourhood of Amsterdam Nieuw West [Amsterdam Nieuw-West | Rodi](#), The streetnewspaper [Z! de Amsterdamse straatkrant](#), the Amsterdam-based daily newspaper [Het Parool - Vrij, Onverveerd](#), local television station in Amsterdam [AT5](#), daily Dutch newspaper [NRC - Nieuws, achtergronden en onderzoeksjournalistiek](#), and citizen reporters [Home | Stadsreporters](#).

¹⁰² Within Foodpark Amsterdam, anybody who has an idea for doing something can in principle go ahead, but they are expected to consult others before execution. This gives everybody a sense of ownership of their own work and freedom and creativity to do what they can do best. At the same time, the consultation ensures broad support and also improvement of plans. As it is basically impossible to pull a bigger initiative on one's own, the

alternative' through the launching their first pilot Foodpark in a plot of land recently won through tender. This gives Foodpark Amsterdam the opportunity to prefigure on the ground their vision on collaboration and collective care for land. Simultaneously, they are making sustained efforts of community building, particularly in the neighbourhood of Nieuw-West. To build an alternative economy it is of primary importance that relationships are formed within the neighbourhood and a collective conversation around food and environmental justice is flourishing.

Finally, Foodpark Amsterdam is also involved in growing the initiative, and their community is constantly growing. So far, it has proven to be more difficult to also 'materially' grow, in other words, to make more land available for urban agriculture, particularly land that originally was not already reserved for urban agriculture (such as the smaller plot now used for piloting their approach).

Foodpark Amsterdam's strategies aim to combine the local and concrete (challenging the development plans, building an alternative vision for the Luktmeester) with the broader narrative (challenging political economic paradigms and institutions, developing a commons based alternative society). The following strategies emerged during the PAR research:

1. Organizing protest
 - a. Shaping public discourse through protesting and campaigns
 - b. Media and communication (lots of videos, social, media, visuals)
2. Influencing Policy
 - a. Using opportunities for policy engagement, using speaking time during municipal commission meetings, letters, lobbying
 - b. Developing institutional mechanisms: commoning
 - c. Joint Fact Finding
3. Building (local) communities
 - a. Bodily engagement: walks, cooking sessions
 - b. Artistic expression: working with artists
4. Prefiguring the alternative (by giving the right example)

These different strategies are all very contextual as they respond continuously to different opportunities and barriers within the field. This involves the people that have energy to pull initiatives, engaged in political events such as elections, the agenda of the municipality, available funds, and not at least the experience of success and failure. For instance, the overall ambition of Foodpark Amsterdam changed quite a bit from when we joined in early 2023 until now, mid 2025. Foodpark Amsterdam started with the ambition to turn a 43 hectares plot within the Luktmeesterpolder into a commons-governed food park. Yet by now, almost half of this territory is under construction. Nonetheless, they continue to struggle for all remaining hectares. Besides, they made and won a tender submission for a smaller adjacent plot of land of 9,5 hectares (zoned for urban agriculture). The aim is to use this small plot as a pilot and show on a smaller scale how different entrepreneurs (ranging from food foresters to urban farmers, to herbalists, and cooks) who need land can cooperate and share the land as a commons in the neighbourhood.

Fitting with Foodpark Amsterdam's flexibility to continuously and creatively respond to changing political circumstances, also in our collaboration with Foodpark Amsterdam we have adapted a more flexible way of working. Instead of having one plan to follow through, we worked in short half-year cycles, updating what will be important upcoming events and opportunities and how we could collaborate for this purpose. Such an approach required an initial period of getting to know each other, so Foodpark Amsterdam was getting a sense

consultation process also ensures that there are always enough people in support of a plan. While there are people that are in charge of the budget (in terms of organizing payments and applying for funds), the budget is also transparent and everybody who would like to do something can make a budget plan. There is one person who makes decisions, however the aim is to come to an agreement.

of what kind of questions we were interested in and vice versa. In this process we learned that we could most effectively support their aims through organizing workshops and collaborating with artists, circulating the story of Foodpark Amsterdam, making connections with other researchers. Therefore, we worked together primarily on these terrains. As such, we contributed most significantly to further articulating and promoting the transformative change potential of the initiative to address the indirect drivers of biodiversity loss. Ideally, this would have contributed to replicating enablers of biodiversity and reduce the impact of biodiversity disruptors, particularly here the expansion of the business park on the land. Yet, this remains questionable as so far there are no signs that the building activities within the Lutmeeerpolder will stop.

6.2 Enablers and disruptors

In the case of Foodpark Amsterdam, the enablers and disruptors concern very local circumstances, that is circumstances that mostly concern municipal politics.

Enablers

There is a growing movement that embraces key aspects about which Foodpark Amsterdam also stands for: an alternative economic vision, a social justice outlook, a perspective that also centres ecological flourishing, that does not view agriculture as separate from biodiversity.

The appeal of the ideas Foodpark stands for can be deduced from the number of times they are invited to speak on public occasions (e.g., Pakhuis de Zwijger, as well-known cultural meeting place in the centre of Amsterdam), take part in expert and public conversations (e.g., on the topic of women and food), and are sought out by researchers and educators as a fieldtrip destination and the continuous support they manage to mobilize.

Moreover, there are vibrant networks active on these various frontlines, ranging from commons coalitions to (urban) agroecological networks. Within a cosmopolitan city like Amsterdam, there is plenty of opportunity for these different ideas to cross-fertilize and support each other, become integrated in the curricula of local educational institutions ranging from primary schools to universities. This demonstrates the strategy of FPA to connect the concrete case of the Lutmeeerpolder to the wider social and political context (see 6.2). At the same time, in its specificity the Lutmeeerpolder serves as a concrete example where the enablers and disruptors to biodiversity regeneration become very clear. For instance, it also inspired the national agroecological network to think about alternative models of landownership. There is no shortage of people that would like to work in this sector and also plenty of potential customers. A further impact of the increasing support of the ideas Foodpark stands for is also that it can reach policy circles, leading to ambitious policy plans.

Whether these enabling factors will ultimately lead to the spreading of Foodpark Amsterdam and whether the different volunteers will ultimately take these ideas to other work and initiatives in which they are also involved, remains to be seen.

While there are no designated subsidies for the kind of work they do, Foodpark has been able to access various funds, ranging from donations from private people, funds given out by companies (Lush, Patagonia), and funds that stimulate grassroots initiatives with a commons agenda (Stichting Doen, Community Wealth Building). These funds allow Foodpark Amsterdam to keep on going, by allowing them to pay two members one day a week, have some budget for hiring external expertise on a project basis (e.g. a landscape architect) and for occasionally printing a flyer, buying sunflower seeds, or other material costs for their campaigns.

Disruptors

The main disruptors are economic interests over ecological ones. This becomes most visible in the companies that aim to settle within the Lutkemeerpolder. Their business in themselves relies on extractive industries and unsustainable practices. Besides, they managed to be so successful at this that they see the need to expand their businesses, building on what Foodpark Amsterdam did not fail to bring to attention – the last fertile soil of the city. The municipality, whose *raison d'être* is to act on the public good of its citizens is prone to stand at the side of the disruptors for regenerative farming. The reasons for this are multiple:

1. Thinking in terms of old models of the economy is still dominant. For instance, an increased industrial territory is often thought to be automatically good for the economy and job opportunities. Yet, the number of jobs that will be created in the business park and how this contributes to the economic well-being of the residents of Amsterdam (which should be the primary focus of the municipality of Amsterdam) remains unclear. Foodpark Amsterdam activists, for instance, point to the fact that urban logistics and distribution is becoming highly automated and that actually does not offer a lot of jobs, now and especially in the future. Moreover, by removing requirements concerning what kind of businesses can settle in the area (which was previously the case) the municipality has little available tools to stir this process. The worry of Foodpark Amsterdam is then that mostly (multi)national enterprises will settle there. This thinking in terms of old economy does also not recognize the economic potential of a foodpark. For instance, on a third of a hectare, the adjacent Community Supported Agriculture initiative Pluk is capable of providing weekly vegetables for almost 100 households employing three farmers. While small-scale organic farming can hardly economically compete as a producer of food for large supermarket chains, the cooperative model of community supported agriculture provides a robust alternative economic model, where harvesters commit to a season of produce by paying the fee upfront at the beginning of the season according to a model of social pricing. This is quite significant economic activity that very tangibly adds to the economic well-being of the local residents.
2. The municipality understands renting out land as a lucrative business to manage the municipal budget. It can charge higher land prices if renting out land to industry than to agriculture. Since, within a municipal context, there is a shortage in terms of financial resources, extra income for the municipality is always welcome.
3. The municipality wants to come across as an institution of reliable governance [*betrouwbare overheid*] that does not simply overturn the plans of previous administration.
4. The municipality may be faced with compensation claims from companies that have reserved a plot in case it retracts the possibility of establishing a business park there.

So far, Foodpark Amsterdam has not managed to structurally dismantle these disruptors. There are signs that the idea of alternative economies are becoming more popular within circles of the municipality (policy, research, plans and events for a communal economy). At the same time, the step of translating them into laws and regulations that will actually support bringing land into a common governance structure seems to be still far away.

(Mis)match with EU policy

Currently there are no EU policy frameworks that can be effectively evoked within the context. One of the tricky aspects of this is that the opportunities and disruptors are so locally specific. Some policies that would support Foodpark Amsterdam, on a European, national and municipal level would do so because they support green and civic initiatives. A good example is the 2022 ministerial decision to make soil and water leading factors in

spatial decision about where and what to build ¹⁰³. However, these policies have not been able to reverse industrialization as most of the building permits had been already granted. More generally, these green policies run the risk of being ineffective without further institutional and legal changes. Some people see new opportunities in the new De Omgevingswet, the Dutch Environment and Planning Act that is handled since 2024 or in the initiatives around the *Right to Challenge*¹⁰⁴.

It is difficult to evaluate whether the inability to reverse industrialization is a matter of policy or of political will. The alderman [*in Dutch wethouder*] of spatial planning [*in Dutch Ruimtelijke Ordening*] - roughly the municipal equivalent of a minister on the national level - in theory, has the power to reverse decisions that have been made. One reason for this that we have seen is that the municipality wants to come across as a trustworthy government [*in Dutch betrouwbare overheid*]. This means, that there is strong pressure for current aldermen to not overturn decisions and deals that have been made. In the case of the Lutkemeerpolder, these are decisions that have started in the 1980s and that were tweaked and changed throughout the 2000s.

This seemingly absence of political will is striking because since 2022, Amsterdam has a GreenLeft Mayor, and a governing coalition that includes GreenLeft, the Labor Party and the Liberals D66. All these parties support green politics and social causes, combined with supporting local entrepreneurs and job opportunities, all of which is part of the Foodpark Amsterdam plan. Nonetheless, Foodpark Amsterdam is often dismissed as too small, and thus too irrelevant to make a real impact.

6.3 Failed and successful practices

In the case of Foodpark Amsterdam, it is difficult to isolate their different strategies and assess them in terms of failure or success. Often, they inform their learning and the next steps, and ultimately all strategies, taken together, are mobilized towards advancing their project. Moreover, our research and collaboration process does not fit well with a linear and instrumental evaluative approach that would separate strategies into specific actions that can be evaluated as successful or unsuccessful. As indicated above and also in chapter 4, the strategies of FPA are better seen as a continuous process or struggle. Moreover, they are all interconnected and they fit with FPA's long-term vision. Even if a strategy might temporarily appear as a failure, this offers opportunities for learning and reframing. At the same time, the limited timeframe of the project does not allow for an appropriate reflection and discussion of success and failure.

Yet, FPA has managed to build a large network of ambassadors and supporters who are good at disseminating their story and ambitious further. They also have an active volunteer base and despite financial pressures, they have been effective in motivating people to join and support a common cause. Another important strategy has been that of persistence and making their case in various ways. This has contributed to achieving a shift in thinking in the municipality, for instance in terms of more actively supporting the idea of commons and commoning as an alternative economic practice. A tangible result of this success is that Foodpark Amsterdam has won the public tender procedure.

So far, the initiative has not managed yet to stop the building activities and reclaim (part of) the land that is now destined to become an industrial area. Some of the parcels have been built now, but for other slots the building process goes extremely slow. While the reasons for this are unclear, one may be tempted to speculate that some of the campaign

¹⁰³ *Kabinet maakt water en bodem sturend bij ruimtelijke keuzes*. (2022, November 25). [Nieuwsbericht]. Rijksoverheid; Ministerie van Algemene Zaken. <https://www.rijksoverheid.nl/actueel/nieuws/2022/11/25/kabinet-maakt-water-en-bodem-sturend-bij-ruimtelijke-keuzes>.

¹⁰⁴ *Right to Challenge*. Rijksoverheid: Kenniscentrum Voor Beleid En Regelgeving. Retrieved November 20, 2025, from <https://www.kcbr.nl/ontwikkelen-beleid-en-regelgeving/beleidskompas/3-wat-zijn-opties-om-het-doel-te-realiseren/31-beleidsinstrumenten/juridisch/right-challenge>.

of Foodpark Amsterdam was effective in exposing this site as an undesirable building area. The initiative has been also less successful in engaging committed younger people for extended periods of time, particularly from the nearby Nieuw West neighbourhood. However, this cannot be seen as a specific failure for Foodpark Amsterdam, as young urbanites from cosmopolitan cities are more generally difficult to involve in activities perceived as non-urban or involving knowledge and skills that are currently lost from urban environments. This was visible in a speculative workshop *Listening to the Soil* (W02), organised in collaboration with a local international school and involving young people¹⁰⁵.

6.4 Co-learning

Throughout the research process, researchers have been involved in fieldwork and actively took part in regular monthly meetings of Foodpark Amsterdam. We have also held meetings together to co-organize workshops and other activities. As such, co-learning happened primarily through working together (some illustrative examples are provided below). Besides this ongoing process, we are currently organizing more formalized feedback workshops with research partners and societal partners to reflect upon the project results and the co-learning that has taken place.

Some of the collaborations between Foodpark Amsterdam and the University of Twente research team have had a highly reflexive dimension linked to co-learning. One example is the Postgrowth Symposium co-organised by the research partners with Foodpark Amsterdam. This was a crucial moment in the project in terms of co-learning opportunities (see chapter 4). It brought together academics and practitioners that share the common cause pursued by Foodpark to reflect more broadly on biodiversity in the context of urban agriculture and the role of collaborations between researchers, civic organisations, and the municipality.

Another moment of co-learning was the participation of one Foodpark member in all the consortium discussions of the second consortium. This provided the Foodpark member a clearer idea regarding how we work within the BIOTraCes project, but also the BIOTraCes researchers could learn from her knowledge on land commoning ideas and experiences.

Moreover, one Foodpark member and University of Twente researcher co-authored a conference presentation together that the Foodpark member presented at the conference *Regenerating the Commons* (2025). The core idea of paper built on the researcher's insights from her fieldwork, which she formulated and then discussed and refined with the Foodpark Amsterdam member. The topic the presentation addressed was about co-learning in the context of commoning - something we referred to as 'commons literacy'.

Some other activities and instances of co-learning were more about generating academic reflection and output (e.g., societal partner joining consortium meetings, co-organizing a symposium, and co-authoring a conference presentation); while some were more artistic (e.g., the co-production of a narrative for the International Architecture Biennale Rotterdam, co-coordinating an artistic residency). These collaborative actions helped to concretize and articulate some of our ideas.

Sometimes, also, members of Foodpark Amsterdam invite us to teaching and public speaking occasions to which they have been invited. This gives us the opportunity to think together about how we would like to present our ideas, often also complementing each other. An example for this is a recent talk one of the Foodpark members provided at a cultural venue in which Foodpark was presented as an example of 'the regenerative city'. During this talk, the Foodpark Amsterdam member was talking about the activities of the foodpark, while the researcher offered a short reflection on how the activities of foodpark

¹⁰⁵ A discussion of the workshop is included Baibarac-Duignan, C., & van den Eijnden, T. (2025). Designing for Transitions Through Co-created Artistic Methods: Gluing Affective "Rurban" Encounters. *World Futures Review*, 0(0). <https://doi.org/10.1177/19467567251330153>.

may be understood as regenerative. This provided new insights and reflections for both sides.

6.5 Testing of interventions

Feedback workshops with research partners and societal partners are currently being organised to deepen discussion regarding the locally tested interventions. The ongoing activities of Foodpark Amsterdam towards realising an agroecological commons are a critical component in addressing root causes of biodiversity loss (e.g., associated with urbanisation and industrialisation of land previously used for agriculture). A form of 'peer review' has been conducted throughout the project, involving mostly one-to-one conversations. The Postgrowth Symposium was a way to formalise this time of ongoing monitoring and reflection, as it brought different researchers engaging with Foodpark Amsterdam together to discuss the case (for more about the symposium, see chapter 4.2).

As mentioned previously: our collaboration with Foodpark Amsterdam was very integrated. We made great efforts to work as a continuation of their ongoing efforts and make our contributions also relevant to their aims. From this perspective, a framework of 'testing' and 'interventions' is a bit alien to our efforts. Moreover, rather than separate concrete interventions that can be tested and evaluated, the strategies of FPA are better described as a continuous process or struggle.

Nonetheless, we can talk in terms of our contributions to the initiative of Foodpark Amsterdam. Indeed, perhaps our intervention can be best understood as an affirmation of promising approaches we could observe were at the core of the initiative Foodpark Amsterdam.

As can be seen in Table 13, our collaboration involved various workshops that aimed at bringing in artistic and creative reflections. These contributions have generally been embraced by Foodpark Amsterdam. What's more, as in the case of the *Ceramic workshops* (W06), and the *Speculative Monitoring* workshop (W09), we were actually building on collaborations Foodpark Amsterdam has already established before or independent of our participation. These workshops, for most of the part, we co-organized with core members of Foodpark Amsterdam and were about engaging the larger community around Foodpark Amsterdam.

Moreover, providing a narrative for the video for the International Architecture Biennale Rotterdam can be seen as further connecting the learning from Foodpark Amsterdam to a more general theoretical level (see chapter 5). The film and the narrative offer a reflection on Foodpark Amsterdam in the context of architecture and shows that architecture cannot be understood as isolated from the environment where it is situated.

What all of our contributions to the case of Foodpark Amsterdam have in common is that their focus is on highlighting the social, ecological, and cultural aspects of biodiversity. This is particularly relevant, as there is more and more recognition that – what used to be different departments and sectors – really need to work together for addressing complex problems like biodiversity loss.

6.6 Discussion

In this section we have discussed and reflected upon the strategies employed by Foodpark Amsterdam to advance their commons-based vision of urban agriculture and alternative economies. We have identified strategies that break, push, build and alternative and grow a movement around the local initiative. These strategies are being developed and employed in parallel and despite what may be perceived as failures along the way, taken together they have been promoting the cause and approach of Foodpark Amsterdam among the activist, practitioners and academic community. Moreover, their ideas and

vision have started to shape more support from the inside of the Municipality of Amsterdam for the commons and the alternative economic practices commoning implies.

Moving on from the strategies employed by FPA, we have identified some key enablers and disruptors. The main enablers include the various related initiatives that share aspirations for an alternative economy, social justice and ecological flourishing. Together they are shaping a movement at the forefront of which is Foodpark Amsterdam. On the other hand, the reliance on volunteer support represents a potential limitation and weak point in this process. While financial pressures of everyday life in a mainstream economy represents a risk from the volunteer perspective, economic factors can also be observed as wider disruptors. Key is the prevalence of economic interests over ecological ones, which are visible in the industrialization process of the area and arguably could also limit the extent of engagement of the younger inhabitants of the neighbourhood in the initiative.



WR Nature Inclusive Building

D2.5, The Netherlands

December 2025

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Funded by
the European Union

Summary

This case study on nature-inclusive building in the Netherlands examines the relationship between nature and the building sector that plans and constructs new houses and residential areas. Nature-inclusive building is linked to the biodiversity high-impact sector of urbanisation. In the Netherlands, there is an urgent need for around 400,000 new homes. The government aims to build approximately one million houses over the next decade. The planning, design, and construction of new houses and neighbourhoods has significant effects on nature. Over the past decade, around 280 square kilometres have been converted into human habitats. This coincided with a corresponding decline in agricultural and natural areas. The sector is considered a high-impact sector in nature policy.

In response to its problematic relationship with nature, the sector attempts to include more nature in the human habitat. Initially, this gained momentum in the Netherlands, both socially and politically. However, progress remains limited, and problems related to nature have led to stagnation. While actors agree that nature-inclusive building is a promising concept, its actual implementation often falls short, frequently remaining more aspirational than actionable. Stagnation in construction leads to societal issues, and various causes are increasingly attributed to nature. The political climate and public opinion regarding nature protection are shifting negatively.

A case study analysis was conducted to explore the relationship between building and nature. To this end, we collaborated with two innovative partners, representing both societal and policy perspectives:

- An **initiative to realise an eco-community called *De Beuk*** [The Beech] in Wageningen. De Beuk has developed a plan for a site designated for residential development. Their plan includes sustainability measures that go far beyond legal requirements and establishes an organisation responsible for nature in and around the projected site, while committing future residents to a nature-positive lifestyle.
- An **innovative provincial policy programme called *Natuur voor Elkaar*** [Nature for Each Other], focused on nature-inclusive building in the Province of Overijssel. This programme aims to redirect mainstream building practices. Although part of the public administration, its efforts focus less on changing formal regulations and more on influencing the behaviour of actors within the sector—primarily through inspiration and positive examples. The programme has established a broad cooperative structure.

We examined the sector through the lens of these two innovations. In addition, we conducted a sector analysis to better understand how it adopts—or resists—innovations related to the inclusion of nature.

The following research questions were addressed:

1. What (underlying) causes of biodiversity loss are linked to the domain of urbanisation?
2. How do the sector and societal partners view their relationship with nature?
3. Which levers and barriers support or hinder nature-inclusive and nature-positive building?
4. What is the transformative potential of biodiversity innovations?

In new construction projects, the focus is on densifying the existing urban environment—up to 90% of the planned housing. This leads to people living in areas where urban nature is deteriorating. At the same time, green spaces are being developed outside cities. As a result, nature gradually disappears from citizens' daily lives. Actors in the system view damage to nature caused by construction as unavoidable and believe it must be compensated by extending or creating new nature reserves, typically by converting agricultural land.

The entanglement of public and private partners in the sector is seen as a valuable form of cooperation, but it also creates an opaque system of relationships that is closed to external innovations, such as eco-communities. The common agreement to keep housing prices within certain limits leads to a high level of standardisation, which disadvantages citizens who wish to live in harmony with nature. The building sector is highly regulated, creating complexity that effectively raises barriers for newcomers and innovators.

The sector views nature as the sum of protected species and habitats governed by regulation. It prefers nature inclusion to be regulated by government to maintain a level playing field. The nature inclusion programme seeks structural integration of nature into the design and construction of new neighbourhoods, particularly in areas where low-income residents typically live in concrete environments. De Beuk reverses the concept of nature inclusion: it sees humans as part of nature, who must live within and adapt to a natural environment to ensure nature thrives.

The work of De Beuk and the policy programme *Natuur voor Elkaar* runs counter to the organisation of the sector and its innovation policy. De Beuk, with its revolutionary plans, must compete with standard project developers in open competition due to expropriation regulations. Even more problematic is a major obstacle caused by nitrogen policy, which aims to protect nature. The *Nature for Each Other* programme manages to influence building practices at the local level, but this change is modestly transitional and constrained by formal and informal market rules. In response to the negative sentiment toward nature protection, other arguments—such as health—are used to redirect project development practices.

A significant barrier is the confinement of innovation within public-private partnerships. While co-investment in innovation is seen as beneficial for adoption, policy fails to support transformative innovations because the sector resists them in order to protect profit margins. Fortunately, there are levers such as the framework for Private Collective Commissioning, which gives De Beuk a stronger position. Additionally, there are innovative institutions on the margins of the sector that aim to support collective initiatives.

De Beuk has developed a transformative concept: an official nature type based on nature positivity, which could become part of future regulations on nature inclusion. Time will tell whether the sector will embrace this idea. For now, it is gaining considerable support at symposia and workshops where people gather who wish to live in balance with nature.

1. Case study introduction

1.1 Justification of the importance of the case study

This study focuses on nature-inclusive building in the Netherlands, which is based on the idea that a building or home should not be separated from its environment, but rather become part of it. When nature is integrated into the built environment, nature-inclusive building means that space is deliberately created for nature on, around, or within a building, with the aim of enhancing both biodiversity and quality of life.

Nature-inclusive building is part of urbanisation, a high-impact sector for biodiversity, and holds the potential to transform the urbanisation system—including planning, design, project development, and the construction process.

Urban areas in the Netherlands are predominantly 'grey', and biodiversity is in decline. Between 2013 and 2022, the area of nature reserves decreased by 158 square kilometres, while the area designated for living and working increased by 277 square kilometres (see Figure 22 below).

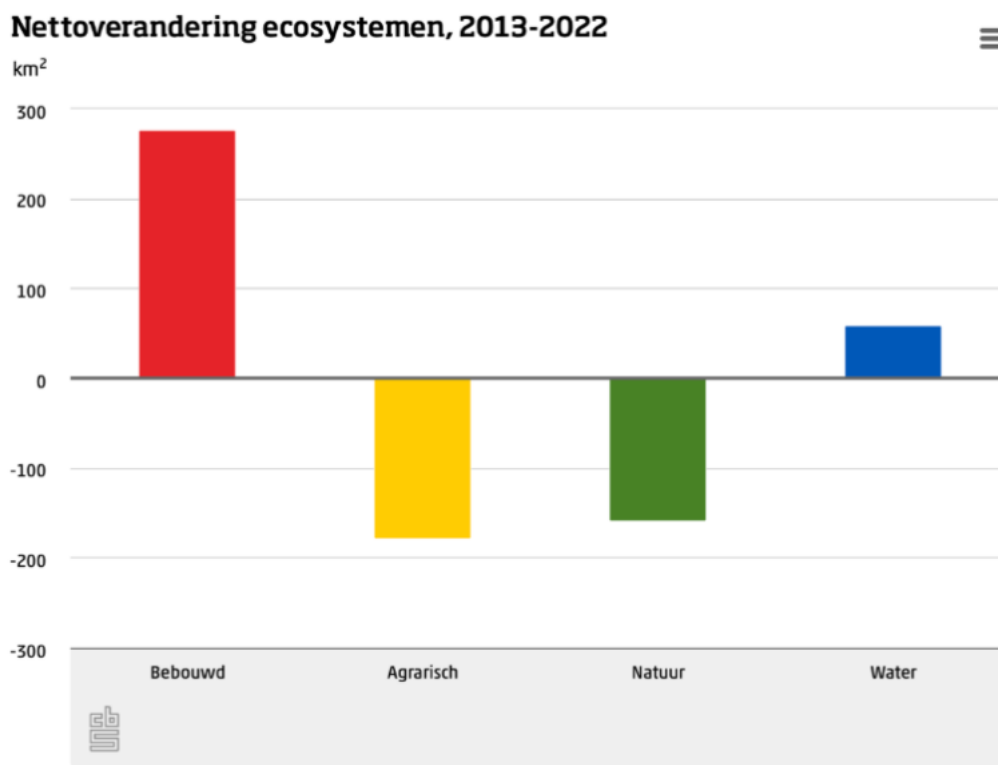


Figure 23 - The statistics of urbanisation and its spatial effects in the Netherlands, between 2013 and 2022. Red is building environment, yellow is agrarian, green is nature and blue represents water¹. Source: the nature capital accounting of the CBS Statistics

According to environmental psychologist Van den Berg (2024), without nature in urban areas, citizens lose their connection to nature. Increasing the presence of nature and biodiversity in the built environment in the Netherlands—through nature-inclusive building practices that create space for a wider variety of plant and animal species and use natural materials—offers numerous benefits. These include advantages for sustainability, biodiversity, natural cooling, and public health, as greenery helps filter the air and encourages outdoor activity.

A 'green' living environment is not only pleasant for people but also more hospitable for birds, insects, mammals, and other animals. Moreover, green neighbourhoods are better able to withstand extreme weather conditions resulting from climate change and help

reduce air pollution. Finally, greenery is visually appealing and is one of the key factors people consider when buying a home. If nature-inclusive building becomes the norm, it will contribute to a more liveable, healthy, and pleasant (urban) living environment in harmony with nature.

Nature-inclusive building involves technological innovation (such as nature-based solutions), social innovation (new forms of collaboration and organisation), economic innovation (new models of ownership and reciprocity), and institutional innovation (e.g. adapting or introducing new regulations).

1.2 Explanation of the focus of the case study

The case study on nature inclusive building is to be seen as composite (grassroot and policy oriented) and embedded. This makes it a strong case, because it encompasses many sectors of society (law, politics, policies, grassroots innovations, networks, movements) that are involved in transformative change. The eco-community as a societal innovation challenges the high impact sector from outside of the system, and the Overijssel case as a policy innovation does so from within.

This case study is not only geographically focused but also domain-specific, which is why it is structured across a societal and policy perspective:

- A grassroots initiative to establish an eco-community and ecovillage called *De Beuk* ("The Beech") in Wageningen, the Netherlands
- A provincial policy programme promoting nature-inclusive building, titled *Natuur voor Elkaar* ("Nature for Each Other"), launched by the Province of Overijssel, the Netherlands

By examining both perspectives, the study enables a deeper analysis of the biodiversity high-impact sector, particularly in terms of the transformations that this sector may embrace or resist.

The case combines two complementary forms of innovation:

- **Societal innovation**, as seen in community-led efforts
- **Policy innovation**, as driven by governmental programmes

The following figure may help illustrate the interplay between these two types of innovation.

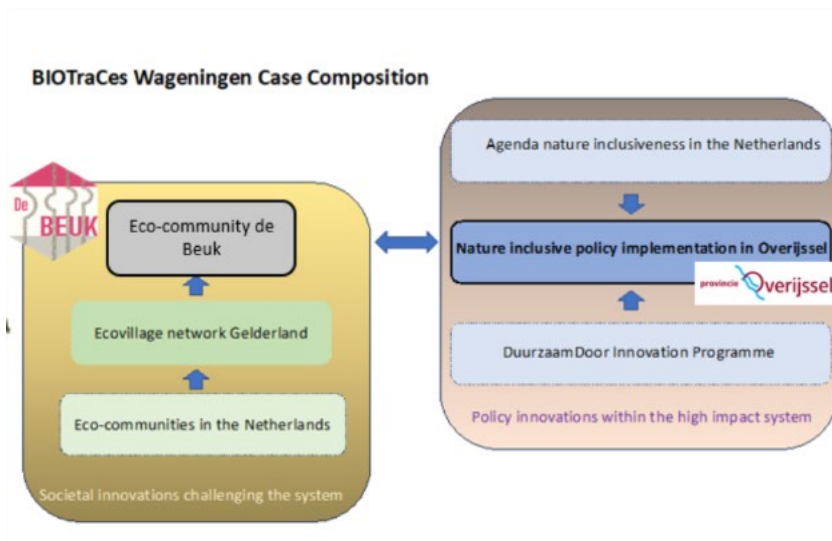


Figure 24 - Perspectives of societal and policy innovation in case study

The *De Beuk*² initiative exemplifies a bottom-up approach. It is a community-driven effort to create an ecovillage that includes tiny houses and collective living arrangements. Despite strong support from local politicians and eight years of dedicated work, the project continues to face significant regulatory and structural challenges within the conventional building sector.

In parallel, the study explores responses to nature-inclusive urbanisation policies. It examines how citizens, project developers, architects, and entrepreneurs engage with and succeed in adopting innovations encouraged by the Province of Overijssel³. Through its 'Natuur voor Elkaar' [Nature for Each Other]⁴ programme, the province facilitates collaboration among diverse stakeholders, fostering dialogue and joint efforts toward a nature-inclusive society. One key component of this programme is the promotion of nature-inclusive building.

1.3 Research questions addressed by the case study

The following research questions are addressed:

1. What (underlying) causes of biodiversity loss are linked to the domain of urbanisation?
2. How do the sector and societal partners view their relationship with nature?
3. Which levers and barriers support or hinder nature-inclusive and nature-positive building?
4. What is the transformative potential of bio-innovations?

1.4 Reading guide

The case on Nature-Inclusive Building in the Netherlands focuses on two key elements: the eco-community *De Beuk* and the *Natuur voor Elkaar* policy programme of the Province of Overijssel. Following this introduction, the methodology will be explained and accounted for, including how participatory action research has been applied.

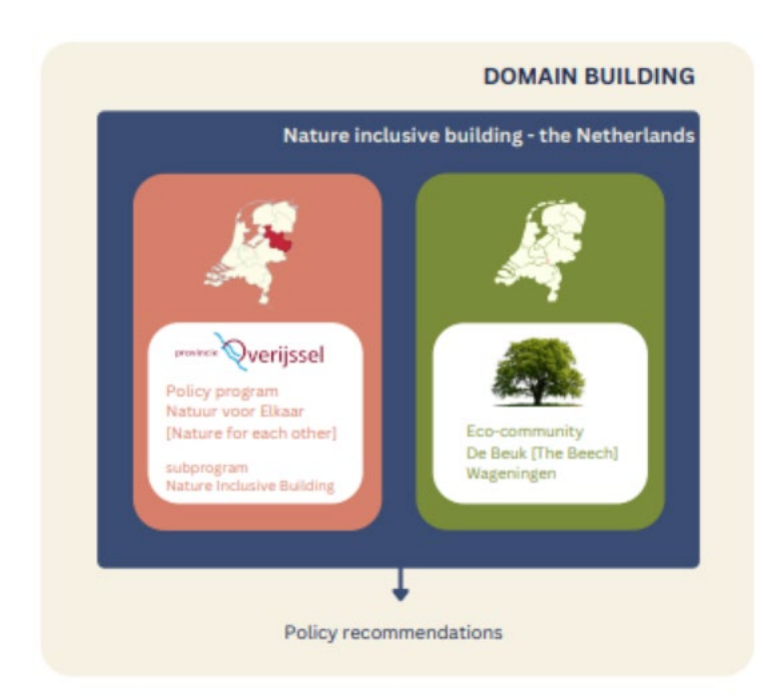


Figure 25 - General overview of WR case study

After this methodological explanation, the context of the work of both societal partners will be discussed. Based on this contextual analysis, we will further explore why and how the work of these societal partners is considered a biodiversity innovation within the sector, and how this plays out in the system of relationships that sustain the sector.

The analysis continues with a deep dive into the social-ecological relationships within the practices of the societal partners, and how these differ from mainstream relationships with nature in the sector. This will provide greater insight into the underlying causes of biodiversity loss and how the societal partners are addressing them.

The final step in the analysis examines the interventions that have been undertaken to create openings within the sector's relational system or to transform it. Both failures and successes will be reviewed to gain a better understanding of the sector.

2 Research methods and application of PAR

2.1 Role of Societal Partner

The case study on nature-inclusive building in the Netherlands focuses on and collaborates with two key actors—one more socially oriented and one more policy oriented. Nature-inclusive building is part of the building domain and relates to the high-impact biodiversity sector of urbanisation. *De Beuk* [The Beech] is a societal initiative aiming to realise an eco-community in Wageningen, the Netherlands. The innovative policy programme *Natuur voor Elkaar* [Nature for Each Other], in the province of Overijssel, promotes nature-inclusive building.

Role of societal partners in high impact sector

From the perspective of influencing a high-impact sector, *De Beuk*'s role is to challenge the building sector at a transformational level. It is developing an initiative that does not align with the standard procedures of the sector and aims to overcome barriers and seize opportunities to eventually convince—or even compel—the sector to open up to their plans and enable more nature-inclusive initiatives. Their main focus is on developing the eco-community, and through this, influencing and transforming the 'business as usual' approach to how houses are planned and built (see Figure 25). In a way, they themselves embody transformative change. They can be seen as problem owners, innovators, and agents of change.

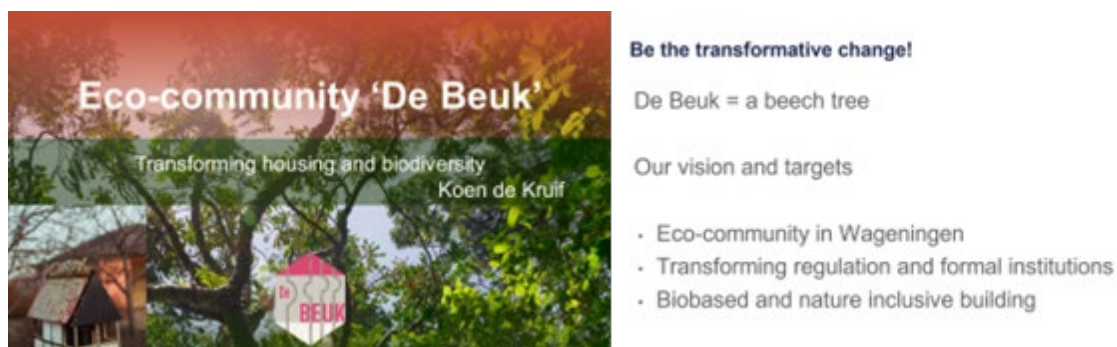


Figure 26 - PowerPoint slides of De Beuk presenting themselves on first live meeting BIOTraCes

The province of Overijssel has a slightly different role in the building domain and high impact sector of urbanisation. It develops ideas, plans and practices to include more nature in development plans and building activities. The interrelations with the sector are manifold and close, so one can say that it is an innovation programme that is based on cooperation with the sector. The policy program can be seen as innovative and experimental as they are not a 'common' policy programme, but actually starting a movement, working together with all kinds of societal actors. Also trying to emphasize action. They can also be seen as boundary spanners as they connect different actors, such as government, business, civil society and academia, facilitating dialogue and collaboration. They are agents of change and also story tellers, as they try to communicate in accessible ways, compelling ways, targeting different audiences.

Role of societal partners in BIOTraCes' research

The WR team reached out to both De Beuk and the Province of Overijssel to collaborate. Figure 26 shows the ideas with which BIOTraCes started the cooperation with the societal partners.



Figure 27 - The promise of conducting research in and with society

Relationships with both partners have evolved over time, adapting to their changing needs and circumstances. Generally, the relationship is characterized by trust and collaboration. In general, contact with De Beuk was more extensive and on more regular basis compared to the Province of Overijssel.

Both partners can be seen as co-creators of knowledge, helping to shape research questions, contributing their expertise, and co-developing solutions. More details are provided in the following sections, but for example, with the Province of Overijssel we co-designed and co-organised several workshops (ANNEX II). We support each other and contribute to events related to nature-inclusive building, including a two-day policy-making event and a scientific conference on governance. We also collaborated with De Beuk in several events. Moreover, they allowed WR an inside-look as we were invited to join their regular core group meetings, in which we mostly listened but also contributed with information, networks or actions.

2.2 Collaborative Research and Application of PAR

We draw on a mixture of methodologies that allow us to create a rich understanding of the case study. Those methodologies are selected to allow for mapping, futuring, and reflecting (see BIOTraCes deliverable D1.4). Some methods used can be seen as methods of entry, methods to develop a shared understanding of a specific issue, methods for dialogue across different perspective and for negotiated action and other methods for learning and reflexivity. See Annex II for an overview of workshops and interviews.

De Beuk

The collaboration between WR and De Beuk involved continuous and intensive knowledge exchange, primarily focused on practical insights.

We conducted a series of eight semi-structured interviews with ten members of De Beuk to explore their unique relationships with nature. These interviews were highly confidential, and participants shared their views, values, and perspectives with remarkable openness. The responses revealed a diverse spectrum of human-nature connections. In retrospect, many interviewees noted that our questions helped them clarify and organize their thoughts.

De Beuk welcomed us into their internal meetings and discussions. Initially, we attended these gatherings every three weeks; after a year, the frequency shifted to approximately

once a month. In addition to these core meetings, we also participated in project development sessions with involved institutions and attended several celebratory events organized by De Beuk.

Students have played a significant role in this process. We had students working via their thesis and via 2 ACT-groups on this research. We also co-presented at a scientific conference, although due to scheduling constraints, our session was merged with others, prompting a change in our presentation plans.

To support De Beuk, we organized an exchange and benchmarking session with De Warre—an already established eco-community. We also facilitated a strategic workshop aimed at identifying barriers and developing actionable strategies. Both sessions were deeply appreciated by De Beuk members, serving as valuable moments for reflection and integration.

In January 2025, we co-hosted a day long intervention workshop with De Beuk, the province of Overijssel and various other stakeholders, designed to be both relevant and constructive. A diverse group of stakeholders participated in discussions about the ecocycle within the nature-inclusive building domain.

In oktober 2025 we co-presented a session at the Coopling day (cooperative living day) on nature positive forms for living.

We also performed a discourse analysis based on the interview data, which provided insights into De Beuk's ideation process. This analysis illuminated how their relationship with nature influences their values and behaviors.

Province of Overijssel

We carried out eight semi-structured interviews with individuals working in the nature domain within the Province of Overijssel, as well as those involved in the *Nature for Each Other* policy programme. Interviewees were selected in close collaboration with the province, and their input informed the design of several co-hosted workshops. One such workshop focused on power dynamics and brought together policymakers and stakeholders from the nature-inclusive building sector in Overijssel.

We are actively involved in the province's Community of Practice on nature-inclusive building. This includes participation in a two-day policymaking event, in webinars and meetings around action plans and hosting workshops for three consecutive years at the province's nature-inclusive building conference. These workshops addressed barriers and leverage points within the sector and human-nature relations.

Our engagement also extends to various meetings, including those focused on sector updates and nature-inclusive social housing projects. Additionally, we are part of a WhatsApp/Signal community where practitioners share highlights, challenges, and news related to nature-inclusive building in Overijssel. We intended to co-present at a scientific conference, though due to logistical changes, our session was merged with others, requiring adjustments to our presentation.

In May 2024, a "Power and Influence Workshop" was held to explore the various power structures surrounding nature-inclusive building policy. Participants included actors active in the field of nature-inclusive building, directly or indirectly connected to the *Natuur voor Elkaar* programme.

In January 2025, we hosted a day long joint intervention workshop in collaboration with both De Beuk and the Province of Overijssel. A diverse group of stakeholders participated in discussions about the ecocycle within the nature-inclusive building domain.

In May 2025, we organised a workshop titled "*The Game of Elements: Exchange on Ownership and Shared Awareness in the Story of Nature-Inclusive Building.*" The workshop focused on fostering awareness and a sense of ownership around the shared narrative of nature-inclusive building.

Through these workshops and interactions, we have gathered valuable insights into the dynamics of provincial governance and sectoral transformation.

The High-Impact Sector

While our understanding of the sector has been enriched through collaboration with societal partners, we also conducted an independent analysis. This included desk research using online sources, particularly data from the Dutch national statistics agency (CBS), to assess sector performance and map systemic relationships. We also reviewed daily policy-oriented blog posts from environmental web mailings, typically authored by legal and planning experts (Van Assche & Verschraegen, 2008).

To deepen our understanding of sectoral perspectives on homebuyers, we developed and distributed a questionnaire to 5,000 members of the *Anders Wonen* network, a community of individuals seeking alternative lifestyles that are less individualistic, more nature-connected, and spatially modest.

This sectoral analysis focuses on the relationship between the built environment and nature, employing a systems and a polysystems approach (Even-Zohar, 1990). It complements the discourse-oriented analysis conducted with our societal partners.

BIOTraCes

Beyond the direct engagements with De Beuk and the province of Overijssel, representatives from both partners were invited to a BIOTraCes session titled "*The times are urgent; let us slow down*" (Bayo Akomolafe), held on January 25, 2024. This conversation explored ecological crises, indigenous knowledge, and personal narratives.

Moreover, WR presented and discussed the case study extensively at several BIOTraCes' meetings, for example with the influencer and stakeholder board, at various online and live consortium meetings, mostly specifically meant for learning and reflexivity on both the content and research approach.

2.3 Triangulation

In our case study, triangulation emerged organically as we combined multiple research methods throughout the process. These approaches complemented one another and enabled us to examine the situation from multiple perspectives. This layering of methods supported the project's diverse research themes and objectives, while allowing us to remain responsive to developments in the field and in collaboration with the societal partners.

De Beuk

Our research on De Beuk employs a triangulated methodology, combining multiple sources and perspectives to ensure a comprehensive understanding. This includes:

- **Anthropological fieldwork**, specifically participant observation, to capture lived experiences and relational dynamics
- **Interviews**
- **Document analysis**, focusing on municipal and provincial policies, as well as the formal planning procedures that shape the context of the case
- **Workshops**
- **System analysis**, examining how bio-innovations interact with the building sector and its underlying power structures

This triangulation integrates relational, policy, and systemic research, offering a multidimensional view of the nature-inclusive building domain.

Province of Overijssel

Our engagement with the Province of Overijssel includes several complementary research methods:

- **Participant observation and contribution** during meetings and events related to nature-inclusive building and the province's broader policy programme aimed at reconnecting people with nature
- **Contributions to meetings**
- **Interviews** with a diverse group of stakeholders, including provincial employees and external actors, involved in nature-inclusive building
- **Workshops** focused on power dynamics, barriers, leverage points, and pathways for transformative change, involving both internal and external stakeholders

Sector Analysis

To deepen our understanding of the broader nature-inclusive building sector, we collaborated with a well-connected writer and researcher in the field. At our request, she included four targeted questions in her annual survey on nature-inclusive lifestyles, which received over 1,000 responses. This data will be incorporated into our overall analysis.

We also conducted a **policy analysis**, complemented by interviews, to gain insights into the policymaking process within the sector.

In our final synthesis, we compare the **discourse analyses** of De Beuk and the Province of Overijssel with the **systemic analysis** of the high-impact sector. This comparative approach allows us to explore how different actors and structures relate to nature and navigate the challenges of nature-inclusive building.

3 Case study Contextualization

3.1 Multidimensional Presentation

Below we will describe the composite case of our case. One focus point of the case concerns “De Beuk”, which is in the outskirts of the city of Wageningen, adjacent to a Nature 2000 area, actually in use as refugee centre, as an ecovillage by a small number of squatters and a surrounding woodland area. The refugee centre is in a former hospital. North of this centre a former forestry research station is part of the territory for which a development plan is under construction. A masterplan has been made by the landowners, and they intend to commission the land and the plan on the free market. This implies that De Beuk will be competing with regular project developers in the acquisition of the land. Their plans go way beyond the masterplan in terms of sustainability and inclusion of nature. The now present squatter community is included in the Beuk process, but not all squatters will be able to join the projected residential area annex ecovillage. The area is used by the inhabitants of Wageningen to walk in a natural environment. The location of the refugee centre is closed for this public. The terrain of the former hospital is owned by an investor. The municipality sees the refugee centre as a temporary facility, that is almost at the phase of closing. But politically, there is no agreement when closure should take place. The province is responsible for the quality of nature, and the state forestry institute is responsible for the management of the natural values. For the inhabitants of Wageningen the location, designated as part of the Wageningse Berg (the mountain of Wageningen) is part of the wider Veluwe region, which consists mainly of vast woodlands.

The second focus point of the case is the province of Overijssel. This province is located in the east of the Netherlands. It has ancient agricultural landscapes (hamlets, pastures, small rivers and moors, woodlands) and only a few big cities. Big cities are Zwolle, Deventer, Enschede and Hengelo (80.000-160.000 inhabitants). There are a few medium size cities, such as Oldenzaal and Almelo. There are many small cities and villages spread across the province. Farms are mostly surrounded by ancient oaks, which goes back to the tradition to grow ones’ own timber, to be used for farmland activities. The countryside is largely in use for agriculture. Small parts are used for nature and for estates. One area for nature is famous as a national park: Wieden Weerribben. This is a former peat excavation area. Generally speaking, people in Overijssel seem to live a bit closer to nature than those in the densely populated western part of the Netherlands, called the Randstad⁵. Especially in the countryside, they share the tradition of “noaberschap”, which means that they are more inclined to help each other in times of need. This goes back to historic times, to help each other with harvesting, to overcome periods of small yields, and to help in case of sickness and death. The inhabitants of the province have no specific relation with nature that differs from other provinces. However, in terms of reserving space and habitats for nature in new development plans, this province has more space than the western provinces. Ground prices are slightly lower than in the more densely populated areas such as Randstad and Brabant, which makes it easier to include natural elements in project development. The province has predominantly dairy farms (three quarter of the agrarian area is grassland)⁶, which are currently under huge pressure of reducing nitrogen emissions.

3.2 Key actors and their impact on worldviews

In their attempt to realize an eco-community and ecovillage the members of De Beuk are confronted with a huge number of actors that sustain the dominant worldview that they disagree with. Members of De Beuk share a holistic view on nature, they feel part of nature and believe in the possibility to coexist with positive effects on nature. Their worldview runs at odds with the governance context they must deal with.

One can see that the province of Gelderland, in terms of politics and policy, is one of the most important actors, because they are responsible for the quality of nature.⁷ For the province nature is not so much a condition of life, but a system of (EU based) agreements

and regulations they must comply with. Policies are addressing the European obligations. Higher ambitions are considered costly and unnecessary. Humans are positioned outside nature; however, humans share a responsibility to protect it. The province supports biodiversity projects in agriculture, schoolyards, in cities and business parks. Regular assessments are made how nature is doing in the nature reserves and how policy targets are met, in N2000 areas and in the provincial network of nature reserves.⁸ One of the main outcomes is that nitrogen has become a problem for the plant species composition in nature reserves, with lots of fauna effects.

When dealing with a request for a permit for a housing plan that may affect nature, their line of reasoning is: "what negative effects on nature are assessed, and should we give a permit or not". They focus strongly on intervention-effect-relations. Each request is judged individually. Each given or refused permit is underpinned by scientific knowledge. In case potential effects on N2000 nature reserves cannot be excluded, an assessment must be made. Refusing a permit must have a legal basis, which makes it difficult to act precautionary.

Solutions for problems, called innovations, preferably result from a cooperation between private and public-private actors. Innovations may be technical and nature management based, or other. The province feels responsible that project development and its results should stay within the lines of profitability, because otherwise the number of houses that will be realised will drop significantly. The province of Gelderland has had an innovation policy that supported private initiatives with nature by citizens.⁹ It now has a subsidy for collective living experiments, but no policies or subsidies for collective living experiments that involve nature positivity.

The provincial worldview is shared by the municipality, which however gives a bit more focus on the quality of the living environments for their residents and how they experience nature therein. Overall, taking care for nature in project development is rather technically oriented with the least possible effects on the price of houses. For the State Forestry Department nature preservation is most important and this task must be done in a context of biodiversity decline. To a certain extent, but not exclusively, nature for them is the quality of the ecosystems within nature reserves. They are a bit less focused on nature in cities and neighbourhoods, because this lies outside their properties and assets. The management plans for their nature reserves must be scientifically underpinned to be eligible for the subsidies coming from national programmes. For project developers that will be competing with De Beuk, nature is nice to include but only on the level of individual species that can easily be accommodated. The location of De Beuk, De Dorschkamp, so close to a N2000 area, is extremely complicated, because this requires extra efforts to acquire permits, to mitigate their actions or compensate effects. The animals living at the site of De Dorschkamp, have no say. They are absent in any discussion, except for the members of De Beuk. More concretely, one of the members of De Beuk mentioned the blindworm, that has the right to live inside their living environment, which implies that chickens and cats in the neighbourhood can be a problem. This might cause a dilemma for the members.

This is how De Beuk presents itself:

"On the Wageningen hill, where the Veluwe merges into the Rhine valley and the former meltwater valley Renkums Beekdal, lies the former Dorschkamp estate. At this special place, the municipality has designated a location for housing under strict conditions. This location, where the asylum seekers' centre and the remains of a former hospital still stand, requires special care and nurturing.

*Together with many Wageningen residents, we, members of De Beuk, have the desire to realize a nature-inclusive ecological hamlet in this place, where sustainability is integrated into daily life and where care for each other and neighbourliness are central."*¹⁰

For De Beuk, the plans and the housing vision of the municipality offer a great opportunity to make this hamlet possible. Now that construction is taking place in this wooded area, it is good to achieve this with a community that values biodiversity and strives to live in harmony with its environment. For the municipality, De Beuk's plans offer a unique opportunity to bring its vision on housing, welfare, nature and climate to life.

De Beuk plans to increase the natural values of the Dorschkamp. They have set up an Area Cooperation de Dorschkamp for the layout of the area, the housing units and the management of the surrounding area. Their goal is to 'live like nature' at the Dorschkamp. Nitrogen naturally plays a major role in the development of the area. They plan to reduce the total nitrogen emissions of this area and thus improve the impact on the natural values of the adjacent nature reserve.

De Beuk aims at minimal nitrogen emissions during the construction of their homes. Building will take place modularly, with production in factories that are located far from Natura 2000 areas. Construction and transport of the building components and other deliveries transported will be delivered with electric transport. In housing, they will emit less nitrogen than what is currently emitted. The actual buildings of the COA (Central Institute for Refugee Care) are not well insulated. About 300 people live there and on a daily basis cars and buses regularly drive over the site. The members of the De Beuk association build compact, well-insulated and gas-free houses. A maximum of 150 housing units is to be built. Assuming the average size of Wageningen households of 1.6 percent, around 240 people will live there, so well less than the actual number. Mobilised transport is limited by using (electric) shared cars/s and promoting cycling and walking. Cars will be limited on the site, with parking facilities on the edge of the area. This means that De Beuk is much less dependent on fossil fuels. They are quite confident about this, because they already know (largely) who will live there prior to building. Their supporters choose to live in this place precisely because of the choices De Beuk makes to improve the quality of the environment, the type of home (biobased, sustainable and circular) and the way we want to live and transport themselves.

With this collective building initiative, they will have to apply for an environmental permit with the necessary calculations of nitrogen emissions and the related room for deposition. The new homes have considerably less nitrogen emissions in construction and use than the current situation.

Key actors and their impact on worldviews in Overijssel

In Overijssel the worldview of the policy innovation group around the policy program *Natuur voor Elkaar* [Nature for each other] focuses on realising innovative practices that may inspire the actors in the sector to become more nature inclusive. Their worldview is focussing on the seriousness of biodiversity loss. They attempt to redirect the mainstream of the building praxis. They are not in favour of solutions that come from more top down strict and severe regulations set by the provincial government. Being part of the public administration, their attempts are not so much about changing the formal regulatory system but merely about changing the behaviour of the actors in the system by means of seduction with good inspiring examples. Emotions and less rational arguments do play a role here, in addition to mainly rational reasoning. They believe that when nature inclusive practices exceed the level of 25%, eventually the mainstream will follow. They cooperate with city planning bureaus, architects, landscape architects, construction firms, municipalities, water management boards, NGO's, brokers, banks and many more. The actors are aware of the price competition in acquiring land and selling the houses. On the one hand those actors are complaining about the abundance and complexity of regulations that regulates the planning, project development and construction process, whereas on the other those actors ask for regulations for nature inclusivity, because this would ensure a level playing field. None of the actors focuses on the lifestyle component of living with nature. Nature itself has no say and no rights, so far.

How Nature for Each Other describes its goals:

"Research shows that Overijssel residents highly value their nature and green surroundings. People feel comfortable in a green living environment and find peace in it. Scientific research shows that nature is a source of well-being, health, and happiness. However, more and more people miss nature and are not always aware of this. The more distance you get from nature, the less you enjoy it and care for it. To break this vicious cycle, preaching won't help. What does help is when, with passion, the experience of greenery connects with the different needs of everyone. So that you experience all facets of Overijssel's nature with your head, heart, and hands, feel involved in it, and ideally, share responsibility for it. Because whoever values nature will also treat it with care. In this way, we safeguard our green living environment for the future."

3.3 Biodiversity Loss Factors

Policy aims

In 2023, the Dutch population counted 17.8 million people. More than 400.000 of them are searching for a new house to live in. There are 8.1 million houses in total, of which 57% are privately owned by households, 29% rented by a housing cooperation and 14% free rent. There is a need for 390.000 new houses. 350.000 people between 25 and 40 are living with their parents. The average value of a house is 369.000 Euro. On the average, a person pays 25% of their income to live in a house. To realize the large number of new houses, a National Housing and Construction Agenda has been made by the sector.

National Housing and Construction Agenda

The Netherlands needs accessible, affordable residential good quality landscapes. The task is complex: it requires a focused effort from all parties involved. Together with important partners in the residential sector, such as local and provincial authorities, housing corporations and market parties, the government is joining forces to tackle the identified problems and causes and to realise the objectives of the National Housing and Construction Agenda.

The agenda has three core objectives:

1. Availability: sufficient housing for everyone. The construction of 900,000 homes up to and including 2030, with the aim of making two-thirds affordable.
2. Affordability: better alignment of housing costs with income. The number of households that have housing costs that are too high compared to their income must decrease.
3. Quality: sufficient housing for focus groups and the elderly, prospects for vulnerable neighbourhoods and sustainable housing accessible to everyone.

More than ever before, the government sets the standard and guards the achievement of national goals. The National Housing and Construction Agenda enables the government to tackle, finance and monitor the various construction and housing tasks together and in conjunction with other interests.

The total stock of houses in the Netherlands is well over 8 million. The production of houses over the years is given in table 14.

Table 14 - Annual production of new houses¹¹

Year	Production of new houses
2016	54989
2017	67669
2018	82680
2019	87556
2020	84788
2021	89175
2022	90208
2023	88156

For 2023 the following data are taken from the CBS Statistics Netherlands and given in table 15.

Table 15 - Increase in total stock of houses in 2023. Source CBS, 2024¹²

Housing statistics in 2023	
Total stock in January	8 125 229
Newly constructed	73 638
Other additions	20 750
Demolished	9 337
Other withdrawals	6 555
Total stock at end of December	8 252 523
Increase	127 294

The number of permits for new buildings and residential areas has risen with 24% in the period January till September 2024, compared with the same period in 2023. The actual planning capacity for the period 2024-2030 is 971 350.¹³

The sector, confronted with these figures, urges for haste, big projects and less regulations to speed up the building process. In all these arguments nature is seen as a problem, because it requires dedication, time to find solutions and deal with procedures and conflicts with standardisation that focuses on efficiency.

Critical remarks about the figures

The Dutch government is facing problems in achieving these aims. One possible solution to improve the situation is to create new opportunities and remove barriers to intensify the use of the existing housing stock. Sharing houses, living behind one and the same front door by more people. The expertise network for neighbourhood development, Platform 31, has calculated that between 15.000 and 30.000 less houses will be needed if the existing stock would be more intensively used.¹⁴

Planning process

Every acre of land is intensively used in the Netherlands. Finding places for new residential areas is difficult. They are designated as potential building grounds in the so-called environmental vision plans and environmental plans. When such a plan is published and the projected land lies in the outskirts of a city or village, project developers will try to buy plots of land from farmers. If they are successful, the price will be determined by its agricultural use: often lying below the 10 Euros per square meter. When the allowed land use changes, because of changes in the environmental plan, the price will rise significantly. For those who are buying a house with a garden, the price of a square meter often exceeds the level of a thousand Euros. This is a strong economic motor of project development. Formerly the government was responsible for the public infrastructure, such as sewers, lights, parks and so forth. This, by law initially called *Grondexploitatiewet* (area exploitation law, now called law on cost recovery), has been changed. The project developer must realize houses and (pay for) public infrastructure.

When space is found inside cities, the use of it must be intensified to ensure profit. This means higher buildings, less open space between buildings and or smaller apartments. Nature is seen as an extra claim on the budget and thus reducing profit.

Building decree

The Building Decree 2012 (recently the instruction building living environment *BBL*) is the regulation that sets the technical requirements for the safety, health, usability, energy efficiency and environmental aspects of buildings in the Netherlands. The decree regulates the technical aspects of construction but does not contain any specific or detailed rules on the protection of nature, such as nature reserves or biodiversity on construction sites. However, the influence of nature is addressed indirectly, through requirements relating to environmental aspects and sustainability.

Although the decree itself is not directly aimed at nature conservation, there are some relevant rules and references that have to do with dealing with the surrounding area and the environment, including nature. These rules often must be combined with other laws and regulations, such as the Nature Conservation Act and the Environmental Impact Assessment (EIA).

The decree contains requirements for drainage and sewerage that relate to the management of rainwater and wastewater. Although it is not specifically aimed at nature, good water management affects the surrounding nature reserves. When building new homes or neighbourhoods, stormwater drainage and water storage must also be tailored to the environment, which can provide ecological benefits. There is room in the decree for the inclusion of green roofs and other sustainable, nature-friendly solutions that can protect both the environment and nature by, for example, retaining rainwater and promoting biodiversity.

Nature Conservation Act¹⁵

This law regulates the protection of nature, animals and plants, and sets requirements for the way in which construction projects in nature reserves or in the vicinity of protected

areas (such as Natura 2000 areas) must be carried out. This can affect the planning process, where the ecological value of an area must be evaluated. If a construction project would cause damage to nature, it may be necessary to take compensation measures, for example by restoring nature or creating or adding land to a nature reserve elsewhere.

The conflicts of interest between the construction sector and nature conservation are a common and complex issue in spatial planning. At first glance, both sectors often have different priorities, which leads to tensions in the process of area development, infrastructure and housing. The construction sector focuses mainly on the realisation of new homes, offices, infrastructure and other structures, while the nature conservation sector focuses on preserving natural values, biodiversity and the environment. This contradiction is reinforced by social concerns about the housing shortage, but at the same time also by increasing concerns about climate change, biodiversity loss and the natural resources that are under pressure.

The construction sector needs sufficient land for new housing, infrastructure or business premises. These areas are often densely populated or are located near cities and other urban areas where the demand for space is greatest. Building homes and businesses requires a consideration of available space, which often means converting agricultural land or nature reserve into building land. Nature conservationists want nature and biodiversity to be preserved, and advocate the protection of existing nature reserves, for example Natura 2000 areas, natural monuments, and ecological connections. Converting natural land to building land leads to a loss of biodiversity and can have negative effects on the environment, such as the decline of animal species, water quality and air quality. The construction industry often prefers locations that have already been designated as rural or agricultural areas, while conservationists advocate the preservation of these areas for their ecological value. This leads to conflicts about the correct destination of certain land.

Policy innovations

In the construction sector, there is an increasing focus on the integration of nature and sustainability, both in the planning process and during project development. There are various reports and guidelines that describe how to deal with nature, promoting biodiversity, and the integration of ecological considerations in the built environment. A manifold of programmes that have been launched by the national government and platforms by the public private building network aim at greening the living environments.¹⁶ A distinction can be made between innovation within the sector and innovations sprouting from citizens' initiatives or nature protection organisations. Most of the innovations within the sector are focusing on biobased building, for example The Gideon Building Transition Tribes.¹⁷ An initiative of the Dutch Mammal Society and Bird Protection Foundation, made possible by *DuurzaamDoor* and the provinces of *Overijssel* and *Brabant*, focuses on habitat creation in the development of new neighbourhoods.¹⁸ A very inspiring citizens-based example aims at changing our degenerative relation with nature into a regenerative and doing that with a specific organisational form called *Zoöperatie*.¹⁹

Milieu Centraal has issued several reports and guides on sustainable building, which also include the integration of nature in the house and the garden.²⁰ This can involve the use of sustainable materials as well as the promotion of ecological processes in and around buildings.

Another innovation programme, *DuurzaamDoor* (translation: Sustainable Progress), is a governmental one that aims to accommodate and accelerate trends towards a sustainable future.²¹ It establishes contact between governments and social initiatives. Learning and collaboration in networks are central. *DuurzaamDoor* creates an environment in which social initiatives can be carried out more easily. The programme helps to accelerate the implementation process and applies solutions for upscaling. In doing this, the programme accelerates the transition to a sustainable society.

According to *DuurzaamDoor*, green living or working environment has positive effects in areas such as heat stress, flooding, health and biodiversity. It is good for your health, for

the quality of life, for the value of real estate and for climate adaptation. In practice, however, it appears that nature and design/construction are not automatically considered integrally. Too often, more attention is paid to the building and/or the design plan and nature only comes into being afterwards.

The conflict between building houses and nature conservation can be solved by paying attention to greenery and biodiversity in construction projects. According to *DuurzaamDoor*, nature-inclusive construction contributes to an attractive and future-proof living environment for people and animals. With nature-inclusive construction and/or area development, nature is integrated into the construction of homes and business premises. For example, the building contains roosting places for bats and sparrows. With nature-inclusive construction, biodiversity will increase. More balance means less nuisance from rats and mosquitoes in urban areas. By installing green roofs and facades, it remains cooler in the summer, and water can be collected.

To achieve this goal and to influence the building praxis, *DuurzaamDoor* organised so-called participation tables.²² Among many others, one participation table is about the inclusion of nature in building. The table aims to connect nature networks and building networks with cooperative activities and projects. The actors in the networks are influential, such as Ballast-Nedam, Heijmans, NL Greenlabel, Bird Protection Netherlands.²³ The proceedings of their meetings are publicly available on their website. The idea is to exchange good examples and make the mainstream of building more nature inclusive.

When overseeing the field of policy innovations, it becomes clear that all of them are situated in the public private partnership (PPS) of the planning and construction sector. The partnership does not nurture ideological innovations. Innovations are aiming at the inclusion of nature insofar the business accept them in terms of little or low effects on the revenues and profits. If innovations are confined to the public private cooperation between governmental institutions and private companies, the danger exists of self referentiality (Van Assche & Duineveld, 2010). Other, often more ideological or normative innovations that emerge from outside the PPS, are then seen as unrealistic, because they do not comply with the principles and fundamentals of the neo-liberal economy (Van Assche et al, 2011).

Nature and the housing agenda

Nature and landscape are under great pressure in the Netherlands. Urbanisation, intensive agriculture and desiccation are deteriorating the quality of habitats for flora and fauna. Spatial developments, such as new roads or industrial estates, can have a major impact on the quality of nature. Conversely, ecological values can influence spatial developments. This has become apparent in recent years. The great crested newt, sand lizard, garlic toad and badger influence the development of industrial estates, new residential areas and recreational facilities. Sometimes this has led to the cessation of these developments, in other cases to far-reaching compensatory measures. A zoning plan can protect the ecological and landscape values of an area. In addition, areas with certain ecological values are protected by international treaties, European directives, and national laws and policies.

Nitrogen problems

In the Netherlands, there are many nature reserves that fall under Natura 2000 protection, such as forests, heaths and marshes, which are vulnerable to nitrogen deposition. Too much nitrogen in the soil causes deterioration of soil quality, changes in vegetation, and loss of biodiversity. This leads to negative effects on nature and means that the Netherlands does not always meet EU standards for air quality and nature conservation.

The nitrogen problem revolves around the emission of nitrogen compounds, mainly nitrogen oxides (NO_x) and ammonia (NH₃), which contribute to acidification and a decline in biodiversity in nature reserves. These substances are mainly released from agriculture

(especially by livestock, manure and fertilizers), road traffic, industry, and also from the construction sector itself.

In the construction sector nature conservation is seen as an obstacle to the rapid realisation of low-cost housing. This is especially evident when there are strict ecological regulations that offer protection to nature reserves, rare animal species or protected landscapes. This can lead to longer permitting procedures, additional costs, and more complex planning processes. There are various pleas and arguments that are sometimes put forward to reduce the emphasis on nature in such proceedings. Some actors advocate relaxing of ecological requirements to make housing construction faster and cheaper. It is often argued that the current regulations are too complex and time-consuming, making it difficult to build enough homes to meet the housing need. This comes to the fore in the discussion around the "housing crisis".

According to the building lobby organisation *Bouwend Nederland* almost a quarter of a million of the projected houses will not be built because of nitrogen problems.²⁴ This would imply an economic loss of 138 billion Euros for the sector. To avoid this massive failure they created a plan, together with the private nature management organisation *Natuurmonumenten*, the environmental protection organisation *Natuur & Milieu*, with The Confederation of Netherlands Industry and Employers *VNO-NCW* and the organisation for small and medium enterprises *MKB* to reduce nitrogen and improve the quality of nature, in advance of new permits to be released by the government.²⁵ They depend however on the willingness of the minister of agriculture but receive a reluctant attitude from the minister. The reduction of the number of dairy cows is totally unacceptable for the actual Cabinet, but alternative plans have not been released so far. This minister has good hopes to change the nitrogen standards in favour of agriculture and other nitrogen emitters.

3.4 Culture-Based Dynamics

Houses are becoming more expensive; stress is rising and time for nature is scarcer construction in the Netherlands is lagging. One million homes must be built, at a rate of 130,000 per year. Nature is partly blamed for delays. Building is expensive and the houses that are built are therefore expensive (on the average 475.000 Euro). Young families find it very difficult to find a home, and if you are not a two-income household, it is very difficult to get sufficient financing.²⁶ The result is a lifestyle where stress and lack of free time is the common thread. People choose to physically rest for media (computer television), there is little time to enjoy the peace and space of nature.²⁷ Being busy gives prestige: commercials regularly start with the opening sentence "I have a busy schedule, and so...." This is a lock-in.

Densifying cities, causing nature to disappear from everyday life

In the process of new construction, the focus is on densification of the existing urban fabric.²⁸ The result is that people come to live in an environment in which urban nature is deteriorating. Provinces in the Randstad are aiming for approximately 90% realisation within existing urban areas. This is then accompanied by the realisation of green areas outside the cities (in Utrecht this programme is called the Green Grows Along).²⁹ This is a process in which nature is gradually disappearing from the daily lives of citizens. Going into nature is then reduced to a form of leisure activity, in which the experience of nature also suffers from large number of visitors. People are getting used to crowds and shifting their needs to get out into nature to short vacations instead of free moments on weekends. In doing so, they unintentionally increase their ecological footprint.

It is striking how much in-depth knowledge there is about our thinking about the relationship with nature and how little is done with it. This is not only about nature as an environment, but also about the influence of nature on our well-being. Well-being in terms of health and mental well-being. We like to read books about it (see, for example, Mari Verstegen, *Nature as Source*, 2025, Noordboek; Agnes van den Berg (2024), *Dichter bij*

de natuur, Vonk Uitgeverij; Matthijs Schouten, etcetera). The arsenal of books creates a kind of restlessness in our existence, but we cannot extricate ourselves from the issues of the day.

In society there is a subculture of people wishing to live closer to nature. Two social entrepreneurs established a network of citizens who desire to live alternatively and more sustainable.¹ On an independent platform, stories are exchanged to inspire citizens to live in a sustainable way. The platform has 200.000 unique visitors per month, and a newsletter is sent to 18.000 addresses. Each year the entrepreneurs send out a questionnaire to keep track of trends and what aspect of sustainability people wish to engage with. In the 2024 questionnaire several questions from BIOTraCes have been taken on board. The questionnaire was sent out to 5000 addresses, 1500 of them submitted their answers. Below a very concise summary of the outcomes is given.²

It is important to realize that 80% of the respondents are dissatisfied with their way of living. One fifth would like to live in a smaller home, 70% and would like to live closer to nature and more than half of these would like to do so collectively. The outcome provides indications that living closer to nature would make it easier for part of the population to adopt a more nature inclusive lifestyle (30% strong agreement, 25% minor agreement). And 70% would like to move to another home to live closer to nature (strong and minor agreement). And lastly, 68% strongly agrees with the statement "would like to better integrate nature in their way of living", and 16% agrees to a certain extend.

The questionnaire, just as the innumerable stories on the platform, gives the picture of a mismatch of how part of the population in The Netherlands would like to live, i.c. closer to nature, and what the system performs. This implies that a certain leverage for the inclusion of nature can be found directly in society. But using this leverage would need a more tailor-made approach in project development, and less oriented to the actual target groups.

The sector in its way of working sustains a typical culture, characterized by public private partnerships and by restricting innovations to more efficiency and biobased materials. The inclusion of nature adds to that culture, and because big constructors are joining, this in due time will become part of the canon of best practices, following the mechanisms of polysystem theory described by Even-Zohar (1990). But the culture also highlights the need of profits to keep the economy of planning and construction ongoing.

3.5 Identity-Based Dynamics

Homes are being designed for the mainstream materialistic lifestyle the construction and housing sector itself seems embedded in a broader discourse that assumes the need for economic growth. In neoliberal thinking, the consumption of people is central to the flourishing of the economy. People are encouraged to buy things through influencers and advertisements. This leads to a standardized picture of the amount of space that a person or a family needs to store or display it.³⁰ Houses are built for people with a consumerist lifestyle. A large house with a lot of expensive stuff also gives status. And so, the construction sector assumes a certain housing career in which people live larger and more expensive.³¹ And the vast majority of people go along with this.

There are groups of people who would like to live closer to nature (Nature Inquiry Asceline Groot). This contradicts the idea of densifying cities to protect nature in agricultural areas. But it also contradicts the practice of building for categorised target groups. If one does not fit in such a target group, because of another perspective on nature, or because of a more nature inclusive lifestyle, the system fails to address such preferences and needs. There are no attempts at all to address the views on nature of those coming from other parts of the world. This sometimes pops up in participation processes about parks and gardens in and around neighbourhoods. A typical Dutch way of conceptualisation is creating "green spaces". But people from other continents do not have this association between green and nature. For them nature is more colourful. This gives rise to misunderstandings and to misaddressing their needs. Also, the needs of people who suffer

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from loneliness and who would like to live in a community or sheltered environment are unaddressed. This need for company often goes along with a need to live closer to nature.

The world of planning, project development and constructing predominantly seems to be a man's world, and no more than 15% of the (sub)top jobs are occupied by women.³² Interesting to note the government advisor of landscape, a woman, challenges the sector to become more nature inclusive and open for innovations from outside the sector. Many advises have been given and now she is ambassador of the national programme on nature inclusion.

An interesting initiative to change the sector is the realisation of the Platform Live Differently (Anders Wonen) by two female social entrepreneurs. They exchange knowledge between pioneering initiatives and people who seek to live differently but who have not a clue on how to start. Annually they send out a questionnaire to a network of approximately 5000 people. The response is showing a combination of preferences of living closer to nature, more sustainable and less individual.

3.6 Political/Institutional Dynamics

Urbanization and project development: big steps quickly at home

The relationships between plans and projects with nature are hardly established in the policy phase of central government and provinces. It is indicated that these effects cannot be predicted without knowing the implementation plans. The Spatial Policy Document provides for the construction of a million homes, without a clear picture of the expected effects. If the relationship is made at all, it is through nitrogen that is released during construction and when new residents use cars and that comes down in N2000 areas. The aim is to carry out large projects, because then the deficit can be made up. Nature is considered a detail that should get in the way as little as possible. Small-scale well-integrated projects are possible but often considered as unfeasible because of the 'business case'. The business case is a kind of black box with which the project developer makes it clear to what extent he is willing to work in a nature-inclusive way.³³

The process of changing a parcel of land into a residential area is utmost complex, due to all institutions having a say over it. The following issues among others must be addressed:

- Forecasting the number of houses needed for demographic change
- Defining the number of houses in separate financial categories or for the renting market
- Defining and designing the space for parking, for sewers, for parks, roads, waysides and so forth
- Calculating the costs and benefits of the project
- Request change in allotment plan
- Request permits for the project, such as:
 - *Omgevingsvergunning* (WABO)
- Reporting assessing effects on nature
- Building permits (construction of the houses)
- Clearing the site (e.g. chopping down trees; tearing down farm buildings)
- Access road, mobility plan
- Environment (soil, archaeology, water assessment etc)
- One must navigate a very complex procedure

This institutional complexity is very effective to hold back newcomers in the arena. Project developers are moaning about the complexity, but they are almost exclusively the institutions capable of navigating through them. This however requires a high level of standardisation. Any change in the system of planning, drawing and building is seen as

additional cost, leading to unnecessary delays. Building with nature is therefore seen as such a complicating ambition that can only be addressed by leaving the path of the standards and finding new ways to build. Project developers are very reluctant to do so. Those innovations come from outside the sector.

This complexity can be illustrated for the situation in Utrecht.³⁴ A journalist, Kees Grimbergen, spent four years researching the housing policy of the municipality of Utrecht. He mainly looked at the expropriation of houses by housing cooperatives. He explains that the sector is complex and that the actors looking for a solution to the housing shortage are looking for solutions that increase the complexity. The complexity is caused by numerous notes and files on interrelated topics and by the structures of cooperation in the sector. For example, the top of housing cooperatives is connected to scientists. And scientists are members of the supervisory directorships of housing cooperatives and of the national association Aedes. Lobbyists play a key role. For example, an emeritus professor of the Housing Market at the University of Amsterdam is director of Finance Ideas. Previously, he worked at Ortec Finance and at the then Central Fund for Public Housing. He is also affiliated with the Amsterdam School of Real Estate, member of the Supervisory Board of BNG Bank, member of the Investment Committee of Amvest Residential Core Fund. He writes columns in which he advocates certain financial policies in the housing market and lobbies for policies that fit the idea of neocapitalism in the free market. The people who work in the sector take complexity as a given and look for solutions that are in line with it and not diminishing it. Within the top of the sector, there is a tendency to keep equity as large as possible. This also applies to housing cooperatives that have a foundation form and may not have a profit motive. According to this journalist, no more than 2 out of 40 councillors share an adequate understanding of the way the sector operates. He speaks of a lobbyocracy that overtakes democracy.

Political barriers the program *Nature for Each Other* is confronted with

Nature for Each Other operates within the political domain of the province of Overijssel. Here, political powers are in play. Therefore, *Nature for Each Other* needs to be aware of what they publicly say and need to have some 'political sensitivity'. This expresses itself in multiple ways:

Strategic Positioning of *Nature for Each Other* in a Polarized Political Landscape

Every four years, *Nature for Each Other* must seek formal approval from the Council of State in the province of Overijssel to continue its operations. Currently, the provincial board is predominantly influenced by a political party that strongly advocates for farmers' interests. This has created a polarized political climate in the Netherlands, where the dominant narrative frames agricultural land and nature conservation as opposing forces; suggesting they cannot coexist harmoniously.

In response to this challenging environment, *Nature for Each Other* has strategically chosen to operate with a low profile. By staying under the radar, the organization aims to safeguard its program and avoid political friction. This approach means they refrain from setting explicit biodiversity targets, instead placing greater emphasis on the social dimensions of their network, such as community engagement and collaboration.

However, this cautious strategy also presents limitations. Scaling up their initiatives becomes difficult, as increased visibility could interrupt with their standing with the provincial authorities and risk political backlash.

Shifting the Narrative and Language

Another element of their strategy involves a deliberate shift in language and messaging. To avoid triggering political sensitivities, the organization consciously avoids terms like *biodiversity* and *nature*, which may be perceived as controversial or oppositional to

agricultural interests. Instead, they opt for more neutral and inclusive phrases such as *green environments*.

Additionally, their narrative has evolved to highlight the tangible benefits of nature for human well-being. Rather than promoting nature for its intrinsic value alone, they now emphasize how natural spaces contribute to public health, mental wellness, and overall quality of life. This reframing helps align their goals with broader societal interests and makes their work more attractive to a wider audience, including policymakers.

Planning process De Beuk is confronted with

Plans to build houses in the Dorschkamp are being made for more than 20 years and failed because of the impacts on nature and cultural history. For instance, in 2012 the municipality made a structural vision (structuurvisie) for its territory and projected a new residential area with villas on the Dorschkamp. This attempt failed. The province of Gelderland in vain tried to remove the Dorschkamp from the Guelders Nature Network in the actualisation of the Environmental Regulation 2021.

In June 2020, the municipality of Wageningen and the Province of Gelderland assigned bureau Witteveen & Bosch to make up a vision for the area that respects its natural and cultural assets. The following aims functioned as the starting point:

- Providing clarity for future spatial developments, in terms of strategic and spatial main options, terms of reference and ambitions;
- Strengthening the great ecological and landscape core qualities of the Dorschkamp;
- Building as many (affordable) homes as possible within the carrying capacity of the area. The housing programming consists of at least 15% social rent and 15% mid-market rent;
- Ensuring that the choices made are justified for all those involved: not only for the municipality and province (administrative, official), but also for local residents; the (social) organizations and the other residents of Wageningen;
- Provide inspiration for the further development of the area in the follow-up phase.

The vision was presented in April 2021. In the implementation of the proposed development for the Dorschkamp, there are various roles and responsibilities. The Dorschkamp has a clear land ownership situation. The northern part is owned by Staatsbosbeheer and the southern part is owned by Smink Vastgoed. The municipality of Wageningen has no property within the area and therefore does not pursue an active land policy to steer the development. However, the municipality can act as a facilitator. This means that the municipality will judge any building initiatives against the principles as laid down in this vision.

The following parties were involved in drawing up this area vision:

- Smink Vastgoed: this party has indicated that it will invoke the self-realisation of the plot in their own land use. In any case, the building plots will be realized by the developing party.
- Staatsbosbeheer: this party refrains from self-realization and is willing to make the land available to market. The form in which this takes place depends on the (land) policy of the Forestry Commission and the purchasing conditions.

To provide certainty in the area development, the vision recommended to make up a private based letter of intent with Staatsbosbeheer. Agreements and principles can be included in this possible land transaction. From the perspective of the area process, the

vision states it desirable that the land of Staatsbosbeheer will be transferred to one of the participating parties in this development. This would prevent process delays and additional costs, such as a possible land bidding process and a tendering procedure with external parties that are not yet part of the proposed development in the area.

We may note here that De Beuk is such a participating partner but not mentioned by name in the vision.

The proposed development in the Dorschkamp does not fit within the rules of the current zoning plan. To make the development possible, a new zoning plan must be drawn. The topics and themes mentioned in the area vision can be embedded in the legal and planning frameworks in the zoning plan. Based on this, permissions for initiatives can be considered and permits can be obtained. According to the vision, the challenge is to formulate more flexible rules for the projected developments. At that moment it was not yet possible to create a new zoning plan, because the area vision is an abstract document. To do this, the vision must be further elaborated in an urban development plan. An image quality plan must also be drawn up.

De Beuk acted upon the vision by attempting to acquiring the status of preferred partner. They managed to set up an agreement with the housing cooperation, with the aim to realise more social houses than prescribed in the plan. De Beuk came to an agreement with the municipality that they could use the legal provision of CPO (Collective Private Commissioning) and managed to influence the CPO policy. The province and the municipality however had serious doubts if such a huge endeavour would be doable by De Beuk. De Beuk received a subsidy from the province and the Bernard Culture Fund to commission a feasibility study, which came out with positive conclusions.

Shortly after publishing the vision a disruptive legal verdict was made by the Supreme Court, called the Didam Arrest. It concerns private non-transparent alienation of land by the government. The government is obliged by the Didam Arrest to provide opportunities for an offer if there are several candidates. It must do so based on criteria that are objective, verifiable and reasonable and that are part of a clear procedure. Exceptions are possible if there is only one candidate, but then it must announce the sale publicly. This arrest caused a big shock in the sector. It changed the rules of the game and also changed the position of Staatsbosbeheer and Smink. They decided to avoid any risk of legal conflicts that may arise when commissioning the site to a preferred actor.

As a simultaneous follow up, backed up by this vision, and aroused by the arrest, the owners of the site, Smink Property and Staatsbosbeheer (National Forestry Agency), started their planning process in 2022 to make up the urban development plan. Together with the municipality they organised a public commissioning process for making an urban development plan. From the offers they chose wUrck, an organisation for landscape and urban design. Staatsbosbeheer and wUrck have a history of cooperation in the eco-inclusive neighbourhood Kerckebosch in Zeist. wUrck started working on the Dorschkamp in May 2022. Part of the planning process is the participation, organised by Dutchplanners via a website called parolo.nl. In total four participation meetings were held. They were attended by members of De Beuk. The members of De Beuk vocalised their ideas and preferences, such as tiny houses, nature inclusive buildings etc. They did not share all their knowledge on nature inclusive planning and building, because they felt they were in competition with project developers when the area and its plan are put on the market.

In a news update December 2022, the state of the art is provided. Three models of a plan for a new residential site, based on an inventory of ecological and heritage values, has been made by wUrck, an urban design bureau. Three models, forest chambers country house and country estate, have been discussed in the third participation meeting, at 12-09-2022. Effects on Nature2000 area is not yet clear at that moment. wUrck was investigating these effects. In the fourth and last participation meeting, organised by Dutch Planners, a forecast on the process was shared. The plan should have been ready in June 2023, the preparation phase in December of that year, after which the procedures and building process can start. There is no mention of putting the realisation of the plan on the market.

Staatsbosbeheer and Smink once more organised a final participation meeting, because of substantial changes in the plan. The meeting was organised by wUrck and Dutch Planners. It was held in April 2024 in the building of the municipality and attended by members of De Beuk and by a member of the Wageningen BIOTraCes team. The plan with its changes was not disseminated beforehand. In total, there were 16 attendants.

Below some indications are given about the meeting.

In this meeting the atmosphere was rather tense. The planners seemed a bit cautious.

A critical question from a resident was raised *"why De Beuk is not mentioned at all, and haven't they also participated from the start?"*

The Staatsbosbeheer raises in front of the room and clarifies *"that they have tried to let everyone have their say. No need to mention CPO/De Beuk separately."* According to him, this is a plan in which all kinds of forms of development are possible.

Someone from the audience responds that this plan with forest rooms lends itself extremely well to CPO. The man from Staatsbosbeheer indicates that CPO also has consequences. After all, they have agreements with the municipality about the percentage of social housing. He also mentions the Didam Arrest. He indicates that he has been involved for a year and a half now, and that an incredible amount of time has been spent to make a very nice plan. It is important to him to get it done as meticulously as possible.

This answer brings about the question whether he sees CPO as a risk to the quality of the plan implementation. He hastens to say that this is of course not the case at all. The chairman also gets involved by indicating that it is a very nice plan that will lead to a very beautiful neighbourhood. He explains that because it is such a sensitive place, it was necessary to work out the plan in as much detail as possible, in order to avoid all criticism. To which a response came: *"but then there is also little room for the project developer to put his stamp on it."* That was exactly the intention.

This led to the following question: *"you have paid a lot of attention to participation and the results of this have had a nice effect on the plan. But De Beuk has also participated and does what De Beuk wants to achieve fit within this plan?"* The architect indicates that he has not received a detailed plan from De Beuk and that he therefore does not know how to address the matter.

People from De Beuk (both Jan and Marijke) indicate that from their perspective there was no participation. It was information every time and that is the most basic step on the participation ladder. They point to the municipality's motion calling for a feasibility study. It will be ready in May or June.

Staatsbosbeheer cites the example of the food forest, brought to the table by De Beuk. They would have liked to have put that in the plan, but that ran into a wall with the province. The chairman emphasizes that the quality of the participation was very high. This was endorsed by one of the local residents. The people of Mooi Wageningen who stand up for nature are also happy with the changes in the plan, especially with the reduction in the number of access roads.

A question was asked about the soil contamination and whether it should be removed before the actual operation of this plan. The man from SBB confirms this. According to him, the contamination is not too bad. There is oil somewhere in the soil of the former forestry testing station. For Smink (who bought the hospital) this is less clear. The logical follow up question was: *"so then the costs are in fact paid by the future residents of that area: is that fair?"* This framing of facts was completely wrong, because *the houses are sold for market prices. So, yes, it has to come from the length or the width.*

In response to a question about nitrogen, Staatsbosbeheer explains that there is no longer a nitrogen problem at all. The hospital's historic nitrogen space is also no longer needed for a permit.

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The asylum seekers' centre is also discussed. That is not a problem either, because there are agreements about keeping the centre open and in case of emergency, part of the plan can already be realized while the asylum seekers are still there.

The next step is the zoning plan revision. Once that has been done, the tender will take place.

This short expose of the discussion in the meeting showed on the one hand the major concerns of the owners of the site and their consultants. On the other hand, it shows how De Beuk has been overlooked. There was no willingness on the side of the owners to explore possibilities to comply with the Didam Arrest and still cooperate with De Beuk. Jurisprudence handed over to De Beuk showed how this could be done.

4 Transformative Biodiversity Innovations

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4.1 Analysis of Inclusion/Exclusion Mechanisms

Exclusion mechanisms and practices in relation to eco-community De Beuk

The values of De Beuk (environmental care, reduced car use, tackling loneliness, greater autonomy in terms of energy, food and materials, and close contact between children and nature) are not acknowledged in the mainstream procedures and processes of creating a new neighbourhood. Their values are not capitalised, as they do not fit within the systemic and social standards of this highimpact sector. All members of De Beuk are motivated by a strong desire for a sustainable and holistic community—sustainable in an environmental sense, but also in a social sense (caring for one another when needed), and at times in a spiritual sense.

In the process of establishing this community, however, members of De Beuk are continually confronted with housing standardisation that prioritises individual or narrowly familyoriented interests and shortterm policies. Within mainstream Dutch culture, there is little physical space to cultivate a connection with nature, let alone a spiritual relationship with it, as most of the interviewees confirmed.

For example, one of the interviewees, B2, feels very energetically connected to the Dorschkamp but often holds back in making that explicit. According to B2:

"Other people sometimes find this strange, which can make people feel ashamed when they make contact with a tree. B2 does not care about that so much but can also adapt without difficulty. B2 sees the way indigenous peoples live with nature as an example. In the Netherlands it is difficult to live up to that way, also in terms of spirituality." (B2 interview, April 2024).

Shortterm policy and planning reinforce more materialistic behaviour (construction), running counter to ecofriendly values and practices. De Beuk is confronted with a planning process they are obliged to engage with, which has neither a clear beginning nor end, nor a defined goal, owing to political indecisiveness. During the research period, the political arena supported policymaking that prioritised economic efficiency in building practices over approaches that could also contribute to restoring biodiversity. This is linked to a housing shortage that has driven up property prices and has particularly excluded firsttime buyers from the housing market, as illustrated by a younger member of De Beuk:

"Everyone in our subgroup is between 30 and 40 years old and has a desire to buy/build a house. Renting feels like a black hole where your money disappears" (B5 interview, June 2024).

Because adding positive conditions for biodiversity restoration is politically perceived and framed as more expensive, 'living with nature' becomes associated with elitism, for it is only accessible for the few who can afford it. Ecovillages are proving this frame to be false but are not, or barely institutionally recognized. So far, there is no formal category of 'ecovillage' foreseen in the allotment plan procedure (this however is possible, as proved by Het Land van Aine). The formal moment to make an offer for the land in combination with the plan that is part of the outsource, is postponed many times over many years now, and the members of De Beuk are getting exhausted due the lack of tangible outcome.

"Politicians only govern for 4 years. In four years, it is almost impossible to implement major changes. Dutch society as it is currently structured, steers towards ego-driven behavior. Capitalism is an expression of that" (B6 interview, June 2024).

B6's remark about capitalism does not come out of the blue. De Beuk is forced to compete with regular project developers because of what is called the Didam Arrest (the obligation for a governmental institution to organize open procedures for selling land), whereas there are good and legal solid arguments to organize a one-to-one contract that lays down the

obligations by which De Beuk helps to realize the biodiversity aims in the management plan of the surrounding N2000 area. Another problem is that the finance sector rules out De Beuk because it is very hard to obtain a collective mortgage in the Netherlands. Almost no Dutch bank has any experience with collective mortgages, therefore collective initiatives have to look for alternative finance schemes or go to foreign banks (bank in Germany for example, are much more advanced in this). For the Beuk, the acquisition of land is perceived as a 'make or break moment'. They are entirely relying on the willingness of the current landowners to sell their land to them, possibly at a lower price than a mainstream project developer can offer. Though the local municipality supports the Beuk, they are unable to provide them any real guarantees:

"A shortcoming that the municipality faces are that they manage little land. For projects, you often have to go to private landowners" (Interview B2, April 2024).

Several core members have mentioned they are trapped in an economic power lock-in. More specifically, especially younger people (≤ 40) and elderly (≥ 67) are in a vulnerable position, due they limited access to financial means. Young people without parents that can offer them financial relieve, are confronted with unbearable high mortgages:

"B5 would like to realize a house for a reasonable price. Reasonable in the sense that you don't have to bend over backwards to pay a mortgage. In the current housing market, they would have to do that if they wanted to buy a family home with a garden. Such a mortgage feels like a 'noose around your neck for a pile of bricks.' That is crooked. (B5 interview, June 2024)."

Elderly people on the other hand, are often not eligible for a mortgage at all due to their shorter life expectancy. Without any private financial capital, elderly people are constrained to renting a home that does not always provide them the security they need, as is illustrated by the following conversation between a researcher and an aspiring future resident of the Beuk:

'Before the walk I speak to a woman. I estimate her age to be somewhere in the mid-60s. The woman tells me that she currently lives alone in a social housing unit in Renkum where she is very lonely. She has no contact with her neighbours and even quarrels with a neighbour. Due to the lack of contact she regularly feels unsafe. In the Beuk she is mainly looking for like-minded people. She is concerned about the earth. According to her, companies and people are greedy, and we consume too much. She would like to see a sustainable, holistic society. She reads a lot about holism and knows of various ecovillage initiatives.'
(Note from a future residents walk, September 2023)

Finally, it was mentioned that knowledge on planning procedures and technical aspects of the plan works out exclusionary, because it takes years of study to get to the same level or to surpass the level of big project development bureaus. On several occasions, the Beuk was confronted by what could be considered (a fear of) institutional complexity that excludes people internally as well as externally. Internally some people had trouble following institutional language:

"The past two years have been tough for several reasons. On the one hand because of the loneliness, on the other hand because starting a residential community also requires a lot of knowledge of terms. It took time to learn these terms" (interview B3, April 2024).

Becoming familiar with institutional language can take its toll, especially for people who also have high demanding jobs besides the initiative. This means especially younger people struggle with finding the energy to keep up:

"B5 sometimes find it difficult to continue to actively participate in all the activities around the Beuk. Their jobs require a lot of energy from them and the uncertainties around the Beuk do too. Sometimes it is not clear what exactly is expected of them, what can they say yes or no to? Some people in the subgroup

have already dropped out with a burnout. People have to go beyond their limits. Those who are now active are also already wavering. At a certain point, the uncertainty can break you. Age also sometimes plays a role in the uncertainties. The older members often know a lot. Sometimes it seems as if meetings are held for the sake of meetings. At the same time, you do not want to fall behind, and you try to participate as best you can. At times such as during the workshop (power and strength) you sometimes start to doubt: what do I really know? Insecurities are also addressed at such moments. You do not want to repeat things or be inefficient. During some meetings, that feeling creeps up on you. For example, when we recently had another meeting about what we call ourselves. The outcome is an ecological neighbourhood. Whether it has become more concrete is questionable. Some things drag on, such as how are we going to divide the costs? That is an issue that we all have to deal with, but nobody really wants to burn their fingers on it" (Interview B5, June 2024).

Inclusion mechanisms and practices in relation to eco-community De Beuk

Amidst the various exclusion practices, some inclusion mechanisms have also been identified. One helpful instrument for *De Beuk* is the recently adopted CPO policy [Collective Private Commissioning Policy] of the Municipality of Wageningen. This policy recognises collective initiatives and can even favour them in certain locations. It enabled *De Beuk* to apply for a subsidy to cover their feasibility study. However, the CPO policy does not override the consequences of the *Didam Arrest*. More concretely, in the case of *De Beuk*, the Municipality can express its support for CPOs but cannot enforce CPO on land that it does not own.

Another inclusive mechanism was activated when *De Beuk* reached an agreement with the social housing cooperative. The cooperative has declared its intention to contribute to some of the financial requirements for building public social housing, and in return *De Beuk* has committed to allocate 10% of households for public social housing purposes (meaning that the housing cooperative provides the residents, although they must be approved by *De Beuk*).

An innovative mechanism pioneered by *De Beuk* is the establishment of a landscape cooperative [gebiedscoöperatie], which operates as a separate legal entity from the association. The distinction between the landscape cooperative and the association is that the cooperative has an economic purpose, while the association functions as a social, nonprofit organization. The cooperative can, for example, acquire land and generate profit from it, whereas the association cannot. The intention of the landscape cooperative—also run by core members of *De Beuk*—is to acquire the land needed to build *De Beuk*. Once this has been achieved and *De Beuk* realized, the cooperative also aims to invite neighboring enterprises to join. The plan is to manage the land—or landscape—coherently and within environmental limits.

Finally, *De Beuk* themselves are highly determined to be as inclusive as possible. This is reflected in the way they manage their finances (through an equitable contribution system) and in their envisioned housing design. Houses within *De Beuk* will ideally be able to accommodate the needs of younger people (e.g. space for children) and older people (e.g. ground level access), while safeguarding a healthy environment for local biodiversity. This vision was achieved through cocreation. During a vision gathering session, the two age groups most marginalized by the mainstream housing market were notably represented:

'The initiators split up without any premeditated intention into two age groups sitting opposite each other. The young initiators (all in their early thirties) sit on the floor. Opposite them, the older ones sit on a chair or bench (all around sixty). Although this arrangement was created for practical reasons (more comfort for the older ones), it suddenly becomes clear that an (age) group is missing; among the initiators present, there are no 40-somethings, nor are

there any family households.’ (Observation from a Beuk vision gathering, June 2023)

To safeguard collective and equal interests, *De Beuk* follows a sociocratic governance system that allows every member to voice their opinion. No decision is taken without the agreement of all. If someone does not agree, all arguments are considered until full consensus is reached. A drawback of this system is that reaching a decision can therefore take a considerable amount of time.

Exclusion and Inclusion mechanisms in relation to the province of Overijssel

Like *De Beuk*, the Province of Overijssel operates within a broader system that does not always align with its goals. This system is shaped by prevailing political values which—at the time of research—tended to frame nature more as a barrier than a benefit. For example, excess nitrogen was commonly portrayed as an impediment to housing development. In contrast, the province seeks to reinterpret such limitations not as obstacles, but as boundaries that can guide sustainable development. A key strategy in this effort is to reframe nature’s role, emphasising its benefits rather than its constraints. One way the province promotes inclusivity is by linking nature to public health. As one interviewee explained:

“How can we involve people in nature inclusivity? I’m not talking about building new houses, but about existing ones, where gardens have become paved and lifeless. We’re asking: how can we inspire and motivate residents to enhance biodiversity in their gardens? We also approach it from a health perspective, because not everyone is naturally drawn to plants. So, it’s interesting to connect nature-inclusive building more explicitly with nature-inclusive living.”

The Nature for Each Other programme also includes mechanisms to engage younger generations. For instance, the province has hosted informal “pizza nights” to attract young people and spark conversations about their visions for a nature-inclusive future. In addition, they collaborate with a provincial youth board, which contributes ideas and feedback to shape the programme’s direction.

4.2 Niche Innovators and Key Players

In the context of nature-positive building, the primary niche innovators are the societal partners themselves, most notably, the members of *De Beuk*. Over time, they have cultivated a sustained process of social learning focused on integrating nature into their envisioned living environment.

Originally conceived as a knowledge hub for biobased residential construction, the initiative gradually evolved into a private effort to develop a multifaceted eco-community. This includes an ecovillage, a complex of tiny houses, and other forms of collective, nature-integrated living. Located in Wageningen, *De Beuk* has benefited significantly from its proximity to Wageningen University, tapping into academic expertise and student-led research. In addition, the group has built a robust network of professionals and institutions with deep knowledge of nature-inclusive design and construction.

Through this journey, *De Beuk* has developed a distinct concept they refer to as “human-inclusive nature”, a vision in which nature is not merely preserved or observed, but actively intertwined with daily life, habitat, and livelihood.

At the heart of *De Beuk* is a core group of six members, each representing a specific subgroup within the community. This core team meets biweekly, occasionally joined by other subgroup members to share leadership responsibilities. Each core member brings a unique relationship with nature and faces personal challenges in shaping a lifestyle that aligns with their ecological values.

The following section provides brief profiles of these core members, the subgroups they represent, and their individual motivations for joining De Beuk.

Individual key players of De Beuk

B1

B1 describes herself as a connector. She likes to bring people together to start processes. Finishing is less her thing. Formally, B1 is the secretary of the board of De Beuk. Because of her former jobs (she is now retired) she knows how to navigate a role a secretary, but she does not necessarily like it. She understands the necessity of the role and therefore felt she should fill in the gap (no one else wanted to take up the role). Ever since she started studying when she was younger, sustainable and healthy food has been an area of interest of B1. Since corona, she no longer uses supermarkets. Corona was a period of reflection for her; a moment to stand still and think about life. Consumption behaviour was something she thought about for a longer time. She gets fresh produce locally, mainly from harvest garden initiatives that she is a member of. After her studies in domestic science in Wageningen, B1 lived in Africa for a while in an Anthroposophical community. She initially came there for a project on social participation and improving drinking water supplies. In Africa, the seasons were experienced much more consciously than in the Netherlands. This was partly due to the anthroposophical philosophy of life, which often refers to the transition of seasons. In Africa, B1 first met biodynamic agriculture. Community is an important value that B1 seeks, among others at the Beuk. Community for her, means looking after each other. Community does not mean controlling each other. People with an enormous missionary zeal are often an annoyance to B1. Previously, B1 experienced that in some communities there are expectations. Activities were always undertaken together and if you did not participate in certain things, you were addressed about it. Those experiences were not always positive. Now she seeks community in a way without too many expectations, in which cordiality and compassion are central without being dogmatically imposed. There is a balance in giving and taking and saying no is also possible.

B2

B2 is involved in several sustainability initiatives. She is a member of the Beuk and Platform Duurzaam Wageningen and also involved in the Community Vitaal Voedsel and has set up her own foundation: Gaia Sira [earth nest]. B2 is an active citizen and can work well with the municipality. She has regular contact with municipal council members and aldermen and often goes to council meetings to speak. B2 feels involved in the CPO policy that the municipality makes and is also active in the fields of sustainable food production and air quality. Other people sometimes call B2 business oriented. She feels like she is just good at achieving goals. In Wageningen, partly thanks to B2, there are now 80 people actively measuring air quality. That is the same as the citizen network of Paris that is committed to air quality.

B2 considers people as part of nature. She cherishes a need to experience nature, to be aware of everything that blooms. After high school, B2 started studying nutrition. She had developed an interest in this from home. Her motivation was initially to live as healthy and vitally as possible. During her studies, she learned nothing about the importance of healthy soil, while healthy soil and healthy intestines seem to have a lot in common. Sustainable supply chain cycles and obtaining good soil have now become an important goal for B2 about nutrition (food production). Fortunately, this is also being recognized by more people, organizations and institutions. B2 has a great intrinsic motivation for sustainability. She it is our responsibility to pass on a healthy earth to children. Nature fits in with that. She has also been able to pass on appreciating nature, among other things, to her own children. Her youngest daughter is now a draftsman and designer of green playgrounds for children. What motivates B2 in relation to the Beuk? A bit of idealism and yet also a bit of business orientation. B2 doesn't earn as much money as she used to. Sometimes it's really

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a bit like scraping the pieces together. Fortunately, she doesn't need much. What is important to her is that there are no more things that must be done. She doesn't have the energy for that anymore. B2 worked for a while as an office manager and director at Stichting Agromisa. This foundation mainly supports small farmers with knowledge exchange and financing. After Agromisa, B2 worked at De Kleine Aarde and then at Kraaybeekerhof in Driebergen; an anthroposophical centre for natural food. B2 however, does not identify as anthroposophical. B2's assignment was to bring the activities of Kraaybeekerhof more into the present day. At the same time, she also became a single mother and had a difficult relationship with her ex. B2 ended up with a burn-out. However, sitting still for long was not possible. B2 quit her job at Kraaybeekerhof and set up her own foundation: Gaia Sira. Now, besides the Beuk, she guides family constellations and gives courses on vital agriculture. In the meantime, she is a core group member and leader of the Working Group Financing.

B3

B3 sees himself as a front runner. That means he must convince other people to come and live at the Beuk. B3 experiences this as a big and tiring task, but at the same time he gets energy from telling the story and recruiting people. That is also his talent: to inspire people. At the same time, B3 also wants to be able to understand what is going on to be able to translate matters to the vision group: the subgroup formed by part of the current squatters. He then functions as a kind of filter and translator; for example, when it comes to the plans of the urban planners. Living amongst the squatters has made B3 'conservative/right-wing', according to himself. By that, he means that he has started to live more principled. This is expressed, for example, in his view on smoking: you simply don't do it. Not only because it is bad for nature (filters that remain), but also because it is bad for your body: why would you consciously poison your own body? B3 tries to deal with his body very consciously. He himself also suffers from asthma. Amongst the squatters, people sometimes dealt very loosely with principles, for example regarding smoking, and that can be called somewhat hypocritical. B3 became increasingly annoyed by this hypocrisy the longer he lived amongst the squatters. There was not always honesty. Another example is the Slow Worm. Since chickens have been roaming around on the squatter's premises, there have been fewer slow worms on the Dorschkamp. That is a shame, B3 thinks. Especially because the slow worm is a vulnerable and rare native species and chickens are not. Standing up for the future generation doesn't really appeal to B3. That will be fine. What he is looking for is experience. Sensation encourages action. Nature is sensational. Nature can also move B3. For example, it can remind him of his mortality. B3 lived in the Amazon for a year. There he had several near-death experiences (including Dengue). The Netherlands and Belgium are like 'the shire' to B3. Nature is not dangerous here. Agriculture is the new nature here. Perhaps an expression of our desire for more control. In general, B3 is a fan of wonder. Let nature come to you. It's okay if it's a bit messy. B3 has been chairman of the Beuk for a while now. It is not entirely clear what that role entails. In practical terms, he is present at all AGM and Core Group meetings. There is also an administrative task attached to the role of chairman (including signing things, being the point of contact for the municipality). B3 is also the driving force behind the ecology working group and a project at the Science Shop.

"As chairman, it is my job to ensure that the association goes towards its goal and does not stray too much from its goal. So, to stay on course a bit, give direction. That is the function of a chairman. And he listens to everything that comes in and so on. What makes me so special in all of this, and what I think is also necessary as an ingredient for the Beuk, and what makes me so successful is, I am actually really not at home with all those crazy difficult complex terms. Certainly not to the extent of B4 and B6 for example who know how to express that very well, really the business, boring and so on, and what I realize is: even though I am not at home with that, I feel very compelled to understand it, but I do my best to translate that into my own language and that is a bit more basic than that of B6 and B4 for example. Because I succeed in making that

translation, into a slightly easier language, it is so much easier to communicate with the supporters, and with the rest of the board and with the core group and externals, and I think that is precisely where my strength lies. Keeping everyone up-to-date and informed and letting them sail along in this project, which creates a feeling of 'we are all running this spaceship'." (Voice note, send by B3 on the 20th of June 2024)

B4

B4 was raised with Christian values, but he and his family are not practicing. In addition to living in the green, 'decluttering' is also an important reason for B4 to move into a Tiny House. With everything you have, you start asking yourself: do I really need it? If not, it goes away. B4 experiences having less stuff as a relief. At the Beuk, B4 finds people who share an interest in sustainability. B4 considers himself an entrepreneur and likes to tackle things. What they (Tiny house group - THG) have in common is the desire to live smaller in a green environment. A Tiny House may not be larger than 50 square meters. B4 considers the versatility of the group as a strength. Of all the subgroups of the Beuk, being together is perhaps the least important in the THG. Members want to live sustainably and reasonably off the grid, but also independently. For B4, living in a Tiny House symbolizes less materialism and fewer worries. Less stuff means less stress. Living smaller can simplify your life. B4 is now also developing a food forest in his neighbourhood in Ede. This initiative originated from a neighbourhood network. He himself helps with, among other things, applying for subsidies and realising and organising the initiative. B4 considers nature-inclusive construction as something in which nature is part of the design. As an architect, B4 wants to further develop what that looks like. This also ties in with his efforts in the development of the plan for the Beuk. Nature-inclusive construction must go further than just biobased construction. B4 prefers to be a bit reserved when it comes to decisions. His participation in the Beuk is more of a voyage of discovery. He has no problem with others occasionally determining the course. B4 considers himself an entrepreneur and likes to tackle things. Unconsciously, boundaries may also be pushed in the Beuk. That appeals to B4. B4 is chairman of the Tiny House Group and in that capacity is involved in all administrative tasks. He has been doing this for 5 years now. The core team of the THG consists of about 12 people, 4 of whom are board members. There are now 40 people on the waiting list. B4 sees himself as an initiative developer within the THG. He starts initiatives and connects people/members to the initiative and promotes initiatives externally. Design workshops are also organized and lectures in the library about small living.

B5

B5 are a young couple. B5 know their friends and subgroup 'Between the Trees' [Tussen de Bomen] from juggling and festivals. What connects everyone from Between the Trees is the importance that everyone attaches to sustainability and the desire to live in a community. Many now also live in a student house or housing group. Property-wise there are different wishes within the group. B5 would like to buy their house and piece of land. They have a need that their house is really theirs, including their own piece of land. B5 do not necessarily identify as spiritual, but they do experience a superhuman connection. This connection is also nature; it is our position and role in a greater whole, our soul. The young man first says that he does not feel called upon to convince others. The young woman sees it a little differently. They agree that appreciation for and experience of nature cannot be enforced. People simply prefer to be with other people. Sometimes you are also just in a completely different phase of life. Teenagers, for example, are extremely focused on each other. That is a phase that almost all of us go through at that age. There is also a difference in how people experience and prioritize 'nature' in Between the Trees. For some, living in nature is very important and for others, living in a community is especially important. For B5, both are important, but especially nature. They like the fact that they can cook together, for example, but also that it is not an obligation to cook together. Ideally, nothing

is required, and a lot is possible. For festive occasions, it is very nice that there is a communal space to come together for a feast. B5 are inspired by Buddhism. They once followed a training with Matthijs Schouten [Dutch Nature philosopher] and have followed meditation courses. Buddhism teaches you, among other things, to have respect for all life. You no longer kill something so quickly. You even try to accept the snails that eat everything in your vegetable garden. Meditation mainly influences the relationship with yourself. Meditation helps you to let go of a piece of ego. Buddhism considers everything in essence as pure. This purity is shared with nature and the universe but can be overshadowed by pieces of ego in the course of your life. Meditation helps you to think about what really belongs to you. It brings peace because you can peel off pieces of ego until you are in balance again: in connection with life. B5 are not so involved in all institutional matters. Others simply know much more about that. A visualization and the design of the forest rooms is something they would like to be involved in. For example, when thinking about green play areas for children. The members of Between the Trees are all at the age that they think about children. Raising children in a community appeals to them all. They also all want their children to grow up with each other and in a green environment. It must feel safe and nice to ring the neighbours' doorbell. Formal matters such as setting up an area cooperative, on the other hand, are more remote from them. B5 are intrigued by the concept of 'effective altruism'. Peeling off ego is part of it but is only effective if you don't get destroyed by it yourself. You can't carry the weight of the world on your own.

B6

B6 has lost a good friend during his studies. This event affected him deeply. They once had the ambition to save the world together. However, the problems in the world weighed too heavily on his friend. B6 promised him to continue. He keeps his friend in honour through his idealism. B6 meets his wife during folk dancing in '84. They complement each other. She is more of the 'social side.' He is more concerned with the earth. This is reflected in their housing wishes: she is especially looking forward to living in a community (neighbourhood), he is especially looking forward to sustainable living. A book that influenced B6 is greening the dessert. This book describes a project of a man who brought a seemingly dead place back to life with plants in seven years. B6 tells that all civilizations have once perished due to an environmental disaster. For our civilization, ryegrass is perhaps the disaster.

B6 knows how to tell a story, both to governments and to businesses. He regularly attends events about sustainable living. That's how he met BIOTraCes: on sustainable Tuesday [Dutch Sustainability event]. He also works in his own neighbourhood to teach people who are open to it about sustainability and nature. He thinks it's a shame that a lot of greenery in his neighbourhood has disappeared: people would rather have a shed with a bar in their garden. He also prefers to show things. For example, he once planted a potato with children from the neighbourhood to show that a few months later 12 potatoes suddenly appeared. B6 also used to have his own vegetable garden. When he heard about the substances that Chemours released [neighbouring chemical plant], he gave up his vegetable garden. B6 first met ecovillages through Ad Vlems, initiator of ecovillage Boekel. In 2009, Ad placed an advertisement in which he was looking for people who wanted to think differently. That appealed to B6, and with him 300 others. 300 people is too many to build a community. Ecovillage Boekel was eventually realized for 100 households. According to B6, you can build a community with at most 27 people. A vision is often more powerful if fewer people participate. The more people, the more hollow and less concrete a vision often becomes. With the experience that B6 had gained in the civil service world, came the logical responsibility to explore the civil service part of the realization of Ecodorp Boekel. B6 knows all the government terms and could therefore advise governments on how to deal with eco-village inactives. A good first step is always to write a letter to the alderman about your plans. After that, an alderman is obliged to invite you for a conversation. B6 calls himself someone who does not let himself be led. He does not want to be a leader himself but rather inspire others.

Discussion on innovative characteristics of key members of the Beuk

De Beuk deliberately calls itself an ecological hamlet. That feels like something between a district and a community. The subgroups, and their core group representatives are quite diverse in their wishes (hence no community). A concrete example is the desire for ownership of various participants/subgroups. Some absolutely want to own their piece of land/house, others do not have that desire or have less of it. No consent has yet been reached on how to deal with this. There is, however, consent on the fact that the houses may not be used as speculative objects. The consequence of this is that the price of owner-occupied houses cannot rise. Compared to the dominant building regime that is very much driven by financial revenue, this is a bold and very social decision.

Social and ecological values are at the heart of every key player. Each core member of the Beuk has a strong desire to be surrounded by people that share similar values. Most members have developed these values at a relatively young age. Some are inspired by their experiences abroad, living in communities in Africa and the Amazone. Others were influenced by spiritual philosophies like Anthroposophy and Buddhism. One also mentioned Christian Values. A factor that has reinforced social ecological values for some, were traumatic experiences. One core member lost his best friend and swore to honour him by advocating ecological living. Other members experienced disease and burn out and were able to regain energy by reconnecting with nature. These core members are familiar with social and ecological resilience. They skilfully work together in ways that allow people to activate they individual strengths and tactfully use individual networks. For all members, working towards sustainable goals gives energy and purpose. This is also in contrast to a majority of mainstream project developers.

The Province of Overijssel as niche innovator (and system innovator)

The Province of Overijssel has the ambition to reach people 'outside of their bubble' with its policy programme. They are seeking to spread their message on the importance of natureinclusive building and biodiversity to a broader audience. As they described it, until now they have mainly reached 'dark green' people, those already interested in or concerned with nature and biodiversity. Now, they want to reach 'lighter green citizens', whom they hope to inspire to become more involved in nature and biodiversity activities.

Their approach is to create practical toolboxes to support citizens and organisations in making natureinclusive buildings accessible and manageable. To achieve this, they are focusing on natureinclusive building projects in social housing, which are generally located in lower income areas. These areas also tend to be less green, so investing in green surroundings will improve climate adaptation. Greener areas will also support public health. Health has therefore been adopted as an additional objective in their policy programme, as this is more likely to gain approval and support in the current political climate, whereas nature as a goal in itself is not widely supported.

They are also making efforts to involve young people, to include their perspectives on nature and their vision for the future. The province pursues several strategies to ensure that the ideas and values of natureinclusive building reach others:

- They make things practical, local and achievable. For example, they ensure toolboxes are developed for communities, citizens, municipalities and other actors to use in implementing natureinclusive buildings.
- They actively frame their language. At present, 'nature' is not a word they use directly; instead, they find alternative terms and integrate nature in other ways, for example, by using the health angle.
- They integrate nature into other domains.
- They seek to challenge mainstream ideas.

- They actively connect the provincial level with the national level on nature-inclusive building, taking a leading role in involving and influencing national policy.

The general impression is that they are successfully engaging with 'lowhanging fruit' and involving them actively, but the challenge now lies in reaching the 'medium' and 'highhanging fruit' and ensuring those actors are also actively engaged.

Key players within the Province of Overijssel

Program Strategist

The civil servants involved in developing and implementing the policy program Nature for Each Other are working in a notably innovative and collaborative manner. They actively engage a wide range of organizations during the design phase, fostering a participatory approach to policy-making.

At the center of this initiative is the program strategist; a dynamic, extroverted, and highly energizing person. Their network building style is based on connection and collaboration. They are excellent in linking individuals, organizations, and projects in meaningful ways. Their personal relationship with nature is holistic and spiritual; they view nature not as something separate from humanity, but as an integral part of our existence. This perspective often leads them to seek immersive experiences in natural environments, reinforcing their belief in nature's intrinsic value and interconnectedness.

Policy Makers

The policy makers interviewed as part of this research tend to approach nature from a more analytical and rational standpoint. Their understanding of nature is largely shaped by the concept of ecosystem services, which are the tangible benefits that natural systems provide to society, such as clean air, water, and climate regulation, beneficial to human health.

Their motivation for engaging in nature-inclusive building practices stems from a sense of stewardship. They see themselves as responsible caretakers, working to preserve and protect these services for current and future generations. This pragmatic view influences their policy decisions and underpins their commitment to sustainable development.

(Landscape) Architects:

Several architects and landscape architects are actively contributing to nature-inclusive building solutions. In collaboration with Nature for Each Other, they have developed innovative approaches to integrate nature into the built environment, helping to make such practices more mainstream.

While biodiversity remains a key consideration in their work, they also place a high value on creativity and design freedom.

Exploring the transformative power of the Beuk and the Province of Overijssel

De Beuk and the Province of Overijssel both operate in power arenas where they are regarded as niche innovations and minorities in their views and practices. Both De Beuk and the Province of Overijssel aspire to amplify their views, practices and structures, and to contribute to building a new regime in which building and living with nature is considered normal. To help explore how De Beuk and the province might achieve this, the research team offered to organise a workshop, designed on the basis of the academic review on power (Deliverable 1.7).

During these two workshops, key players from De Beuk and the Province of Overijssel were presented with academic interpretations of power derived from multiple publications (Avelino & Wittmayer, 2016; Avelino, 2021; de Geus et al., 2023). This enabled participants to recognise their position within a power field alongside other actors. Placing

themselves in this field helped them to negotiate potential strategies to amplify their values, structures and practices.

The outcomes of these workshops can inform how De Beuk and the Province position themselves outside, in opposition to certain societal domains, and interact with actors representing or working within those domains.

Power workshop with De Beuk

On 19 April 2024, researchers from WR organised a workshop to explicitly discuss the power field around De Beuk. De Beuk identified actors and power relations within and around them. When asked about their transformative potential, the following response was given: *"Nobody knows the rules of the game that belong to different fields, nobody knows which goal to shoot at. We are sitting on a chessboard."* (Core member of De Beuk during the power workshop, April 2024).

At that time, De Beuk was practising prefigurative power (the power to innovate, bringing new ideas and practices into the mainstream) through joining GENNL, a global ecovillage network of private entrepreneurial cooperatives that seek to realise multiple government ambitions through their network. These ambitions include social security and care, energy efficiency and sustainability, and nature restoration goals. De Beuk also aims to implement an antispeculative financing system to secure longterm affordability.

De Beuk practises countervailing power (the power to challenge mainstream practice) by adopting a lower parking standard than that prescribed by building policy. They also joined a fund designed and owned by previously established ecocommunities to create opportunities for other ecocommunity initiatives. *De Beuk* identified themselves as less active in practising reinforcing power (the power to embed new ideas and practices). They acknowledge that living in an ecocommunity "is not for everyone" and therefore do not wish to enforce it on anyone. However, they do share the view that governments should make it easier for ecocommunities to establish themselves.

An important actor contributing to De Beuk's transformative potential is Cooplink, which can also be identified as a significant niche innovator. Cooplink is a support organisation for housing cooperatives:

- It presents initiatives to one another for inspiration.
- It organises knowledge meetings, open to members and nonmembers alike.
- It offers a space where experiences can be exchanged.
- It consolidates knowledge in a shared knowledge base.
- It represents the interests of housing cooperatives with politicians, financiers and other parties.
- It monitors trends and developments.

In the WR case, Cooplink plays an important role in advising on how to finance the ecocommunity initiative. This is transformative, as it is generally impossible to obtain a mortgage for an initiative that refrains from dividing the land into private lots. Working literally on common ground is what the ecocommunity strives for. Cooplink also advises on how to create a contract for the flourishing of nature in the wider area of the residential site. De Beuk will organise a workshop on "living as nature" during Cooplink Day on the 3rd of October 2025. In this way, De Beuk interacts with and potentially influences other cooperative living initiatives to organise themselves in closer integration with nature.

Power workshop with the Province of Overijssel

On 28 May 2024, researchers from WR organised a workshop to explicitly discuss the power field around the natureinclusive building domain with representatives of *Nature for Each*

Other. The representatives identified actors and power relations within and around them. There are many different forms of power at play; below are some examples.

There is a contradiction within the group regarding how to overcome certain powers in play, and whether this should be done by transforming the system itself or by operating within the system while creating their own rules. For example, one participant noted that including natureinclusive measures in the national building code could serve as a regulatory lever during project outsourcing, since the party issuing the tender holds the power. Others emphasised that while regulations help, internal motivation is equally important, as they believe intrinsic drive is needed to truly embed natureinclusive principles.

When discussing the power that exists with others, participants stressed that this is a key form of power within *Nature for Each Other*. Power in this context is less about rules and more about collaboration. It is about collective action. They spoke of valuable “hotspots” where stakeholders with both power and motivation come together.

Participants also reported feeling powerless in the building domain. They expressed: *“There’s a lack of professionals who can influence procurement processes. Buyers and tender issuers often prioritise development speed over sustainability.”* They also mentioned feeling powerless because change takes so much time, and traditional thinking in the building sector still dominates, which runs counter to natureinclusive building approaches.

To overcome this sense of powerlessness, transformative power was discussed at the end of the workshop. Two key elements emerged:

- **Storytelling** in many different forms by a wide range of actors is crucial. Professionals, ecologists, landscape architects and the province should share their positive examples, and spaces for dialogue must be sustained.
- **Governmental role** should be strengthened, either by setting conditions for new housing developments or by introducing taxes that reflect societal impact.

4.3 Scalable Bottom-Up Innovations for Transformative Change

De Beuk

De Beuk is an innovation both within and external to the building sector itself. To explain how De Beuk works in an innovative way, we first need to understand the governance context:

The Building Decree 2012 (and its subsequent amendments) is the regulation that sets the technical requirements for the safety, health, usability, energy efficiency and environmental aspects of building. The Building Decree therefore regulates the technical aspects of construction but does not contain any specific or detailed rules on the protection of nature, such as nature reserves or biodiversity on construction sites. However, the influence of nature is addressed indirectly, in particular through requirements relating to environmental aspects and sustainability. Although the Building Decree itself is not directly aimed at nature conservation, there are some relevant rules and references concerning the surrounding area and the environment, including nature. These rules often have to be combined with other laws and regulations, such as the Nature Conservation Act and the Environmental Impact Assessment (EIA). Normally, when effects on protected species and habitats have been assessed, a mechanism of compensation is triggered. Compensation is sought through additional financing for the management of nature reserves, enlargement of reserves, or the conversion of agricultural land into natural habitats.

This practice contrasts with the way De Beuk develops its plans for an ecovillage/eco community. They strive to realise the best possible solutions for bio based building materials, energy efficiency, minimising non natural substrates and so forth. This places them ahead of regulatory frameworks. In their efforts, they challenge the usual assumption that sustainable building in close harmony with nature is more expensive than using mainstream materials and procedures.

The greatest drawback here is the enormous amount of time they must dedicate to acquiring and developing knowledge, in order to build their praxis and convince actors with regulatory power in their environment that their ideas are feasible. Together with many other initiatives, they hold the promise of changing the mainstream culture in project development in the sense that:

- Building with and in harmony with nature is not more costly than building according to the regulations of the Building Decree.
- Building with and in harmony with nature creates an environment in which people can innovate their relationship with nature and adjust their lifestyle accordingly.
- People are enabled to build their dream living environment instead of having to adapt their wishes to what an architect has designed for a category or target group.

Despite this promise, they remain too insignificant to change the mainstream of the building sector, because the return on investment is considered much lower. The significant effects on the wellbeing of new residents, and a testing ground for innovative nature positive lifestyles, is not recognised in the sector, nor in political discourse. Most difficult is that nature positivity collides with the prevailing view in public administration and nature management institutes that creating new areas for living will by definition harm nature. This places De Beuk partly outside the system. However, working outside the system also contributes to De Beuk's transformative potential, because they create space for others who want to live alternatively, whether nature positive or otherwise. This space not only entails the freedom to think and bring alternative ideas into practice, but also allows others to build on the knowledge and experience they have gathered regarding regulation and the establishment of eco communities, thereby creating space for other values in governance systems.

De Beuk has also articulated how they envision increasing their transformative power in the future. They want to remain an important prefigurative force by serving as an area for experimentation—particularly in the field of sustainability and nature inclusive building (e.g. offering a testing ground for innovative energy solutions and water retention, compostable toilets, collaboration with sustainable start ups, and designing 'living houses' that are modular and can 'breathe'). They also consider starting a children's care facility focused on building early connections with nature. To increase their countervailing power, De Beuk is considering making a film about their journey towards realising their dream. In general, they see themselves as an example that ambitions can become reality. They plan to organise excursions and to become a hotspot for students and researchers on innovative, sustainable and circular lifestyles. They also want to contribute to evidence building, for example in relation to close to nature food forest cultivation. De Beuk also intends to offer space for mindfulness and spiritual connections.

All this also feeds into De Beuk's reinforcing ambitions. By providing evidence and showing that it can be done, they hope to inspire local government (e.g. province and municipality) in their conceptualisation of nature inclusive living. More concretely, De Beuk wants to contribute to food forest cultivation standards and circular building techniques. They also aim to form an energy cooperative and are currently organising themselves as a landscape cooperative (landschapscoöperatie). In the longer term, De Beuk also intends to provide (micro) funding to other eco community initiatives.

The province of Overijssel

The province is innovative in the way it creates policy programmes for biodiversity. Their aim is to establish a broad network of people who both have a say in the programme and help to implement it. They have set up a community in which bottomup innovations are included. Within this community, small amounts of funding are allocated to support these innovations. The province strives to bring nature closer to people and people closer to nature by providing easily applicable tools. This includes, for example, a stepbystep programme for municipalities to make the edges of their territory greener ('Recipe for Edges'), or support for regreening social housing. The policy programme genuinely

considers how to achieve change, and a number of key players involved in these biodiversity innovations are highlighted below:

Straatboer: An organisation that regreens the gardens of social housing and supports residents in maintaining them. They organise activities to regreen entire streets or neighbourhoods. In this way, this innovator fulfils both an ecological and a social function. They are supported by the policy programme through subsidies and the network of the Province of Overijssel.

Oversticht: A foundation involved in greening (monumental) houses and neighbourhoods, advising on natureinclusive building and the policies surrounding it. They also aim to inspire others in the dominant building sector to improve their sustainability practices. They are part of the Community of Practice on natureinclusive building established by the province. We interviewed them and invited them to our workshop on power.

Architect: An architect is involved who is a pioneer in natureinclusive building. He has strong ideas about what needs to change to raise the standard for natureinclusive building. He expresses these views in several meetings and is regularly invited to do so.

Nature for Each Other: The civil servants designing and implementing the policy programme Nature for Each Other work in an innovative way. They involve many organisations in the design of their programme. The lead person is highly connecting, extrovert and energising.

Placing transformative biodiversity innovation next to the high impact sector as a system

In the figure below the high impact sector is illustrated and described as a system of practices, structures, and worldviews that is generating innovations or being confronted with challenging novelties. The left column represents the status quo: the dominant ways in which the building sector works, is organised and thinks. The middle column represents innovations that occur within the system but are often incremental and not effective enough to bend the curve of biodiversity loss. De Beuk and the Province both (also) partake in these innovations. However, in addition, they experiment, or (intent to) offer space for experimentation that also fosters practices, structures and worldviews that align with the right column that represents a state of nature positive transformation.



Figure 28 - Overview how the transformative biodiversity innovation relates to the high impact sector as a system

4.4 Initial Mapping of Interventions

The case study is aimed at engaging the local community and niche innovators. It is mainly carried out by *De Beuk* and the province themselves, with researchers only playing a modest and consultative role to ensure that we do not interfere in their strategic activities. Our supportive role has been formalised in a cooperation agreement.

Interventions by De Beuk

All decisions concerning *De Beuk* are taken through sociocratic governance, which requires enormous patience and perseverance. This way of decision making perfectly fits the process of social learning about how to live with nature. A further step in this evolution is the creation of an area management agreement, in which their efforts to help nature flourish around their neighbourhood are formalised in a contract. This is an interesting empowerment strategy because:

- Their future neighbour is the Forest Management Agency, responsible for managing the surrounding Natura 2000 area.
- This may provide a legally valid reason for the agency to set aside the *Didam Arrest* and initiate a one-to-one procurement process.

This evolution can serve as a reliable basis for the creation of new and unprecedented biodiversity innovations that could grow into inspiring examples influencing the mainstream construction sector. However, the municipality, through policy agreements, imposes several regulations on the character of the population that is to live in the new residential area. *De Beuk* is not comfortable with this: they certainly do not welcome the idea of neighbours keeping automobiles next to their houses. They would prefer only nature lovers to join their community. One way they aim to achieve this is by establishing a landscape cooperative. The landscape cooperative will function as the formal property management entity of *De Beuk*. This means the cooperative can also impose rules (or rather agreements) on how residents must manage their environment.

A major barrier for *De Beuk* (on paper) is nitrogen restrictions. In 2024, the Province of Gelderland (distinct from the Province of Overijssel) decided that all development plans

within 500 meters of Natura 2000 areas would be suspended until further instructions from the national government. In June 2025, the Dutch Cabinet (Schoof I) collapsed. This postponed all prospects for De Beuk and caused major demotivation across all subgroups. *De Beuk* has written a detailed plan outlining how they intend to achieve emissionneutral building and reduce current environmental pressures through sustainable techniques and lifestyle adjustments. They aim to apply for pilot status that would allow them to bypass the decision of the Province of Gelderland. At present, they have engaged a group of Master students at Wageningen University to assess the feasibility of their plans.

Interventions by the Province of Overijssel

The Province of Overijssel actively contributes to the accessibility of nature by focusing on natureinclusive building projects in social housing, which are generally located in lowerincome areas. These areas also tend to be less green, so investing in green surroundings will improve their climate adaptation. Greener areas will also support public health. Health has been adopted as an additional objective in their policy programme, as this is more likely to be approved and supported in the current political climate, whereas nature as a goal in itself is not widely supported.

They are also making efforts to involve young people, in order to include their perspectives on nature and their vision for the future.

The province pursues several strategies to ensure that the ideas and values of natureinclusive building reach others:

- They make things practical, local and achievable. For example, they ensure toolboxes are developed for communities, citizens, municipalities and other actors to use in implementing natureinclusive building.
- They actively frame their language. At present, 'nature' is not a word they use directly; instead, they find alternative terms and integrate nature in other ways. For example, they use the health angle to integrate nature.
- They integrate nature into other domains.
- They seek to challenge mainstream ideas.
- They actively connect the provincial level with the national level on natureinclusive building, taking a leading role in involving and influencing national policy.

The general impression is that they are successfully engaging with the 'lowhanging fruit' and involving them actively, but the challenge now lies in reaching the 'medium' and 'highhanging fruit' and ensuring those actors are also actively engaged.

Interventions by the research team

Although the interventions made by research time, should be seen from the perspective of going through a process together, and relate to several forms of actions, such as connecting to other actors via WR, information and knowledge input. We established for example new contacts for De Beuk, such as platforms on housing innovations (e.g. Anders Wonen Maand), policy innovators in the Ministry of the Interior, and technical innovators in building techniques. Some of these new contacts are the result of student research commissioned by De Beuk. The WR research team also organised modest interventions, which are meetings with various objectives and various character fitting the situation of De Beuk and the province. Below a few of those meetings will be illustrated.

One intervention was organised to discuss the issue of climate change through the eyes of ethnic wisdom holders. On Thursday 25 January 2024, the conversation session "*Ecological Crises, Indigenous Knowledge and Your Personal Story*" took place within the scope of the [BIOTraCes](#) project. Together we watched a [recorded conversation](#) between Bayo Akomolafe (author, speaker and teacher), Eriel Tchekwie Deranger (Indigenous Climate

Action, Global Indigenous Youth Caucus) and Angaangaq Angakkorsuaq (elder, traditional healer, spiritual teacher and shaman from Greenland). In the conversation, the speakers shared the impact of climate change from their perspective and what we can learn from traditional wisdom. After showing this recording, we shared our impressions and ideas in smaller groups. Members of De Beuk were able to establish contact with innovative and academic knowledge brokers on human–nature relationships.

Another intervention was a strategic workshop in January 2025. We brought together nature protection and nature management organisations, organisations from the building sector, innovation organisations, the ministry, and an organisation for ecovillages, to reflect on the mismatch between how a growing number of citizens wish to live with or in nature and what the building sector as a system delivers. This mismatch was introduced through a survey of 5,000 inhabitants who expressed a desire to live alternatively. The results of this survey, together with other research on alternative ways of living, were presented by one of its directors. A philosopher specialising in nature–human relationships stretched the comfort zone of the participants by reviewing alternative relationships with nature. A director of a network of ecovillages presented both the advantages and drawbacks of ecovillages, alongside the challenges. We also addressed the tension between nature protection and nature positivity. These elements were used to discuss barriers and opportunities, and to assess how the system could perform better and become more inclusive. The outcome was compiled into a fact sheet and policy brief, which was disseminated by the participants.

A workshop was initiated by a member of De Beuk on '*Living as Nature*' at the Cooplindag (3 October 2025). This is an annual event organised by Cooplind, aimed at anyone involved in, or wishing to become involved in, cooperative living initiatives in the Netherlands. The workshop was cohosted by a member of *De Beuk*, a member of ecovillage Boekel, and a researcher from BIOTraCes. During the workshop, the researcher presented the results from our socialecological systems analysis (see Chapter 5). The two other cohosts presented practical examples of naturepositive systems from their (envisioned) ecovillages. The majority of the workshop was devoted to inviting participants to adopt a morethanhuman perspective and to discuss how to coexist with humans. A set of cards, developed by Jay Marisca Gietzelt (2024) and adapted by Zoe van Eldik (2025), was used to introduce and guide participants into a more-than-human perspective.

This discussion led to nine concrete recommendations, which will be taken up by GENNL, the Dutch national ecovillage network:

1. Recognising the rights of nature
2. Living by the narrative of 'humaninclusive nature'
3. Limiting artificial lights and sounds
4. Including the voices of nature in decisions (e.g. nature as a board member)
5. Monitoring ecological wellbeing via 'icon species' (species identified by local nature networks as fundamental to local landscapes)
6. Learning from examples in other parts of the world. The Netherlands could be inspired by the concept of urban national parks (e.g. London). Within this concept, ecovillages could serve as excellent urban–nature connectors.
7. Promoting nature in education: teaching children that we are part of nature
8. Ecovillage residents taking care of nature, so this no longer has to be the sole responsibility of nature management organisations or the state
9. Building with nature also includes infrastructure

4.5 Discussion

The transformative nature of the Wageningen case remains open to debate. While its potential has been thoroughly analysed, the tangible impact achieved by our societal partners is difficult to measure. This, however, is not due to any lack of effort or commitment on their part.

The key innovators within De Beuk distinguish themselves from the mainstream in several ways. Their values and lifestyles challenge conventional norms, particularly those upheld by the traditional housing market. Young people and the elderly, in particular, often find themselves excluded from this system, forced into living arrangements that disconnect them from both nature and community. De Beuk's vision actively counters these dominant mechanisms. Yet complete detachment from the prevailing system is not feasible. To effect change, members of De Beuk recognise the need to understand and engage with the mainstream. Remaining entirely outside the system would undermine their ability to negotiate and influence outcomes.

As a result, De Beuk members invest significant personal time in learning formal regulations, mastering technical knowledge, and building relationships with local authorities and landscape stakeholders. Despite these efforts, their ability to secure land for development remains uncertain.

In contrast, the Province of Overijssel operates from within the system, seeking to drive change through institutional channels. Civil servants must navigate the shifting landscape of provincial councils and national directives, both of which reflect the broader political climate. Their "transformative arena" is subject to change every four years, or sooner, in the event of a cabinet collapse. While working within the system can be restrictive, the civil servants involved in this case have demonstrated remarkable creativity and resilience in pursuing biodiversity goals. Their work requires courage, endurance, and a strong belief in the value of nature-inclusive development, even when the system temporarily resists change.

The limitations to transformative impact in this case appear to stem more from challenges of scalability than from a lack of innovation. Scalability could be enhanced if the Environment Act were amended to include a formal designation for eco-villages. Additionally, integrating knowledge-sharing and alternative financing mechanisms into the CPO (Collective Private Commissioning) policy, or even beyond it, it could support broader adoption.

A truly scalable solution would involve adapting residential permitting processes to accommodate specific lifestyle choices, such as electric-only vehicles, prohibition of fireplaces, and pesticide-free gardening. If residents were willing to comply with such conditions, they could be permitted to live closer to protected natural areas. These fundamental shifts can be initiated by grassroots efforts like De Beuk and supported by local governments such as the Province of Overijssel, but ultimately they require top-down enforcement to become systemic.

The situation of De Beuk shows that the sector is not prepared to deal with innovations emerging from outside the public-private partnership. The De Beuk innovation is directly based on fundamental values and can be seen as ideological, moral, and even epistemic in its relationship to nature. As an innovation, it seeks recognition and space to become reality. Neither of these is currently happening. The polysystem of planning, designing, regulating and constructing new houses has become self-referential and resists attempts to reach the canon of good practices.

5 Socio-Ecological analysis

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5.1 SES dynamics, interactions, co-dependencies and relations

The socialecological system in the Netherlands is built on rules and regulations designed to protect nature from further deterioration. It resembles the ecological-economic SES conceptualisation described in D1.6. Nature reserves are managed through plans that set biodiversity goals. If management results in biodiversity decline, stronger legal measures must be taken.

Over time, the social and ecological dimensions have become almost separated, as ecological issues have increasingly turned into technical and legal matters. Local pride in national landscapes with high natural value is relatively low. Policies have therefore been introduced to strengthen this pride, such as national park programmes aimed at fostering local connections and building public support.

Quantitative opinion polls show that natural values are widely regarded as highly important for society, though this recognition tends to remain at an abstract level.³⁵ When nature becomes more concrete and local, it is often perceived as a 'party pooper'. The strong technical focus, combined with policies that place responsibility for nature largely in the hands of management organisations, has gradually distanced nature from people's everyday lives.³⁶

Based on European regulations, any initiative with a potential impact on nature has to perform an analysis to assess expected effects on:

- Protected habitats
- Protected species
- Nature 2000 reserves

Legal frameworks oblige developers not only to account for the effects of a single activity, but also for the cumulative effects of human interference with nature in and around the projected site. In cases where there may be an impact on Natura 2000 reserves, an appropriate assessment [*passende beoordeling* in Dutch] is mandatory. Extremely strict norms apply to nitrogen emissions, as they contribute to already excessive levels of deposition in nature reserves. Any plan may reduce or increase nitrogen emissions or alter the chemical compounds in which nitrogen is emitted and transported. These changes must be calculated using the so-called Aerius model.

Many aspects of the assessment rely on expert judgement. When emissions exceed legally defined thresholds, the assessment is reviewed by the Netherlands Commission for Environmental Assessment. If an assessment shows effects on nature, these must be mitigated or compensated in order to obtain a permit for the activity.

The socialecological system is based on maintaining or restoring the quality of nature, measured by the presence of important indicator or rare species. It carries a compelling historical dimension: nature management is dedicated to restoring the nature that once existed, aiming to meet concepts of how nature was perceived in former times. Even when conservationists speak of "nature development," outcomes are referenced against primeval nature. Marc Argeloo, who coined the term "nature amnesia," describes this as nostalgic nature recovery (2025). The system makes a sharp distinction between nature and humans. Overall, humans are seen as a threat to nature, while simultaneously acting as stewards of its wellbeing. The Birds and Habitats Directives stipulate that nature must not deteriorate compared to its condition at the time the directives were adopted in 1992.

Nature is considered easier to preserve in the countryside than in cities. Yet both in agrarian landscapes and urban areas, nature is seen as colonising specific habitats through opportunist species. It is almost exclusively within nature reserves that conservationists speak of ecosystems, places where species cooperate, compete and coevolve in processes of succession.

In project development, the inclusion of nature has become part of the publicprivate discourse on sustainability. This involves reserving spaces for green structures, creating roosting places for bats, and nesting spots for swifts and other birds. It also functions as compensation, since the modernisation of old houses has led to a dramatic decline in species living in and on buildings. How to deal with nature is addressed in a covenant called *FutureProof Building*. In this publicprivate covenant, nature is treated as a principle: naturebased solutions should prevail over technical ones, ensuring worthy habitats for species living in buildings, trees, thickets, flowery grasslands, or water and banks. Projects may choose from three levels of ambition: bronze, silver or gold.

The Province of Overijssel is working to change the mainstream of project development by implementing good practices in nature inclusion. This involves giving nature a structural place in the design of new neighbourhoods and ensuring that young people have regular contact with nature. Their practice is becoming embedded in mainstream project development, and this approach is proving effective. They use formal arguments and causation frameworks, but a holistic ideology underpins their work.

In the case of De Beuk, a first ecological quick scan assessment has been carried out. However, it has become outdated due to recent policy changes on nitrogen emissions. The assessment focused on the actual and potential presence of protected species, the suitability of certain habitats for protected species, the ecological functionality of the area (feeding, breeding, migration, overwintering), and initial judgements of the impact of building a neighbourhood on protected species and on Natura 2000 areas. It did not assess potential effects on the water system or soil quality. Nor did it address the question of the reference basis for nitrogen, which represents a legal difficulty.

SES impact on different actor groups

Below, an impression is given of the actors in and around De Beuk, that are impacted by the social-ecological systems at work in relevant regulative frameworks. This picture was made in a co-learning workshop. A similar workshop was organised in Overijssel, with the province The actors of both workshops are put in table 16 below, wherein also the impact of the SES is indicated.

Table 16 - Actors of the province of Overijssel

Actor	How impacted by the formal SES
Politicians on municipal level	They must comply with the formal system that is used by the province but are open to add other arguments and include novel values that are normally out of the scope of the sector.
Politicians on provincial level	Same as municipal level but facing the responsibility of maintaining the quality of nature, measured in the way the SES prescribes.
Public officers on provincial level	Same as municipal level
Social housing cooperative	For new residential projects, they must comply with the regulations to acquire any permit. The effect of the SES is that those legal constraints need juridical support, in the end raising the price of houses. This makes building social housing less attractive and economically viable. However, by participating in the community of nature inclusive building, hosted by the province of Overijssel, some resources are provided to experiment and do research how to make their houses more nature inclusive.

Residents of province of Overijssel	Residents are impacted by provincial policies. Residents vote for a provincial board, as well as a water board, that create the provincial policies.
Local NGOs, such as Stichting Straatboeren	By being a partner of Nature for Each other, they are legitimized and are provided resources to do their work.
Local animals and vegetation	They have no voice in the SES, and decisions taken based on a SES analysis. Nature for each Other aims to have a positive effect on local animals and vegetation.
Project developers	Projects have become increasingly expensive with significant effects on the price of houses they build. They are complaining about the costs and about the velocity of planning and building new residential areas. For most project developers, Nature is perceived as expensive 'add-on' or blockage.
Architects and landscape architects	Architects and landscape architects that are a partner of Nature for Each other, all have ambitions to make nature-inclusive building more mainstream and having a positive effect on the SES. They struggle with a competitive market, where nature is often seen as add-on costs and efforts.
Builders and contractors	Builders and contractors have expressed the need of juridical and policy guidelines or laws to set a baseline for nature inclusive building.

Decision-making processes and power relations between relevant actor groups

Decision-making is complex. The effects of any initiative on nature must be assessed before a political decision can be taken. Monitoring the quality of nature in reserves is carried out by, or on behalf of, the State Forestry Agency or private institutes such as Natuurmonumenten. Most of this monitoring is undertaken by volunteers. If monitoring shows that critical target species are declining, the responsible institute must assess and address the problem, and a recovery plan must be drawn up.

Recently, an Ecological Authority has been established to evaluate the quality of information used in recovery or management of nature. Their work is legally mandated and aims to prevent further deterioration of Natura 2000 areas. At the system level, the minister is responsible for the quality of nature. At the field level, management organisations hold responsibility. In between, at the policy level, the provinces play a strong role and are held accountable for nature quality.

In the case of nitrogen, scientific actors have a decisive role: they assess the critical deposition loads above which vulnerable species will disappear. A model is required to assess the relationship between nitrogen emissions and deposition in Natura 2000 reserves.

Power is unevenly distributed. Much of it, political support based on public sentiment, lies with farmers, who are the largest emitters of nitrogen but are unable to change their farming practices due to financial constraints. The construction and housing sector is almost as powerful as the farmers. They have the means to buy out farms, thereby creating space for nitrogen emissions. The additional emissions from a project are compensated by the calculated nitrogen reduction of the farm taken out of production. This process is called nitrogen equalising (in Dutch *salderen*), and it can be applied within a project or between projects. If large amounts of nitrogen space are required, a nitrogen bank is created.

Probably the greatest power position lies with the province. They may or may not grant a permit for a project. This permit was formerly regulated under the Nature Law and is now governed by the new Environmental Law. Municipalities have little power within the SES. Similarly, the State Forestry Agency and Natuurmonumenten do not hold much power, though they can mobilise public opinion and thereby strengthen their position.

NGOs have a strong power position in that they can bring cases to court. Given the complexity of planning, there is almost always a flaw in the procedure. Through numerous lawsuits, NGOs have succeeded in changing nitrogen policies. Provinces and ministries remain cautious in dealing with them.

Citizens who take initiatives regarding nature generally hold a weak power position. Only when large groups are involved and the media amplify their cause can they gain some influence. A group like De Beuk has almost no power at all. They must operate within the framework of the SES and fulfil their legal obligations.

Types of knowledge informing decision-making and biodiversity framing

The governance system relies on academic technical knowledge. For nitrogen, the outputs of computer models are given more weight than actual field measurements, since the latter may vary greatly over time (e.g. depending on wind speed, wind direction and rainfall). The process of technocratisation and juridification, as discussed above, means the system is not open to other sources of knowledge beyond the expertise that can stand up in court. Every decision in nature management is accompanied by extensive reports prepared by ecological consultancies. Human activities are, by default, considered negative influences, and there are rules of thumb for acceptable distances or dose–effect relations, based on the large number of impact assessments that have demonstrated significant effects. Other sources of knowledge, arising from alternative worldviews, are visible only in the media and play no role in decisionmaking.

When it comes to identifying sites for new neighbourhoods, the SES operates differently depending on scale. At national level, the main issue is spatial conflicts. Potential effects on nature are discussed in very abstract terms, because the ultimate impacts depend heavily on how a residential area will be designed and constructed. This often leads to decisions about localities that prove far more problematic than initially anticipated. In Environmental Impact Assessments, most effects rely on expert judgement. At local level, the SES is much more finetuned, and in most cases effects can only be minimally mitigated, resulting in substantial compensation efforts. In the mainstream, compensation is achieved by buying out farms, which also creates legal space for nitrogen emissions.

If the system were to embrace other sources of knowledge related to nature positivity, this would require a fundamental rethinking of the relationship between humans and nature.

Ecological functioning of the SES and direct drivers of biodiversity loss

The direct drivers of biodiversity loss are manifold, such as:

- Loss of habitats
- Soil disturbance
- Disconnecting nature reserves
- Increased traffic
- Quick water runoff
- Changing groundwater systems
- Nitrogen emissions due to the use of fuel

The SES functions as an agreement between public-private partners in the construction and building sector and nature management organizations. The principles are that:

1. Development activities have effects on nature.
2. These effects must be compensated.
3. Compensation ultimately leads to either an enlargement of nature reserves or an increase in the properties managed by nature organizations.

This arrangement is often presented as a win-win situation. However, biodiversity loss remains a concern, since compensation is rarely based on the exact ecological qualities of what is lost. Instead, it typically involves providing an equivalent area of land. For example, if ancient trees are removed for a development project, compensation usually consists of planting new trees. This does not account for the original leaf surface or the trees' established capacity to absorb CO₂.

Values underpinning decision-making processes

Broadly speaking, although there is policy concerning nature inclusive building and an initiative called Collectief Natuurinclusief, the building sector is highly driven by financial considerations. The most dominant values in decision making relate to increasing the number of houses and maximizing their selling price. The sector tends to prioritise building homes for young families with good incomes. This is more profitable for project developers and constructors, and also advantageous for public administration.

By contrast, building for disabled people or elderly residents would imply a nearterm strain on municipal budget calculations. For this reason, any deviation from what is most profitable generally requires intervention from higher authorities. This continuous process of negotiation often comes at the expense of including nature in projects. It is often mentioned in interviews and workshops that plans that are nature-inclusive start out with much higher aims than get realised in the end.

Nature is incorporated mainly through legal provisions, or in a bottomup manner, as demonstrated by *Nature for Each Other*, which works collaboratively with partners in a network. However, they also struggle to make nature mainstream.

Embedding the local SES in the high impact sector

De Beuk

The biodiversity innovation of De Beuk is embedded in their view of human–nature relations. In short, their biodiversity innovation is about humans adjusting their homes and lifestyles to the surrounding nature and aiming to increase biodiversity compared with the starting situation. This may be described as a *naturepositive lifestyle*.

Their social–ecological relationship with nature is complex and heterogeneous, as *De Beuk* consists of various groups with specific identities and ideologies. However, all see themselves as part of nature. For them, nature is more than the plant and animal species of a particular location. It is also a way of observing, thinking and living, embedded in values such as rootedness and reciprocity. Ecological and social values are closely interwoven, which is why they oppose the monetisation of property value increases. They wish to live in a sheltered setting, as close to nature as possible, and are motivated to help nature flourish in their daily environment. Using biobased materials and living offgrid are seen as logical choices. They are aware of the effects of consumeroriented lifestyles on biodiversity. Living with nature is considered a learning process rather than a matter of neighbourhood design.

Barriers for De Beuk

- Financial: Their collective property model, with antispeculation conditions, is not accepted by banks.

- Social regulation: Their preference for living with likeminded ecofriendly residents conflicts with municipal policies requiring neighbourhoods to reflect the diversity of local society.
- Environmental regulation: Strict Natura 2000 rules oblige them to prove in advance that their residential area will not harm protected species or habitats. This requirement does not align with how many members perceive nature, and forces them into legal arguments rather than experiential approaches.
- Nitrogen regulation: Even small emissions during construction are prohibited, despite the likelihood that their ecofriendly buildings would reduce emissions compared with current site use.
- Market regulation: The *Didam Arrest* requires open competition for public land, placing *De Beuk* in direct competition with regular project developers who have more resources. Sharing their ideas to gain support carries the risk of competitors adopting them.

Natuur voor Elkaar

The Natuur voor Elkaar programme of the province of Overijssel seeks to shift mainstream building activities towards natureinclusive practices. The programme is invitational, supportive, and aims to gather convincing evidence of benefits for both nature and people.

Discursive Challenges

- Antinature discourse: Political debates around nitrogen and farming have created an antinature sentiment that has also influenced the building sector.
- Pressure for speed: Political demands to accelerate housing construction conflict with the programme's timeconsuming processes of deliberation, research and design.
- Profit limits: Developers are willing to include nature only up to the point where costs affect profits. They call for regulations to ensure a level playing field, but the province prefers persuasion over regulation.
- Space efficiency vs. greening: National and local policies emphasise densification, while cities also pursue greening agendas. Combining these ambitions is difficult, especially in lowincome neighbourhoods where green structures are scarce.

Overall Contrast The system is heavily regulated, contributing to high house prices (on average over €450,000). While nature inclusion is encouraged, it often reduces revenues for actors. There is a clear contrast between *De Beuk*, which seeks to include humans within natural habitats—a potentially transformative innovation—and *Natuur voor Elkaar*, which focuses on demonstrating the benefits of nature inclusion for society. The latter approach is more transitional than transformative and remains constrained by political and economic pressures.

Political, cultural and institutional power dynamics

The sector advocates building one million houses within less than ten years, a goal motivated by demographic arguments. Much of this construction is intended to accommodate migrant workers and other immigrants; without these groups, the population would decline. The government does not have a demographic degrowth strategy. Within this context, any controversy involving nature is often framed by the sector as an obstacle to achieving this societal objective. The building and construction sector presents itself as a driving force of the national economy.

An alternative way to address the housing challenge would be to increase the number of inhabitants per dwelling, making housesharing more attractive. However, this would generate less income for the government. More houses mean more revenue through dedicated taxes such as real estate taxes, VAT on building materials, and taxes on profits made by private actors in the sector. Public actors can also benefit financially if they participate directly in building projects, and this applies equally to semipublic actors such as the State Forestry Agency.

In practice, both public and private actors gain from the building process. Nature is often regarded as a constraint on returns, particularly when natureinclusive measures require more space and reduce the number of houses per hectare.

Given the significant power of publicprivate partnerships (PPS), any conflict with nature is perceived as an infringement on their initial business model. The costs of hiring lawyers or pursuing court cases are negligible compared to project revenues. This contributes to the juridification of the sector's dealings with nature. It places a strong constraint on the SES, as the knowledge used must be legally defensible. This also strengthens the position of academics, since even minor uncertainties or knowledge gaps can provide openings to win lawsuits.

Economic structures' impact over the SES

Given the sector's ambition to build one million houses, large projects are generally favoured over smaller ones. Small innovative projects rarely meet the requirements needed to realise developments involving hundreds of houses. The publicprivate nature of the sector also makes it difficult for smaller initiatives to enter the market. Commissioning of new projects must usually take place in an open market, unless there are strong arguments to act differently. As a result, small innovative, naturepositive initiatives must compete with powerful project developers who do not need to borrow money for land acquisition and who possess the legal expertise to navigate regulatory hurdles.

In the Province of Overijssel, the programme seeks to introduce change within the open market system by applying a natureinclusive grading system. This results in project tenders where natureinclusive quality is valued alongside, or even above, low price.

When nature is incorporated into a project, this often reflects the priorities of specific parts of public administration, more often at provincial than local level. For example, the Province of Utrecht has launched the programme *Green grows alongside urbanisation* (*Groen groeit mee*), which aims to balance green and functional urban structures. In this way, public administration invests resources in natureleisure areas. Legislation allows for cost recovery from urbanisation projects, either through a facilitative process without a fixed timeframe or through an active approach within a defined period. Key here is the application of the PTP criteria—profits, attributability and proportionality—which set boundaries for investing in nature within the context of urbanisation projects.

Large construction firms operate internationally and have shareholder structures. Shareholders often place constraints on the resources allocated to nature inclusion.

Ensuring sufficient appropriate housing for highly educated residents and migrants is considered an asset for regional economies, as seen for example in the technology region around Eindhoven.

Banks tend to view collective projects such as De Beuk as financially risky. Mortgages for land acquisition in collective ownership, managed by an association of residents, are generally not available. Banks prefer individually based mortgages, and government regulation of the banking sector plays a role in this preference.

Assessment of biodiversity challenge and related biodiversity trends in the high impact sector

As discussed above in relation to environmental impact plans, local biodiversity challenges are not addressed at higher planning levels. Housing programmes are generally regarded as compensable in terms of natural quality. Awareness of the sector's contribution to ongoing biodiversity loss is relatively low, although there are initiatives moving in a more naturepositive direction.

Practices such as integrating nesting boxes into the building process are considered positive, albeit costly, innovations and have now been adopted into mainstream practice. A strong example of successful natureinclusive building is provided by Unitura³⁷, a company offering a wide range of solutions for housing bats, insects, and nesting places for birds such as sparrows and peregrine falcons, as well as green façades, green roofs and local seed compositions. These products are tailor-made for new building projects and developed in cooperation with the construction sector. This represents an innovation that has emerged from within the sector itself.

Although the minister had planned to remove this obligation from the building decree (now part of environmental law), the sector had already integrated it into its workflow and opposed the proposal.

Current enablers and barriers for transformative change

Transformative change towards natureinclusive building in the Netherlands is supported by some policy initiatives, innovative projects, and civil society engagement. At the same time, it encounters barriers such as financing constraints, regulatory rigidity, fragmented governance, and competition for space.

Enablers:

- Policy and government initiatives: The Dutch Ministry of Agriculture and Nature is actively promoting nature-inclusive living, emphasising greener, healthier urban environments.
- Collaborations and networks: Partnerships between policymakers, ecologists, architects, and local communities are helping embed biodiversity goals into urban development.
- Practical innovations: Companies like Unitura demonstrate how green roofs, façades, nesting boxes, and biodiversity-friendly designs can be integrated into mainstream construction.
- Collective Private Commissioning (CPC) carries potential for systemic change, as it supports innovations emerging from outside the sector and beyond its direct control. In connection with CPC, community-based housing experiments show similar potential, particularly when communities intend to adopt nature positive lifestyles and apply advanced ecological techniques in the construction of their homes.
- Civil society involvement: The Collectief Natuurinclusief movement mobilise communities and professionals towards a shared vision of a nature-inclusive society.
- Public awareness: Opinion polls and campaigns show that natural values are broadly recognised as important, creating a supportive environment for policy change.

Barriers:

- Low private sector engagement: Many developers still prioritise short-term profitability over biodiversity goals.
- Competition for urban space: High demand for housing often conflicts with the allocation of land for nature-inclusive features.
- Insufficient policy implementation: While several frameworks exist, enforcement and mainstreaming of nature-inclusive standards remain inconsistent.

- Limited collaboration: Fragmentation between municipalities, provinces, and national authorities slows systemic change.
- Knowledge and data gaps: Reliance on technical models (e.g. nitrogen deposition) can overshadow practical ecological knowledge, leaving uncertainties that hinder innovation.
- Financial constraints: Banks often view collective or experimental housing projects as risky, making it difficult for initiatives like ecovillages to secure funding.
- Regulatory rigidity: Strict environmental laws and permitting systems focus on mitigation and compensation rather than experimentation with new human–nature relationships

5.2 Vision: What alternative SES could be?

Society is accustomed to viewing the environment as a system of interconnected objects. For example, a chair is seen as belonging to a table, with each object perceived as stable unless visibly altered. These relationships form what we commonly describe as systems. When humans interact with such systems, meanings emerge. This perspective also shapes how we view nature: we see trees and shrubs and associate them with concepts such as forests or nature reserves. We seek to understand how natural elements relate to one another, categorising them into species, biotopes, habitats and ecosystems.

When changes occur in nature, we instinctively search for causes. Scientific inquiry is largely focused on uncovering causal relationships—how one element influences another within a system. This often reveals chains of change, where one shift triggers another. Our understanding of causality depends on observable relationships between things. Yet causality is not entirely free from human interpretation. In many cases, the true causes of change remain uncertain, leading us into the realm of hypotheses and assumptions. Our knowledge of what initiates change is limited, and the full complexity of causal relationships is often beyond our grasp. As a result, many natural objects are perceived as isolated and unchanging, with relationships only acknowledged when they are visibly active. Anything beyond that tends to fall outside our perceived scope of relevance.

A Holistic Alternative: Human-Inclusive Nature

An alternative way of relating to nature is practised by the societal partner in our case study. Their approach is rooted in holistic principles and highlights the potential for harmonious interaction between humans and the natural world. They work on the belief that everything in nature is interconnected, even if those connections are not immediately visible.

De Beuk has developed a concept called human-inclusive nature, which envisions humans not as external disruptors but as integral parts of the ecological web. This philosophy suggests that people can inhabit natural areas without degrading them, instead becoming embedded within the network of relationships that define those ecosystems.

Their interpretation of a Social-Ecological System (SES) differs from conventional models that underpin nature-inclusive frameworks. It moves beyond the standard “business-as-usual” approach and even beyond nature-inclusive thinking, towards a genuinely nature-positive SES. Below in table 17 we describe shortly the basic difference between SES in business as usual, a nature inclusive and a nature positive social ecological system.³⁸

Below in table 17 we describe shortly the basic difference between SES in business as usual, a nature inclusive and a nature positive social ecological system.³⁹

Table 17 - Fundamental differences in social ecological systems within and outside the high impact system

SES in Business as usual	Nature inclusive SES	Nature positive SES
One or two species are welcomed in adjusted architecture	Structures of nature can be fitted in the human habitat	People can fit in a natural habitat, if they adjust their lifestyle
Nature in leisure and parks	Living close to nature	Living is nature
Significant influences of humans need to be compensated	The influence of humans is negative and should be restricted	The influence of humans can be positive and lead to a process of co-succession
Image of nature is restricted to protected species and habitats	Image of nature is based on what nature has been (memories and space for time substitutions)	Image of nature is physical and metaphysical, and is more about relations than objects
Focused on nature that adds value to projects	Focused on ecological patterns	Focused on ecological processes
Nature translated in norms and standards	Nature as opportunity for better lives	Nature translated in best ecological techniques
Innovations restricted to policy categories: circular and biobased materials	Transitional innovation in co-creation and under the control of the sector	Transformative innovation beyond the control of the sector

5.3 Discussion

A fundamentally different approach to understanding our environment shifts attention from static objects and their changes to the dynamic relationships that continuously shape both humans and nature. This perspective, known as relational ontology, suggests that instead of viewing things as fixed entities, we should consider the ever-evolving web of connections that defines our world.

Philosophers such as Bayo Akomolafe and Bruno Latour advocate this relational view, emphasising that our understanding of the environment is inherently limited. We cannot grasp all the relationships around us, and rather than isolating individual causal links, we should seek to understand the broader network of interactions. In this view, causality becomes secondary. Where relational understanding is incomplete, our minds fill in the gaps, much like recognising a face in a painting composed of dots.

In our case study, the Social-Ecological System (SES) is understood as a socially constructed framework of relationality, which varies across actors and groups. We adopt a relational ontology to explore the human–nature connection, viewing relationships not merely as links between entities but as discursive constructs that shape those entities themselves (Brijan, 2023). As Descola (2012) argues, without relationships, objects cease to exist.

SES is closely tied to worldviews. Holistic perspectives position humans within nature, influencing how we act in relation to the environment. These stand in contrast to Western

dualism, which separates intellect and experience. Tim Ingold (2011) describes this divide as the “thinking mind” versus the “executive body,” critiquing the assumption that all action must originate in the brain. He suggests that Western thought often misinterprets other worldviews by attributing life or spirit to inert things, whereas many cultures perceive a dynamic sphere of relations in which all forms of life, whether person-like or object-like, interact and co-create existence.

Such holistic worldviews move beyond causality and empirical facts, using metaphors to explore relationships between humans and non-humans. Expressions such as “listening to the trees” or “a landscape has a memory” serve not as literal truths but as tools for understanding interconnectedness. According to Brijan, these metaphors are not intended to form a complete body of knowledge but to open space for exploring alternative worldviews. We observed this metaphorical intimacy in our case study.

Humans construct ontological boundaries to make sense of the cosmos, and these boundaries in turn shape lifestyles and societal structures (Joerstad, 2019). The most radical form of relational ontology would eliminate the distinction between humans and nature altogether. One way to transcend this divide is by granting personal rights to natural entities such as rivers and forests.

In this case study, we observed diverse expressions of cosmopolitical thinking, enriched with spiritual metaphors and holistic values. These perspectives often led to sustainable lifestyles and collective actions aimed at putting ecological ideologies into practice.

Despite operating within conventional causation frameworks, both De Beuk and the Province of Overijssel have assembled a bricolage of technical solutions, nature-inclusive measures and spiritual practices to bring their visions of living with nature to life. While regulatory systems, such as those governing permits for ecovillages and eco-housing, must be addressed thoroughly, they are only part of the picture. Beyond these rational structures, more intuitive and relational elements are essential to realising a genuinely nature-positive way of life.

6. Locally tested interventions

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6.1 Nature inclusive Building

The planning, design and construction of new houses and neighbourhoods has a significant impact on nature. Over the past decade, approximately 280 square kilometres have been converted into human habitats, coinciding with a corresponding decline in agricultural and natural areas. The sector is rightly considered high impact. In response to its problematic relationship with nature, efforts have been made to incorporate more nature into human living environments. These innovation programmes are referred to as part of the “natureinclusive agenda.”

The system tasked with building around one million homes in the coming decade is highly complex, involving a multitude of actors, legislation and political disputes. As a result, it is difficult to change. The power to initiate or resist change is distributed across a wide publicprivate network. The aim of this case study is to uncover the structures and mechanisms that either block or enable innovations that could improve the sector’s relationship with nature.

This case study focuses on one such natureinclusive innovation programme, *Natuur voor Elkaar* [Nature for Each Other], hosted by the Province of Overijssel. In parallel, it examines an innovative citizens’ initiative called *De Beuk*, which aims to establish an ecovillage and ecocommunity on the outskirts of Wageningen. The research methods applied are rooted in action research. By engaging directly with the bioinnovative enterprise and collaborating with the citizens of *De Beuk* and provincial officers, researchers encountered the challenging path of marginalisation, blockage and leverage.

Biodiversity loss is indirectly driven by a narrow view of nature, understood merely as species and habitats, whose decline is assumed to be compensable by converting agricultural land into new nature reserves. This approach backfires in politics and public opinion, as the public tends to sympathise with farmers. Nature is often blamed for the sector’s current stagnation. The deterioration of nature is countered by an increasingly strict set of regulations. Ironically, these same regulations now hinder the success of bioinnovations. Innovations emerging from new human–nature relationships are seen as potentially harmful to the forms of nature that existing protection frameworks recognise and safeguard. The regulatory and permitting system remains unyielding.

The case study reveals that innovation within the sector is primarily driven by goals of efficiency and the adoption of biomaterials. Ideological and moral innovations, however, do not fit within the sector’s systemic boundaries. Although natureinclusive building is widely recognised, it is still difficult to realise and often remains more words than practice.

6.2 Evaluation of strategies in action

Below, we present the interventions and strategies identified in our case study and discuss them in relation to:

1. their potential for transformative change
2. the manageability of indirect drivers of biodiversity loss
3. their capacity to foster plural perspectives
4. the empowerment of vulnerable and underrepresented groups
5. gender balance within the biodiversity governance agenda
6. concerns related to environmental justice

De Beuk

De Beuk has been established as a cooperative endeavour of five standalone initiatives, seeking to engage in the development of *De Dorschkamp*. This site, formerly a hospital and forest station, lies just outside the city and adjacent to a large nature reserve. A new allotment plan prepared by the municipality of Wageningen allows for the construction of 120 houses. The municipality supports De Beuk's plans under the Collective Private Commissioning policy. However, because the allotment plan has been altered, the site cannot yet be developed. It requires multiple permits, one of the most difficult being the nature permit, which falls under provincial responsibility. At the outset, De Beuk's strategy was to address challenges by drawing on their own experience and their extensive network of specialists both within and outside the sector.

Internally, De Beuk faces the challenge of reaching agreement on ambitions and overall plans, given the heterogeneity of the five groups involved. Initially conceived as an ecovillage, the idea evolved into an ecocommunity. Within this ecocommunity, the ecovillage (built environment) remains central, but other elements are also included, such as community childcare, shared land stewardship, and educational, celebratory or spiritual activities (lifestyle). Members are united in their commitment to circular biobased materials, adapting to the natural environment, and adjusting their lifestyles away from consumerism and its associated housing trajectory. Yet operationalising these lifestyle choices reveals differences in preference, and participation in activities is not mandatory. To manage this diversity, De Beuk adopted an internal strategy that provides space for individual and group variation, financial equity, common spaces, and inclusive activities aimed at people with less access to living with nature—such as young people, singles, and those without property. Activities also accommodate elderly members with limited mobility. A gender balance has emerged naturally among members.

Members of De Beuk clearly wish to minimise their ecological footprint: no cars next to houses (or no cars at all), no private gardens, offgrid and selfsupportive living. This ideology of a likeminded group conflicts with municipal policy, which requires neighbourhoods to represent diverse social groups. In response, De Beuk began cooperating with the Wageningen social housing institute, enabling them to adopt important social aims of the local administration.

It soon became clear that De Beuk must solve hundreds of problems and underpin numerous technical and ecological choices. BIOTraCes supported them by organising a workshop on power in networks, offering new insights into cooperation and strengthening agency. One example is De Beuk's coalitionbuilding with other ecovillages to increase lobbying power.

Externally, a major barrier is land acquisition. The Didam Arrest, a Supreme Court ruling, requires public procurement of government property through open competition. Exemptions are possible but demand extensive preparation and carry risks. This forces De Beuk to compete with investors and developers. Their dilemma is clear: building trust with landowners such as the State Forestry Agency and investor Smink requires transparency, but openness risks losing the competition, as their naturepositive ideas could be appropriated by others.

Their willingness to adapt lifestyles offers no advantage in procurement, even though their aspirations address biodiversity loss in ways mainstream developers do not. Their plan meets all legal sustainability standards and goes beyond them, aiming to integrate housing into nature. To achieve this, they keep their plan discreet while strengthening trust with landowners.

The WR team studied the Didam Arrest and explored avenues for negotiation. If De Beuk can significantly contribute to the policy aims of the landowner, the ruling might be bypassed. Such contributions could include contracts requiring residents to abstain from car use, avoid fences, and adopt practices that enhance species richness. Similar bypasses have succeeded elsewhere, for example in contracts mandating social housing. However, landowners remain focused on maximising revenue and insist on open competition. To secure nature permits, they commissioned a master plan from an architectural firm that incorporates nature inclusion.

In consultation with WR, De Beuk developed a followup strategy to strengthen their bargaining position. They formalised a 'gebiedscoöperatie' [area cooperation] to manage biodiversity across the terrain, enabling land acquisition as a cooperative entity. The strategy also involves engaging the innovation department of the State Forestry Organisation, which works on nature inclusion in housing development. Although formally invited only after acquisition to ensure objectivity, this plan has already fostered relations between De Beuk and the department through workshops with sectoral institutes.

Another external barrier is nitrogen deposition from construction. The province announced that no permits will be issued within 500 metres of Natura 2000 areas. Initially this seemed a showstopper, dismaying members. The WR team, having studied the policy, explained that landowners now face a problem that De Beuk could help solve. This improved their competitive position. Strategically, De Beuk is exploring pilot status, aiming for a 70% reduction in nitrogen emissions and, more importantly, recognition of a new nature typology: humaninclusive nature. Together with GENNL, the Dutch ecovillage alliance, they presented this idea on 4 October 2025 at a Cooplink symposium on collective housing.

The WR team used a morethanhuman method, employing character cards to advocate humaninclusive nature. Developed by Jay Marisca Gietzelt (2024) and adapted by WR, the cards invited participants to adopt the perspective of native species and landscapes, considering how coexistence with humans might be possible. This exercise tested the concept of humaninclusive nature within a wider network not usually addressed by the sector. Should this new typology be adopted in housing and nature policy, it would represent a gamechanger and a significant transformation of the sector. The near future will reveal whether this becomes reality.

Natuur voor Elkaar

The programme Natuur voor Elkaar, executed by the province of Overijssel, deliberately aims to transform the urbanisation sector by adopting principles of nature inclusion (see also Chapter 3 in D2.5). The programme strongly believes that good examples can serve as a compass for the sector to become more natureinclusive.

Their strategy is composed of four elements:

- Stimulating the process "from thinking to action"
- Disseminating actionable knowledge
- Building diverse networks and facilitating cooperation
- Providing resources for innovative actions

An example of how principles are disseminated within the network is the *Recipe for Edges* project. In this initiative, spatial arrangements and provisions for the inclusion of nature in new residential areas are sketched by a landscape architect and discussed within the network. It is intended as inspiration for architects, municipal officers and project developers.

At the end of their first programming period, confronted with an antinature atmosphere in public policy, the programme realised that "nature" alone was not sufficiently appealing. A new narrative was required. Their strategy shifted to emphasise nature for the benefit of people, for example, nature for health or for deprived communities living in environments without green structures. This can be seen as a survival strategy in a policy environment hostile to nature.

Part of this new narrative was the recognition that the programme should not focus solely on elites, as this risked gentrification. In their second period, they redirected their strategy to include lowaccess groups in society. This was achieved by initiating and discussing good examples. One such example is 'Straatboeren' [Street farmers], an initiative that supports residents in social housing to improve biodiversity in their gardens. Social housing neighbourhoods, often characterised by low socioeconomic status and grey, tiled gardens,

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are particularly vulnerable to climate change impacts such as heat waves. *Straatboeren* works with housing organisations to create greener, climateresilient gardens. These gardens mitigate the negative effects of heat and weather extremes, while contributing to liveability, health and wellbeing (Snep et al., 2023).

Even small improvements in biodiversity, such as in foursquaremetre gardens, can have significant impacts, providing food and habitat connections for insects and birds (Delahay et al., 2023). Beyond construction, the initiative supports maintenance, teaching residents how to care for plants and manage water use. The project also has strong social elements: neighbours share sprouts, organise planting days, and help each other in communal gardens. An app allows residents to exchange experiences, tips and questions, strengthening neighbourhood networks and helping to combat loneliness.

The adverse attitude towards nature in national and provincial politics has created controversy. Commercial actors within the network demand rules and standards for nature inclusion to ensure a level playing field. While inclusion can benefit them reputationally, they resist additional costs that might raise house prices in the free market. The programme sees no possibility of meeting this request, pointing to the political climate that seeks to reduce regulations—especially those favouring nature.

One innovative action supported by the programme is the ranking of nature inclusion with numerical scores, enabling benchmarking and collective learning. This initiative has already been adopted by several municipalities.

When considering the overall cases of De Beuk and Natuur voor Elkaar, there are no interventions to date that can be regarded as having produced transformative change. However, innovations emerging from the margins of the sector do carry the potential to influence it. De Beuk may contribute to transformation if their new typology of nature—where humans are seen as integral to nature and prepared to adapt their lifestyles to support its flourishing, is recognised within policies and by the sector. For this to occur, the sector would need to open up to new perspectives on human–nature relationships. So far, there are no indications of such a shift.

The provincial programme Natuur voor Elkaar operates as an innovation initiative. With its focus on nature inclusion and its deployment through a public–private partnership, its objectives are primarily transitional rather than transformative. It does not seek to alter the power configuration of the sector or to expand citizen agency.

The reasons for this limited transformative impact are outlined in Table 18 below, which reviews several elements of transformative change.

Table 18 - Overview of findings regarding transformative change in the work of the societal partners De Beuk and Natuur voor Elkaar

Elements of TC	De Beuk	Natuur voor Elkaar
Transformative change potential	Creating opening of the system with radical new typology of nature positivity: high potential for fundamental change in views about interrelations of humans and nature. Additional potential for other innovations from outside the sector	High potential for a moderate change in the sector to become nature inclusive.
Manageability of indirect drivers	Addresses the indirect drivers by proposing economic equity for De Beuk members, nature positive building techniques, nature positive	Leaving the underlying drivers of biodiversity loss mostly unaddressed.

	lifestyle adjustments and different nature typology, but mostly on a voluntary basis. Living according to their standards cannot easily become part of formal institutions and governance.	
Fostering plural perspectives	De Beuk adopted an internal strategy to manage its diversity, creating space for individual and group differences, ensuring financial equity, and providing common areas and inclusive activities.	The programme's strategy focuses on persuasive examples and guiding principles, which leans towards consensus-seeking rather than actively fostering plural perspectives. They do want to reach further than 'the usual suspects'.
Empowerment of vulnerable groups	This has been adopted to a limited extent in their strategy by incorporating some space for newcomers that have acquired a status but is not the core of their strategy. Other vulnerable groups like children, women and elderly are well represented.	Indirect empowerment of those deprived of nature in their daily living environment (working for them and not with them)
Gender balance in biodiversity governance agenda	The building and construction sector is absolutely dominated by men. In De Beuk there is gender balance, women are well represented in the lead.	The building and construction sector is absolutely dominated by men. Women may be more active in innovations because they are more open towards potentially deeper relations with nature. This for instance is shown by the huge population Anders Wonen that wishes to live closer to nature, consisting for more than 80% of women (see chapter 7 in D2.5).
Environmental justice	The Beuk contributes to environmental justice by: 1. Organizing themselves as a landscape cooperation that provides a legal entity wherein members can make equitable contributions. This makes living with nature more accessible to people with less financial means (distributional justice) 2. Making decisions sociocratically. This allows all members of the Beuk to voice their opinion until consensus is reached (participatory justice)	The Straatboeren project is aiming at environmental justice. Social housing itself is a contribution to distributional justice, providing lower income households with adequate housing. Greener gardens can increase distributional justice further, as the services that they provide in terms of climate adaptation and well-being, are likely to make social housing neighbourhoods wealthier (Snep et al., 2023).

	3. Making space for different, albeit nature positive, values to coexist in communal areas. All members can organize activities that vary from practical 'planting trees together' to spiritual 'healing trees together' (recognitional justice). These aspects of environmental justice are not evident in the mainstream building sector.	

6.3 Enablers and disruptors

In the work of both societal partners, several key enablers can be identified.

For De Beuk, the most significant enabler is their extensive network, which includes individuals with strong professional standing and specialised expertise. Support from the municipality and the province has also been crucial, particularly in funding a feasibility study. Notably, many of *De Beuk*'s enablers, such as Cooplink and the Global Ecovillage Network (GEN), operate outside the conventional building sector, offering alternative perspectives and resources.

For Natuur voor Elkaar, the strength of their network is equally vital. It brings together individuals and organisations willing to challenge conventional norms. Nationallevel opinion leaders, including CEOs of major construction firms such as Heijmans, act as influential enablers. Each progressive step towards nature inclusion within the network generates momentum for further innovation, reinforcing the programme's transformative potential.

Despite these enabling factors, the path towards bioinnovation remains fraught with challenges. Key issues include:

- **Mismatch between local biodiversity agendas and broader economic interests:** Efforts to regenerate biodiversity often conflict with prevailing trends in economic development, creating tension between ecological goals and sectoral priorities.
- **The capacity to replicate enablers:** Societal partners struggle to scale up successful strategies and extend their impact across wider territories.
- **Managing disruptors and mitigating longterm effects:** Sustaining progress requires the ability to respond to and neutralise disruptive forces—whether political, economic or social.
- **Influence of higherlevel policy frameworks:** Local regeneration policies and action plans may be strengthened, undermined or delayed by national legislation or European directives—even those aimed at environmental protection.

The following sections address these key issues in more detail.

Mismatch between the local agenda on biodiversity regeneration and economic sectors' interests and trends

A possible mismatch between the agenda on biodiversity regeneration and economic sectors can take the shape of a lock-in, or of negative feedback. The sector may deploy a strategy of black boxing to elude responsibility. The mismatch may take various shapes. We will discuss them in a more general perspective to shed a light on the sector.

Rising Housing Costs, Stress and Scarcity of Time for Nature

December 2025

Construction in the Netherlands is lagging. One million homes must be built, at a rate of 130,000 per year. Nature is partly blamed for delays. Building is expensive, and the houses that are completed are therefore costly (CBS, 2025). Young families struggle to find housing, and without two incomes financing is difficult (CBS, 2025). The result is a lifestyle dominated by stress and lack of free time (Roeters, Vlasblom & de VoogdHamelink, 2018). Leisure is reduced to passive rest in front of television or social media, leaving little time to enjoy nature. Being busy even carries prestige—commercials often open with “I have a busy schedule, and so...”. This is a lockin that *De Beuk* seeks to overcome.

Densifying Cities, Nature Disappearing from Daily Life

New construction focuses on densification of existing urban fabric. As a result, urban nature deteriorates. Provinces in the Randstad aim for around 90% of new housing within existing urban areas, accompanied by green zones outside cities (e.g. Utrecht’s *Green Grows Along* programme). This process gradually removes nature from citizens’ daily lives. Visiting nature becomes a leisure activity, often crowded, reducing the quality of the experience. People increasingly substitute weekend nature visits with short holidays, unintentionally raising their ecological footprint.

Urbanisation and Project Development

Relationships between projects and nature are barely acknowledged in policy phases. The *Concept National Spatial Policy Document* (BZK, 2025) provides for one million homes without clear assessment of ecological effects. Where links are made, they focus on nitrogen emissions during construction or car use affecting Natura 2000 areas. Large projects are prioritised to meet housing deficits, while nature is treated as a detail to minimise. Smallscale, wellintegrated projects are possible but often blocked by the “business case”—a black box determining how far developers will go in adopting natureinclusive practices.

Housing for a Materialistic Lifestyle

The housing sector is embedded in a broader discourse of economic growth. Neoliberal thinking centres on consumption (see sustainability lecture by Kees Klomp). Influencers and advertising encourage buying, shaping a standardised view of the space families need to store and display possessions. Housing is designed for consumerist lifestyles: large houses with expensive goods confer status. Construction assumes a housing career where people move towards larger, more costly homes, and most follow this trajectory.

Nature Deteriorating, Shifting Baselines

Bird and insect populations have declined dramatically over the past thirty years (Vugteveen & van Hinsberg, 2017). Younger generations, unfamiliar with past richness, accept current impoverishment as normal. This is the lockin of shifting baselines. Behaviour also shifts baselines: unsustainable actions confer social status—travelling far, buying gold, eating large amounts of meat, maintaining perfect gardens. Living in balance with nature lowers rather than raises status.

Meaning and Nature

There is extensive knowledge about human–nature relationships, yet little of it is reflected in policy or actions of powerful actors. This concerns not only nature as environment but also its influence on health and wellbeing. Numerous books explore these themes, such as *Nature as a Source* (Verstegen, 2025), *Nature’s Mirror* (Schouten, 2025), *The Rebellion of Nature* (Blom, 2017) and *An Ecological Theology for the Future* (Keasberry, 2024). This abundance of literature creates restlessness, yet daily pressures prevent deeper engagement.

BottomUp Housing Experiments

Initiatives to live closer to nature or in a naturepositive way are proliferating. Collective approaches, such as ecocommunities, offer advantages by enabling larger scales of living with nature. They also respond to rising loneliness among Dutch citizens (*Een tegen Eenzaamheid*, n.a.). Addressing loneliness while living in balance with nature is a potential

leverage point. Connecting these initiatives through civil society could strengthen their impact.

Health and Nature

Knowledge of the relationship between health and nature is expanding, leading to new initiatives. This includes awareness of microorganisms as well as mental and physical wellbeing (van den Berg, 2024; Health Council of the Netherlands & Advisory Council for Spatial Planning, Nature and the Environment, 2004). Urban planning increasingly addresses heat stress, stimulating greening of cities. Yet this often conflicts with densification, and the net result is deterioration of urban greenery.

Capacity of replicating the enablers, broadening their impact in the territory

In the case of De Beuk, replication of enablers is currently weak. The initiative is not positioned to scale or reproduce its biodiversity innovations independently. For efforts such as De Beuk to be replicated more broadly, a supportive innovation policy is required, one that empowers initiatives emerging from the margins or outside the conventional building sector. A notable replicable innovation contributed by De Beuk is the new nature typology of *humaninclusive nature*. The Dutch EcoVillage Network acts as the thought leader of this typology, which aims to make it easier for future naturepositive communities to obtain building permits.

By contrast, *Natuur voor Elkaar* demonstrates a clearer capacity for replication. An example is the *Recipe for Margins* project, which promotes architectural innovation by reserving space for nature before housing developments are mapped out. The programme has the resources and institutional support to drive such innovations within the sector.

However, its replicability is not without limitations. The programme operates within a defined mandate and depends heavily on the willingness of network partners to adopt nonstandard approaches. This reliance on persuasion and soft influence, rather than regulatory authority, constrains its ability to scale. While the potential is evident, the programme risks overstretching its boundaries and must navigate carefully to sustain momentum.

Capacity of dealing with disruptors and reducing their long-term impact

De Beuk is currently struggling to deal with disruptors in its process, largely due to financial disadvantage. A longterm scheme they plan to contribute to is the ecovillage fund initiated by the Dutch Ecovillage Network (GENNL). Existing ecovillages contribute to this fund once their mortgages are repaid, enabling future ecovillages to access financing more easily and at better interest rates. However, as most Dutch ecovillages are relatively new, this remains a longterm strategy with no immediate benefit for De Beuk.

By contrast, the programme *Natuur voor Elkaar* focuses on establishing good practices. Its strategy centres on positive examples that can inspire and be replicated. The programme does not directly address disruptors. In theory, disruptors could be confronted with positive examples of biodiversity balanced with housing development, but such a shift would require a change in strategy. This could jeopardise the programme's existence, as the sector might resist and withdraw cooperation. Its current theory of change is therefore firmly rooted in inspiration and persuasion.

How policies work out for regeneration

The extent to which local policies, strategies and action plans on regeneration may be reinforced, weakened or delayed by national policies or European directives, even those focused on environmental issues, will be discussed below. The policy landscape is extremely complex. One might argue that public policies themselves contain both direct and indirect drivers of biodiversity loss, many of which originate at European level.

- Nature is a domain in itself, and, from a policy perspective, is almost exclusively focused on nature in nature reserves
- Nature recovery and nature management are confined to nature as we know it has been, which leads to a focus on recovery and not to the uncertain and unknown outcomes of co-evolution of human activities and natural development (this could be a potential outcome of nature positivity)
- In The Netherlands, nature has been brought under the jurisdiction of the province, while schemes for the building sector originate from national level. This causes the problem that provinces might have to deal with a problem created on national level that is caused by planning new residential areas in ecologically unfortunate places. An instruction by letter has been issued by the minister of Infra saying that water and soil should be leading (Harbers & Heijnen, 2022), but altogether this is far from fixed.
- Damage to nature by human activities is perceived as unavoidable and must be compensated by extending existing or realising new nature reserves⁴⁰
- Compensation is achieved by converting agricultural land into nature reserves, a practice that generates controversy and fosters negative attitudes towards nature protection.
- Private commercial partners and public organisations, including local and national political bodies, profit from the practice as it stands; likewise, nature management organisations benefit from the enlargement of their estates.
- Profits are highest if cheap agricultural terrain (9.3 Euro per square metre (Kadaster, 2025) is reshaped in costly residential (767 Euro per square meter, CBS (2025) and most of the profit occurs due the change of land use in the environmental plan
- Almost all problems in the housing sector are translated into building agendas for new neighbourhoods, rather than into better use of the existing housing stock.
- The entanglement of public and private partners in the sector is widely regarded as valuable cooperation (and there is truth in this), but it also produces an opaque system of relations that is closed to innovations from outside.
- The common agreement to keep house prices within certain limits is achieved through a high level of standardisation.
- Standardisation has the disadvantage that citizens who wish to live in or with nature are not addressed. In practice, only wealthy individuals can afford housing in or near nature.
- Regulation of the building sector is very high, due to national and European frameworks. This complexity creates a boundary of inclusion for those able to cope with it, but a threshold for newcomers or innovators. Coping requires resources for legal officers who can navigate the procedures.
- Innovation policies are embedded in public–private structures (such as the so-called top-sector policy), based on the belief that co-investment supports adoption. However, the policy fails to embrace transformative innovations, as the sector resists them to safeguard profit lines.
- The stance towards nature, and the focus on human–nature negativity, originates in national policies of the 1980s and 1990s. These were taken up in European policies and have since rebounded, undermining public support for decisive biodiversity measures. Public support for nature in general, however, remains strong.
- Market regulation is embedded in European policies and directives. The baseline is to maintain a level playing field and create transparency. The drawback is the opaqueness of the public–private cooperative system, essentially corporatism.

Altogether, there is not enough room and support for biodiversity innovations that have the potential to change the sector. Problems of biodiversity loss migrate from national planning schemes to the local level, under the assumption that if the right choices are made and designs are natureinclusive, the effects of a new plan on biodiversity will be negligible. Nitrogen problems have been undervalued for centuries, as has habitat loss in the agricultural landscape. As a result, due to a shortage of workforce and the reduction in permits issued, the sector is no longer able to perform as it should. There is not enough space within environmental norms to add to existing problems. This is a perfect timing for transformative change.

6.4 Failed and successful practices

Success and Failure: Too Early to Judge

For De Beuk as well as for Natuur voor Elkaar, it is too early to determine success or failure. Much depends on the perspective from which one judges. Does the programme in Overijssel fulfil its promises, and should it therefore be seen as a success? From a BIOTraCes perspective, success would mean transforming the sector—contributing to pluralisation, empowering innovative actors, politicising debates and embedding practices within broader socioecological systems. We combine different views and reflect on success and failure from an outsider's perspective, considering the realisation of aims, transformative change and environmental justice.

De Beuk

The story of De Beuk shows that they are struggling to realise their aims. A major obstacle is land acquisition. Regulations, limited financing opportunities and their commitment to equity create difficulties. Regulations such as the Didam Arrest, which prescribes mandatory public procurement, do not work in their favour. The upcoming tender process by the State Forestry Agency will likely be executed in two steps: first limiting candidates based on feasibility studies, experience and financial position—placing De Beuk at a disadvantage. Nitrogen restrictions have also become an obstacle due to provincial regulation. One might argue that, because the province seeks to strengthen nature protection, experiments in nature positivity cannot be attempted.

Internal controversies further complicate land acquisition. Some members favour a fully cooperative model, excluding speculation or personal profit after realisation. Others prefer personal land ownership. This division risks becoming a breaking point in their cooperation, representing a failure to put part of their ideology into practice. No solution has yet been found.

On a broader level, De Beuk includes members who have worked in Africa and elsewhere, drawing inspiration from practices of living in natural environments. This has led to a holistic ideology within a linear Dutch context. Frictions arise when worldviews clash (e.g. holistic practices versus strict protocols), but the group also provides a safe space for plural values to coexist. Members wish to engage with refugees currently living in De Dorschkamp, but the refugee centre's management forbids contact. Nevertheless, De Beuk has reserved space for newcomers with residence permits in their development plan.

A step beyond their current experiment would be to allow citizens with migrant backgrounds—bringing different human–nature relationships—to conduct their own experiments in balancing humans and nature according to their traditions or worldviews. It is striking that the system fails to recognise this potential. Dutch society is rich in diverse perspectives on nature, yet this remains unacknowledged and unused as a source of innovation.

The area De Beuk wishes to purchase is currently used to house refugees. Their plan reserves space for some refugees with permits who wish to remain in this temporary neighbourhood. This represents a small step towards environmental justice in biodiversity

action. At system level, however, environmental justice from the perspective of cultural heterogeneity remains unexplored. This is both a failure and a missed opportunity. The system also fails to address the wishes of many people who would prefer smaller houses and closer contact with nature (see chapter 7 in D2.5). Instead, it assumes a standard housing trajectory—from renting to a large detached family home.

At system level, a lock-in is created by the combination of limited target groups (based on an imagined “average Dutch citizen”) and the complexity of regulatory frameworks and permits. Innovative groups must dedicate years of spare time to project development, facing numerous obstacles because the system is not open to alternative human–nature relations. Forced to compete with regular developers, ambitions to live in harmony with nature are no advantage. Those with jobs and families face severe time constraints, while the system’s complexity effectively excludes people with limited time or lower education, blocking pluralisation.

De Beuk initially sought a privileged position in land acquisition by building trust with landowners and offering a plan most beneficial for natural values. This seemed logical, as the surrounding land remains under the State Forestry Department (SBB), who would be their neighbours. However, SBB refuses to expropriate De Dorschkamp in a one-to-one contract, citing the Didam Arrest and their need to achieve the highest possible market price due to budget shortfalls.

Because De Beuk relied on trust, any intervention from the Wageningen team risked undermining this. The team therefore acted with the utmost caution. Gradually, as this strategy proved ineffective, De Beuk shifted towards a more procedure-oriented approach.

Natuur voor Elkaar

Natuur voor Elkaar has been successful in community building, which is expressed in several ways. Firstly, through active digital networks such as a lively WhatsApp group that sustains informal dialogue. Secondly, via the annual conference organised by the programme, which quickly sells out and attracts around 400 participants, providing space for exchange of ideas and networking. Finally, there is an active community of practice around nature-inclusive building, where experiences and examples from the field are shared, supporting networking and peer-to-peer learning.

From this network, strong collaborations have been established with partners such as Odin and Stichting Oversticht, alongside new alliances in the health domain. Within current political currents, where parties in power do not prioritise nature, Natuur voor Elkaar demonstrates resilience. Their adaptive strategy includes shifting focus towards the relationship between health and nature. The fact that the programme continues to exist in this climate reflects its dynamic approach.

Concerning failed practices, external actors expect objectives to be translated into policy demands. The organisation refrains from doing so, raising the question of whether this represents an inability to act or a deliberate choice to avoid overpoliticisation. Another failed practice is the lack of diversity in the network. Although goals have been articulated and development is ongoing, the group remains socially and demographically homogeneous.

Recent organisational developments have altered the programme’s character. While embedding within institutions ensures continuity, its innovative and transformative dimension has diminished. The programme now functions more as a facilitator than as a collaborative governmental experiment, raising doubts about its capacity to drive systemic change.

6.5 Co-learning

As discussed above, both societal partners have established strong networks as part of their strategy. These networks serve as knowledge resources and platforms. A good example is De Beuk inviting the collective housing experiment De Warren from Amsterdam to WR for an exchange of experiences. Numerous interactions took place between the societal partner, its network and the WR team. Each obstacle encountered—such as the Didam Arrest or the nitrogen restrictions—was turned into a learning moment. Learning also occurred within De Beuk's network, even in cases where the societal partner was not directly involved. Knowledge transfer between WR, De Beuk and the programme Natuur voor Elkaar was intensive, often mediated by student assignments from Academic Consultancy Training (ACT). Workshops organised by WR (ANNEX II) provided opportunities for reflection and knowledge exchange. Members of De Beuk noted that they were so occupied with the practicalities of realising their plan that they lacked time to reflect. The same applied to Natuur voor Elkaar. The interactive workshops helped both partners step back from immediate concerns and gain perspective, which proved crucial in shaping their strategies.

When challenges arose, such as the 'Didam Arrest' or nitrogen restrictions, De Beuk was eager to understand the fundamentals of these issues and how to address them. WR was able to draw on actionable knowledge from its own network. Conversely, WR gained valuable insights for the BIOTraCes research. One of the most important lessons was how regulations and relationships with nature converged in the case, revealing that values and behaviours, often kept outside the housing sector, are highly relevant when aiming for a positive relationship with nature. De Beuk demonstrated how social, technical and ecological aspects of housing can be integrated, showing WR that separating the social from the physical act of building is shortsighted. Their plans illustrated that a positive relationship with nature is possible, provided lifestyle adjustments are made.

For WR, another key lesson concerned group dynamics, which proved central to success or failure. Members of *De Beuk* invested significant time in workshops with dedicated tasks. Their group dynamics were based on selforganisation rather than anarchism, and learning occurred at a professional level, with solutions tailored and implementable. Differences between groups—for example, between younger and older members—remained visible, particularly in the patience shown in discussions.

Learning also emerged from a critical dilemma within *De Beuk*. Some members hold a transcendental view of nature, seeing it as a worldview requiring internalisation rather than proof. For them, facts such as species counts are less relevant; instead, they emphasise lived experience, such as the belief that healthy vegetables require healthy soil regardless of chemical standards. Others recognised the necessity of traditional ecological impact assessments to obtain permits, requiring evidence that protected species and habitats would not be harmed. Students working on ecological assignments encountered this controversy. As the dilemma cannot be resolved purely through facts, it required negotiation and discussion among members. They learned to manage these differences by taking time to deliberate and reach solutions.

For Natuur voor Elkaar, the concept of transformative change proved inspiring. Participation in a European project highlighted the range of options available for programme development. WR learned from the provincial partner how sensitive their work is to language. The Natuur voor Elkaar network provided numerous learning opportunities, as members were eager to share and absorb information across the planning and building process. This revealed the complexity of the sector and the many relationships between actors. Interestingly, there was a clear need for formal arrangements and regulations to maintain a level playing field. Common questions addressed to the programme include: "When are we doing well enough?" and "What constitutes a satisfactory level of nature inclusion?" No definitive answers exist. However, WR and BIOTraCes observed that such questions are less pressing when the focus shifts towards nature positivity.

6.6 Testing of interventions

An intervention aims at changing the system of relationships constituting the sector, to change business as usual. It can be about working methods, about power, about exclusion and so on. A strategy is a choice from a spectrum of possibilities of actions to be taken to achieve a specific goal. A strategy must be viewed from the perspective of innovation; An intervention should be seen as action and reaction between innovation and system. A strategy is maximally focused on a goal; an intervention can also be aimed at creating space or a favourable condition for change.

We looked at interventions, actions and strategies that the biodiversity innovations have and also what BIOTraCes contributes. There is not really a single intervention that stands out, but rather a process that was navigated. For De Beuk quite some difficulties presented themselves in alternation. The knowledge of WR was often called upon.

De Beuk primarily wants a different way of dealing with nature for the place where they wanted to live. In doing so, they run into a sector that works against this, because it is not in line with how the sector is organized and how the sector thinks. As such it is a secondary goal is to influence the sector, in which there is more of a strategy than that De Beuk can be seen as an intervention. For *Natuur voor elkaar*, it is slightly different. Here the emphasis is more on making the sector nature-inclusive and then the entire program can be seen as an intervention. Here too, it is mainly a situation of gradually developing and putting strategies into practice. The interventions we discuss are therefore usually not aimed at a total change in the sector, but at achieving their goal. The process our societal partners went through can primarily be characterized as a learning and navigating experience. Despite this characterization we will discuss testing the innovative actions. First, we will dive into the story of De Beuk, secondly in that of *Natuur voor Elkaar*.

De Beuk

At the local level, De Beuk has succeeded in persuading most of the Wageningen council that their ideas for an ecovillage and ecocommunity would be suitable for the site. This has not been achieved through argument alone; earlier versions of the plan had already stalled at provincial level. For the municipality, the site requires careful consideration in relation to the adjacent Natura 2000 areas. The council is open to De Beuk's proposal at an abstract level and is even assisting them in securing funding for a feasibility study, which will help strengthen their position with landowners. However, the municipality does not go further. It could have purchased the land under its legal preference provision and commissioned it through its Collective Private Commissioning (CPO) policy, but this was deemed an unacceptable financial risk. Another option would have been to change the zoning plan so that only an ecovillage could be built there. A precedent exists in another municipality, but such a process would be lengthy, requiring changes to the environmental vision, the environmental plan and its regulatory framework, with no guarantee of standing up in court in the event of a formal protest.

The landowner, the State Forestry Department (SBB), although itself a national nature management organisation, is not receptive to *De Beuk's* ideas. Facing financial difficulties and budget cuts, it is primarily interested in achieving the highest possible market price. On the other hand, following a network meeting involving SBB's innovation division, colleagues expressed strong support for the plans, and subsequent appointments were scheduled.

Confronted with nitrogen challenges, De Beuk adjusted its sector intervention, though not its biodiversity innovation, by introducing a new nature typology, which they call *humaninclusive nature*. This intervention is still at an early stage and requires further development. The next step is to gain support from innovative actors in collective housing, followed by a formal request for pilot status. This will be submitted to the provincial governor or, if unsuccessful, directly to the minister. BIOTraCes has been asked to assist

in developing the typology and to join the delegation to the governor. This, however, lies in the future, and there is nothing concrete to test yet.

Overall, responses from public and semipublic actors in the sector have been positive, while reactions from private actors are not yet visible. The most promising intervention with transformative potential is the concept of a novel nature typology in which humans are integrated, under the condition of nature positivity.

Natuur voor Elkaar

The programme Natuur voor Elkaar has been under development for several years. In its early phase, the focus was on activating and building a network or community, within which new forms of cooperation also emerged. Joint storytelling on nature-inclusive building and the Natuur voor Elkaar community is now seen as the next step. In this context, WR organised a workshop and exchange on ownership and shared awareness, centred on developing a collective narrative about nature-inclusive building. In later feedback, participants noted that this positively influenced cooperation, marking the beginning of a shared story and a sense of ownership, although this remains a work in progress.

When considering how the programme's ideas and plans are being transferred to the wider sector, it is clear that actors within the network are enthusiastic about including nature in new neighbourhoods. However, this enthusiasm is largely confined to those directly involved.

Each year, the province organises the symposium Congres Natuurlijk [Symposium Naturally]. In recent years, attendance has exceeded 400 participants, with waiting lists required. WR has been observing, discussing and reflecting on changes in thinking and working practices for three consecutive years through workshops on obstacles and leverage points, the role of actors in the sector and power relations in transformative change, and on human–nature relations (e.g. Mens in de natuur, natuur in de mens / People in Nature and Nature in People). These workshops have tested how theories resonate with sector representatives and how discourse on these topics is evolving. While indicative, further research is needed to understand how institutions are, or are not, being taken along in the process of innovation.

New innovative practices are indeed being realised, though their influence and disruptive potential remain open to debate. Change is gradual and has not yet reached the mainstream of the sector. Private partners are willing to integrate nature more fully into their plans but call for binding regulation to ensure a level playing field. It is expected that governmental actors will eventually follow, though this will take time. At present, the request is directed at provincial authorities, but it must also be addressed at national level. The issue therefore needs to migrate from provincial to national politics.

These developments reflect a transitional process of experimenting with spatial configurations and technical adaptations that allow nature to enter human habitats. A further question is whether innovators within the network will continue their efforts once the programme ends. On this point, BIOTraCes cannot yet provide an answer, it will only become clear in the near future.

6.7 Discussion

Introduction of a New Nature Type

The most notable intervention introduced by De Beuk is a new nature type in which humans coexist with nature. This typology is intended to take its place alongside existing categories used to mitigate and compensate for the impacts of construction on natural areas. It is too early to draw conclusions about the acceptance of this conceptual innovation, which would imply a fundamental shift in the urbanisation sector.

So far, De Beuk's plans to create a habitat where humans and nature can codevelop run counter to regulations based on the assumption that human presence always has a negative impact on nature. Such impacts are considered inherent and unavoidable, and can only be mitigated or compensated. This highlights an important insight: prevailing images of nature are framed in terms of restoration, how nature is, has been, or can be, rather than how it might evolve in experimental settings alongside humans. At present, no innovation policy or framework exists to support human–nature relationship experiments, which represents a barrier to exploring the outcomes of a naturepositive society.

The new nature type developed by De Beuk clearly has transformative potential. Its implications could be farreaching, opening new avenues for collective living experiments that bring people closer to nature. However, integrating this concept into policy could also have unforeseen effects. An ex-ante policy evaluation would therefore be required. At present, there are no signs of acceptance.

Persisting Tensions, Barriers and Structural Forces

It may be tempting to highlight barriers that could be resolved to transform the sector into a naturepositive one. However, this would not fully reflect the praxis observed. The challenges are manifold and arise from multiple directions: time, finance, permits, complexity, knowhow, institutional culture, incoherent policies between national and local levels, assumptions about human–nature relations, lack of frameworks to foster naturepositive lifestyles, a profitdriven sector with high margins, perceptions that including nature reduces profits, and the pressing societal issue of housing shortages—particularly for young people, which drives demand for standardised, largescale housing projects. The reliance on generic target groups also fails to engage meaningfully with nature.

These tensions coincide with biodiversity innovations such as Natuur voor Elkaar and De Beuk. Addressing them may begin with human–nature relationship innovations that encourage naturepositive lifestyles. Such approaches represent disruptive innovations—ones the sector itself would not generate. They emerge from groups operating at the margins, motivated not by profit but by values, and willing to make sacrifices to live closer to, and more harmoniously with, nature.

Dilemma of Nature Positivity

As shown above, the case of De Beuk is marked by normative frictions. One such friction concerns the location chosen for their plans. The site forms part of the distinctive landscape of the Wageningse Es, a gardenlike patchwork once used for tobacco cultivation, and is embedded within Natura 2000 forest. Ideally, such an area would not be transformed into a residential zone.

Our discussion of De Beuk's plans has been framed through action research. This does not mean that all researchers are committed to living there themselves. *De Beuk* is neither more nor less than an innovation that challenges the sector. Examining the sector through the lens of De Beuk provides valuable insights into its dynamics. At the same time, we have also considered *De Beuk* from the system perspective of the sector itself.

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b. Foot Notes

- ¹ <https://www.collectiefnatuurinclusief.nl>
- ² <https://www.cbs.nl/nl-nl/nieuws/2024/18/minder-natuur-en-bosgebied-in-nederland>
- ³ <https://debeukwageningen.nl/>
- ⁴ <https://www.overijssel.nl/onderwerpen/natuur-en-landschap/de-natuur-in-overijssel-dichter-bij-mensen>
- ⁵ <https://www.natuurvoorelkaar.nl/>
- ⁶ <https://www.overijssel.nl/onderwerpen/natuur-en-landschap/de-natuur-in-overijssel-dichter-bij-mensen/>
- ⁷ <https://kennishub-landelijk-gebied-overijssel.hub.arcgis.com/pages/kengetallen-landbouw-agrarisch-grondgebruik>
- ⁸ <https://www.gelderland.nl/themas/natuur>
- ⁹ <https://www.gelderland.nl/themas/natuur/natuurdoelanalyse>
- ¹⁰ This was called 'Gelderse Natuurmakers'
- ¹¹ <https://debeukwageningen.nl>
- ¹² <https://datawonen.nl/dashboard/dashboard/kerncijfers-woningbouw>, CBS-BAG - Basisregistraties adressen en gebouwen - bewerking ABF datawonen.nl Retrieval date: Monday 30 September 2024
- ¹³ <https://opendata.cbs.nl/statline/#/CBS/nl/dataset/81955NED/table?fromstatweb>

- ¹⁴ <https://datawonen.nl/dashboard/dashboard/kerncijfers-woningbouw>
- ¹⁵ <https://open.overheid.nl/documenten/ronl-9d49f1d4-dc8c-49b7-be8a-e30936722552/pdf>
- ¹⁶ Since 2024 integrated in the National Environmental Law
- ¹⁷ Influential platforms are for example <https://biodiversiteit.frl> and deltaplan biodiversiteit <https://www.samenvoorbiodiversiteit.nl>
- ¹⁸ <https://www.linkedin.com/company/gideon-building-transition-tribes/posts/?feedView=all>
- ¹⁹ www.bouwnatuurinclusief.nl
- ²⁰ <https://zoop.earth/nl/>
- ²¹ <https://www.milieucentraal.nl/huis-en-tuin/tuin/maand-van-de-groene-tuin/>
- ²² <https://www.duurzaamdoor.nl>
- ²³ <https://www.biind.nl/longread/ook-de-bouwsector-aan-de-slag-met-natuurinclusief-bouwen>
- ²⁴ <https://www.duurzaamdoor.nl/participatietafel-natuurinclusief-bouwen>
- ²⁵ <https://www.bouwendnederland.nl/nieuws/algemeen/stikstof-zet-bouw-244000-woningen-op-slot-en-economische-schade-van-138-miljard-dreigt> Retrieval date: 14 March 2025
- ²⁶ <https://media.umbraco.io/bouwend-nederland/2utk4aqb/versnellingsplan-versie-20-november-2024-definitief.pdf> Retrieval date: 14 March 2025
- ²⁷ [https://www.eib.nl/pdf/'Koopstarters%20op%20de%20woningmarkt'%20-%2015042021%20\(002\).pdf](https://www.eib.nl/pdf/'Koopstarters%20op%20de%20woningmarkt'%20-%2015042021%20(002).pdf)
- ²⁸ Time Use Survey in the Social State of the Netherlands; CBS data
- ²⁹ <https://www.clo.nl/indicatoren/nl201210-wonen-binnen-bestaand-bebouwd-gebied-2000-2023>
- ³⁰ <https://www.provincie-utrecht.nl/onderwerpen/ruimtelijke-ontwikkeling/groen-groeit-mee>
- ³¹ The Environmental law and more specific the BBL (Bouwbesluit Bouwwerken Leefomgeving) dictates minimum requirements to the dimensions of a house
- ³² <https://www.cbs.nl/nl-nl/nieuws/2025/26/wooncarriere-starters-begint-vaak-in-een-private-huurwoning>
- ³³ <https://www.ser.nl/nl/actueel/zicht/op/art-man-vrouwverhouding>
- ³⁴ <https://www.bayoakomolafe.net>
- ³⁵ <https://www.cbs.nl/nl-nl/longread/rapportages/2025/de-gebruikswaarde-van-natuur-in-nederland?onpage=true>
- ³⁶ https://www.tijdschriftcdv.nl/actueel/nieuws/130-48_Naar-een-nieuwe-natuurvisie
- ³⁷ <https://toekomstbestendigbouwen.nl/convenanten/>
- ³⁸ Table 14 is the product of interpretation by the writers of this report. It resonates with the framework of values approach in IPBES, see Luque-Lora, Rogelio, 2024. IPBES: *Three ways forward with frameworks of values*. Environmental Science and Policy 159. <https://doi.org/10.1016/j.envsci.2024.103827>

c. Overview of workshops and interviews hosted by WR

Table 19 - Overview of workshops and interviews hosted by WR

Date	Partner	Activity	Description
19-04-2024	De Beuk	Workshop	Workshop with members to discuss actors around the Beuk and their power
28-05-2024	Provincie Overijssel	Workshop	Workshop with members to discuss actors around the program Nature for Each Other and their power
June 2024	Provincie Overijssel	Interview	In this month, 7 interviews were conducted with actors involved in the policy program nature for each other
March-April 2024	De Beuk	Interview	In this month 6 interviews with 7 participants were conducted with members of the Beuk
22-01-2025	De Beuk and Provincie Overijssel	Workshop	Thinkers and do-ers from diverse backgrounds gathered to explore how nature-positive living and nature conservation can reinforce each other. In a roundtable discussion, these experts shared their experiences and insights. How can initiatives survive in a system that primarily focuses on harm reduction? And how can the system world learn from innovative citizen initiatives?
26-05-2025	Provincie Overijssel	Workshop	Workshop on storytelling: how do you create a story that different partners can spread?
4-10-2025	De Beuk	Workshop	Koen de Kruif (Gen-NL & de Beuk), Ad Vlems (Ecodorp Boekel) and Zoë van Eldik (BIOTraCes) hosted a session about 'living as nature' on the Cooperative Living Day (organized by Cooplink). Around 25 people participated in the session, mostly members of cooperative living initiatives. After a quick check in, the hosts kicked off the session with a short presentation.

Conclusions

Authors: UNICT

Reviewers: BC3, CES and WR

The conclusions of this analysis of case studies can be read as a comparative synthesis of the nine cases, organised around three recurrent clusters of elements:

- The barriers and lock-ins that hinder nature-positive change.
- The enabling conditions and enabling actors that support transformative processes.
- The directions for future action in biodiversity governance policies and practices.

In this context, the first part of the conclusions can be understood as a **mapping of barriers**: it foregrounds the structural drivers of biodiversity decline, the various forms of institutional fragmentation, and socio-ecological inequalities, showing how values, power and behaviour combine in configurations that generate lock-ins and complicate the upscaling of local innovations. The second part focuses instead on **enabling conditions**: here, transformative biodiversity innovations, collaborative governance and co-produced interventions with stakeholders are interpreted as dispositive that redistribute power, pluralise knowledge systems and open spaces for learning, in line with the four PEPE principles of the Theory of Transformative Change.

Finally, the section on **governance and future prospects** translates these findings into forward-looking orientations, relating the patterns observed across the cases to the need to dismantle systemic barriers, mobilise key actors as enablers of change, and delineate institutional and policy pathways capable of sustaining inclusive, nature-positive socio-ecological transformations over time. Within Deliverable 2.5, *Analysis of Case Studies*, this reading guide thus suggests approaching the conclusions not merely as a summary of empirical results, but as a grounded, comparative articulation of some key conceptual lenses for understanding the trajectories of transformation unfolding across the nine territories.

Barriers to Biodiversity Regeneration

Patterns of Socio-Ecological Transformation Across the Nine Cases

Across the nine BIOTraCes case studies, a consistent set of patterns becomes visible regarding how biodiversity pressures are produced, how local actors respond, and which conditions shape the prospects for change. Despite their different ecological, institutional, and social contexts, the cases reveal shared dynamics that shed light on how innovative practices take shape and where they encounter limits. These dynamics highlight the importance of structural factors, institutional arrangements, and everyday constraints in determining whether efforts toward socio-ecological change become more substantial or even upscale or remain isolated in scope and vulnerable to reversal.

This comparative synthesis therefore weaves together insights on transformative innovations, socio-ecological system dynamics, and locally tested interventions. Here, innovation is understood not as the introduction of new technologies or standardized conservation tools, but as the emergent, situated adjustments through which human and nonhuman actors reorganize themselves in response to specific social-ecological pressures. Grounding the cross-case analysis in these cumulative findings allows the synthesis to show how such context-specific, often adaptive practices shape both the possibilities and the limits of biodiversity governance across different territories.

Taken as a whole, the cases illuminate how biodiversity is not a discrete object to be protected, but a relational process shaped by values, power relations, infrastructures, imaginaries, and the lived realities of communities navigating rapid environmental and

socio-economic change. Biodiversity outcomes emerge from these intertwined processes rather than from biophysical conditions alone. As a result, the barriers to its regeneration must be understood as deeply embedded within broader socio-ecological regimes and structural challenges, rather than as isolated ecological deficits.

Structural Drivers of Biodiversity Decline

One central element emerging from the comparative analysis concerns the structural drivers of biodiversity decline, which manifest with notable consistency across rural, peri-urban, and urban contexts. Land-use intensification—through monocultures, industrial agriculture, real-estate development, or infrastructure expansion—remains a dominant pressure that simplifies ecosystems, fragments habitats, and erodes ecological connectivity. Market-based rationalities prioritising productivity, short-term returns, and cost efficiency reinforce such dynamics across agriculture, energy, water management, and spatial planning. The case studies show how these economic logics frequently prevail even when ecologically viable alternatives exist, thereby narrowing the range of practices that are considered realistic or legitimate.

Climate instability exacerbates these trends. Droughts, floods, and extreme temperature events in dryland territories such as Mértola, riverine systems such as the Simeto Valley, wetlands in Lithuania, and forested areas in Sweden and Romania further weaken already fragile ecosystems. Across the cases, these pressures appear not only as biophysical or economic trends, but as expressions of dominant sectoral paradigms that frame biodiversity through instrumental and efficiency-oriented lenses. Such paradigms reproduce extractive trajectories, marginalise relational understandings of nature, and constrain the institutional space for regenerative socio-ecological configurations. As a result, the structural context in which the project operates is one in which ecological degradation is systemic rather than episodic, and where efforts at restoration or conservation must contend with deep-rooted economic and policy models.

In many territories, these structural pressures are further reinforced by global commodity chains, financialization of land, and development strategies that privilege large-scale investments over small-scale ecological stewardship. Local actors—farmers, forest owners, herders, small-scale producers—often find themselves navigating landscapes whose dominant economic logic pushes towards intensification even when they hold deep ecological knowledge and cultivate strong attachments to place. This tension between extractive pressures and place-based care emerges as a defining feature across Europe's socio-ecological landscape and constitutes a major barrier to biodiversity regeneration.

Governance Fragmentation and Institutional Lock-ins

Equally significant are the effects of governance fragmentation and institutional lock-ins. All case studies report that responsibilities for biodiversity, land use, water, planning, agriculture, and energy are dispersed across multiple authorities whose mandates often overlap or contradict one another. This fragmentation generates institutional blind spots, weakens accountability, and obstructs coordination, especially when cross-sectoral issues—such as river basin management, agroecological transitions, or nature-inclusive urban development—are at stake.

Administrative procedures—particularly in the Dutch (Wageningen) and Hungarian cases—tend to privilege actors with technical expertise, financial resources, or legal literacy, reinforcing long-standing power asymmetries and excluding newcomers or marginalised groups. In the Italian, Lithuanian, and Romanian territories, weak administrative capacity, limited financial resources, and fluctuating political priorities constrain the ability of local institutions to sustain long-term ecological strategies, even when there is political will or civic pressure to do so.

These institutional lock-ins help explain the persistent gap between policy ambition and implementation. Even when interventions align with European or national objectives, they

are frequently slowed or undermined by procurement constraints, bureaucratic rigidity, or accountability systems that measure performance in narrow technical or economic terms rather than in relation to ecological and social regeneration. These dynamics reveal a structural tension at the heart of European biodiversity governance: ambitious targets coexist with governance architectures that systematically impede their realisation.

Across multiple cases, institutional fragmentation is not only administrative but also epistemic. Governance cultures often privilege specialised expert knowledge at the expense of situated, experiential, community-based forms of ecological understanding. This creates a double lock-in—bureaucratic and behavioural—that limits the capacity of institutions to learn from local practices, adapt to changing socio-ecological conditions, and co-evolve with diverse territorial contexts. Overcoming such lock-ins requires not only reforming procedures but also building cultures of collaboration capable of recognising different ways of knowing and valuing nature.

Uneven Socio-Ecological Vulnerabilities

The case studies also demonstrate that socio-ecological vulnerabilities are unevenly distributed across groups and territories. Exclusion operates through interlinked social, spatial, and epistemic mechanisms. Socio-economic marginalisation—affecting migrant agricultural workers in Italy, Roma communities and isolated elderly residents in Portugal, or low-income rural households in Romania and Lithuania—limits actors' capacity to participate in decision-making, access ecological resources on fair terms, or engage in regenerative practices that may require time, knowledge, or material investment.

Spatial peripherality further exacerbates inequalities, restricting access to services, mobility, and environmental quality for residents of isolated villages, peri-urban margins, or degraded riverine areas. In these places, exposure to pollution, hydrological risk, or land-use change often coincides with weaker institutional presence and limited political visibility. Epistemic exclusion is equally present: traditional, experiential, and community-based forms of ecological knowledge are frequently undervalued or rendered invisible within institutional assessments. The innovation narratives show that such exclusions are historically sedimented within governance cultures that privilege scientific-technical expertise and dismiss local or traditional knowledge as outdated or irrational, thereby reinforcing long-term socio-ecological injustice and narrowing the cognitive and practical repertoire available for biodiversity regeneration. There are cases – such as Mértola – that illustrate an alternative trajectory. Here, tacit knowledge carried by elderly women, refugees and farmers is recognised as epistemically legitimate and contributes directly to governance and innovation. This stands in clear contrast to the dominant patterns of epistemic exclusion, where such knowledge tends to be marginalised or dismissed.

Across the nine contexts, vulnerability emerges as a relational condition shaped by intersecting forms of inequality, including economic precarity, limited mobility, land dispossession, racialisation, gendered labour dynamics, and unequal access to voice in governance arenas. Biodiversity decline and human vulnerability are thus co-produced: degraded ecosystems amplify social fragility, while social fragility often inhibits communities' capacity to defend or regenerate ecosystems. Recognising these entanglements is essential for designing interventions that are not only ecologically effective but socially just and attentive to the differentiated capacities of actors to participate in transformative change.

Plural Ecological Worldviews and Value Conflicts

Another key dimension concerns the plurality of ecological worldviews across the nine territories. The case studies reveal contrasting ways of valuing and relating to biodiversity. Relational and place-based ontologies underpin agroecological and community initiatives in Italy, Portugal, and Sweden, where ecological care is grounded in everyday practices, cultural memory, and long-term territorial attachments. Justice-oriented and commoning

perspectives drive the Dutch (Twente) case, where land is understood as a shared resource and biodiversity becomes closely intertwined with struggles over the right to the city and access to space for food production and social life. In contrast, in the Dutch (Wageningen), Lithuanian, Romanian, and Spanish contexts, biodiversity is more often framed through scientific or conservationist lenses, with nature understood via metrics, assessments, and compliance with regulatory frameworks.

These differences matter because they shape what counts as a legitimate ecological concern, who is recognised as a relevant actor, and which solutions are deemed feasible or desirable. The socio-ecological system analyses indicate that transforming these configurations requires shifts in the narratives that organise practice, politics, and personal imaginaries, so that more relational understandings of human–nature interdependence can enter governance arenas and reshape what is seen as possible and worth pursuing. Across all cases, transformative change emerges not from imposing one worldview over another but from creating deliberative spaces where divergent valuations—scientific, relational, activist, technical, and conservationist—can interact, coexist, and mutually inform decision-making.

These plural worldviews also produce conflicts—over land, rivers, forests, infrastructures, and urban spaces—that function as critical moments where underlying values and assumptions become visible. Conflicts, rather than being symptoms of dysfunction, can open opportunities for the articulation of new ecological visions, the renegotiation of territorial priorities, and the construction of alliances that would otherwise remain latent. The cases therefore demonstrate that negotiating plural values is not a marginal task, but a central condition for enabling socio-ecological transformation.

Table 20 - Observed barriers, their sub-dimensions, and relevant cases

Observed Dimension	Sub-dimensions or Characterising Actions	Cases Where Particularly Salient
Governance Fragmentation and Institutional Lock-ins	Dispersed mandates across sectors; contradictory responsibilities; administrative complexity that favours established actors; limited capacity in local institutions; narrow audit and performance metrics; epistemic lock-ins privileging expert knowledge.	• WR (Netherlands) • CER (Hungary) • UNICT (Italy) • UBB (Romania) • MRU (Lithuania)
Uneven Socio-Ecological Vulnerabilities	Intersecting forms of socio-economic, spatial, and epistemic exclusion; reduced ability to engage in regenerative practices; heightened exposure to environmental risk; marginalisation of community and traditional knowledge; vulnerability as a relational condition.	• UNICT (migrant agricultural workers) • UBB & MRU (low-income rural households)
Plural Ecological Worldviews and Value Conflicts	Coexistence of relational, scientific, conservationist, activist perspectives; divergent valuations shaping legitimacy of concerns and solutions; conflicts revealing underlying assumptions and opening renegotiation of priorities.	• UNICT (relational agroecology) • CES (regenerative worldviews) • UGOT (relational forestry) • UT (communing, activist framings) • WR/MRU/UBB/BC3 (scientific and conservationist framings).

Enabling and Transformative Conditions

Characteristics and Fragilities of Transformative Innovations

Alongside these barriers, the case studies also identify a wide spectrum of transformative biodiversity innovations. Despite their diversity, these innovations—agroecology, community-supported food systems, participatory mapping, open ecological data, nature-inclusive spatial design, land stewardship initiatives—tend to share a set of common properties. They are generally small-scale, relationally grounded, and experimental. They mobilise combinations of local knowledge, civic engagement, and cross-actor collaboration. Their transformative potential lies not in technological novelty as such, but in their capacity to reconfigure human–non-human relations and challenge dominant socio-ecological dynamics rooted in extractive logics by creating new social-ecological imaginaries.

Yet these innovations remain structurally fragile. They are often dependent on volunteer labour, personal commitment, project-based funding, or the support of a limited number of organisations and individuals. Across the innovation cases, their transformative significance lies less in novelty per se than in their capacity to cultivate political imagination, nurture new alliances, and foreground practices of multispecies care. Their fragility reflects the structural asymmetries of the regimes in which they operate rather than any inherent weakness.

In several territories, these innovations also act as pedagogical spaces where communities experiment with alternative futures, including new forms of land tenure, cooperative governance, place-based monitoring, ecological restoration, and collective food strategies. They demonstrate that transformation is not only institutional or infrastructural, but also experiential, emerging from learning processes that reorient how communities perceive, value, and inhabit their environments. The potential of such innovations lies in their ability to embed new narratives of care, responsibility, and reciprocity within everyday life and to link them to broader struggles for environmental and social justice.

Hybrid Socio-Ecological Regimes

Insights from the socio-ecological systems analyses indicate that all territories display hybrid socio-ecological regimes in which extractive and regenerative dynamics coexist and interact in complex ways. Feedback loops link water, energy, land, and food systems, producing reinforcing cycles that either perpetuate degradation or open possibilities for recovery. These systems are highly sensitive to governance decisions and cross-scale influences; changes in one domain—such as river restoration, agroecological experimentation, procurement reform, or shifts in land-use planning—can produce cascading effects across others.

From a process-relational perspective, systemic change depends on disrupting the dominant instrumental logic of high-impact sectors and embedding relational values, community stewardship, and multispecies ethics within institutions, rather than treating them as rhetorical add-ons. Hybrid regimes also reveal the political nature of ecological transformation: regenerative efforts must continually negotiate with entrenched interests, historical legacies, institutional routines, and dominant paradigms of high impact sectors that stabilise extractive models. At the same time, they offer spaces of possibility, where small shifts—new alliances, policy windows, community-led experiments—can alter feedback loops and generate new socio-ecological trajectories. Understanding these dynamics is crucial for identifying leverage points and designing interventions that act across scales and sectors rather than within isolated domains.

Conditions That Enable or Disrupt Interventions

The same cross-case perspective sheds light on the factors that enable or disrupt interventions. Enabling conditions include long-term, trust-based collaborations between researchers, civic organisations, and local administrations, as well as facilitation

infrastructures such as living labs, participatory mapping processes, community festivals, and co-design workshops. These spaces allow actors to build community and social cohesion and to develop shared diagnoses, explore options, and negotiate trade-offs, thereby consolidating the social and organisational foundations of transformative practices.

Conversely, obstacles such as bureaucratic rigidity, unstable funding, political turnover, and conflicts over land use or resource allocation often shape the trajectory of interventions more than their technical design, determining whether they remain isolated experiments, are diluted into conventional practices, or evolve into embedded and durable configurations. The intervention analyses show that such initiatives function as political devices that interrupt dominant routines, redistribute visibility and power, and open spaces for alternative socio-ecological relations; their importance often lies in the alliances, conflicts, and repertoires of action they set in motion beyond the temporal and spatial boundaries of specific events.

Successful interventions consistently demonstrate the importance of mediation: actors or organisations capable of translating between institutional languages and community perspectives, stabilising collaborations, and generating trust across divergent interests. These mediating roles, often performed by boundary organisations, facilitators, or local leaders, are essential yet frequently undervalued within formal governance frameworks. Strengthening these relational infrastructures is fundamental for enabling innovations to endure beyond individual projects and to influence broader governance arrangements.

Transformative Change Through the PEPE Principles

Taken together, the cases refine the Theory of Transformative Change developed within the BIOTraCes project. The principle of Pluralising is visible in efforts to bring together heterogeneous knowledge systems—scientific, traditional, experiential, activist, and relational—thus broadening the epistemic foundations of biodiversity governance and challenging dominant technocratic paradigms. Empowering emerges in attempts to redistribute agency to community organisations, informal networks, local producers, and historically marginalised groups, recognising them as protagonists rather than mere beneficiaries of ecological policies.

Politicising appears in the foregrounding of power asymmetries, structural inequalities, and contested valuations of nature that shape ecological outcomes. By making these dimensions visible, actors can reframe biodiversity loss from a purely technical or managerial problem into a socio-ecological issue rooted in uneven development, histories of exclusion, and competing moral economies. Embedding, however, remains the most difficult dimension to achieve. Many innovations show promise but remain dependent on temporary funding or favourable political moments, and few benefit from legal or organisational infrastructures that could stabilise them over time.

The innovation, socio-ecological systems, and intervention perspectives converge in identifying Embedding as a central bottleneck for long-term transformation: without durable institutional arrangements, relational infrastructures, and adaptive funding systems, practices that pluralise, empower, and politicise remain vulnerable to rollback, co-optation, or exhaustion. The four PEPE principles thus operate not as isolated components, but as mutually reinforcing processes: pluralising expands what is thinkable, empowering expands who can act, politicising expands what is contestable, and embedding expands what can endure. Transformative trajectories emerge where all four processes intersect, enabling communities and institutions to reconfigure their relations with nature in more equitable and ecologically grounded ways.

Table 21 - Conditions supporting or hindering transformative action

Observed Dimension	Sub-dimensions / Characterising Actions	Cases Where Particularly Salient

Characteristics and Fragilities of Transformative Innovations	Small-scale, relationally grounded, experimental initiatives; mobilisation of local knowledge and civic engagement; reconfiguration of human–nonhuman relations; structural fragility due to volunteer labour, project funding, limited organisational anchoring; innovations as pedagogical spaces for alternative futures.	• CES (regenerative agriculture, food systems) • UNICT (agroecology, ecomuseum practices) • UT (land commoning) • WR (nature-inclusive planning) • CER, UGOT (community and landowner innovations).
Hybrid Socio-Ecological Regimes	Coexistence of extractive and regenerative dynamics; cross-sectoral feedback loops; system sensitivity to governance decisions; need to embed relational and community values institutionally; hybrid regimes as both constraints and opportunities.	• UNICT (water–agriculture–energy nexus) • CES (dryland regeneration) • UBB (HNV vs intensification, abandonment) • MRU (dam-regulated rivers) • WR/UT/BC3 (urban and peri-urban hybrid regimes).
Conditions That Enable or Disrupt Interventions	Enablers: trust-based relationships; facilitation infrastructures (living labs, mapping, festivals, co-design); co-learning processes; mediating roles of boundary actors. Disruptors: bureaucratic rigidity; funding instability; political turnover; land-use conflicts; uneven actor capacities; risk of dilution or rollback.	• UNICT (Presidio, participatory mapping and festival) • CES (TSA, CMM and other key actors enabling food system) • BC3 (schoolyard renaturing) • UT (mediation in land-use conflict) • WR (procedural constraints) • CER, UBB, MRU (dependency on intermediaries).
Transformative Change Through the PEPE Principles	Pluralising (diverse knowledges), Empowering (redistribution of agency), Politicising (making power asymmetries visible), Embedding (institutional stabilisation). Embedding emerges as the main bottleneck across all cases; the four principles operate as interconnected processes.	All nine cases, with differentiated emphases: strong pluralising and empowering in UNICT, CES, UT, UGOT; politicising in UT, UNICT, WR, BC3; embedding weakest across all sites.

Prospects for Biodiversity Governance and Future Action

Convergences and Divergences Across the Nine Territories

Cross-case comparison reveals both commonalities and divergences. Convergences include shared structural pressures—extractive land uses, speculative development, intensive agriculture, fragmented governance—and persistent mechanisms of exclusion that limit who can influence ecological decisions. Community-driven innovations arise in all cases, attempting to reconfigure human–nature relations through agroecology, commoning practices, participatory monitoring, or regenerative land-use experiments, often with limited resources but considerable symbolic and political impact.

At the same time, the divergences are equally instructive. The cases differ markedly in their governance cultures. In some contexts, institutions operate within centralised administrative systems with rigid procedural requirements; in others, actors rely on more fragmented or politically volatile local institutions. A third pattern also emerges in cases, where institutions build mutually reinforcing arrangements that stabilise collaborative

governance. Here, local authorities, civil-society organisations and producers operate within a shared strategic horizon, which differentiates this context from both centralised and fragmented governance systems.

Ecological-conditions vary significantly—from dryland socio-ecologies to wetlands, forests, and peri-urban mosaics—producing differentiated vulnerabilities, opportunities, and constraints on transformation. Socio-economic structures further modulate what kinds of interventions are feasible: depopulating rural areas face challenges distinct from those of rapidly developing urban fringes, while regions marked by longstanding land inequalities grapple with different issues than those characterised by recent urban sprawl.

The functioning of participatory infrastructures—from well-established civic networks to emergent or fragile coalitions—conditions the capacity of actors to mobilise, sustain innovations, and negotiate with institutions. Taken together, these divergences underscore that transformative change cannot follow standardised templates: it requires pathways that are deeply context-sensitive, attentive to local histories, ecologies, and institutional configurations. Reading the nine cases as dynamic relational assemblages highlights how trajectories of change depend on locally specific interactions between values, rules, ecological processes, and actor networks, and cautions against one-size-fits-all models of transformation. This diversity of pathways is not a weakness but a strength, demonstrating that socio-ecological transformation emerges through multiple, situated experiments rather than universal models. Recognising this plurality allows governance systems to support diverse forms of innovation, each attuned to the cultural, ecological, and political textures of its territory.

Implications for European Biodiversity Governance

Taken as a whole, the cross-case insights point to several implications for European biodiversity governance. They highlight, in the first place, the need for integrated socio-ecological planning, in which land, water, food, energy, mobility, and biodiversity are treated as interdependent domains rather than separate policy silos. Such integration is crucial for addressing lock-ins, feedback, trade-offs, and unintended consequences that currently escape fragmented governance systems and lead to shifting burdens across sectors or regions.

The cases also collectively demonstrate the importance of long-term investment in participatory infrastructures—the networks, forums, living labs, civic organisations, and facilitation processes that enable communities to sustain ecological stewardship over time. Strengthening such infrastructures requires not episodic consultation, but durable institutional arrangements and financial continuity that recognise the temporalities of ecological processes and community organising.

Furthermore, the findings call for funding mechanisms oriented toward learning, consistency, and collective agency. Project-based funding windows (e.g. through pilots), while useful for experimentation, rarely support the long-term embedding of transformative practices; a shift toward multi-year, adaptive financing would significantly improve the durability of innovations and allow actors to consolidate gains, adjust to emerging challenges, and widen their alliances. At the same time, the cases show that administrative reforms—reducing procedural rigidity, simplifying access to permits, and strengthening transparency—are critical for enabling grassroots ecological initiatives to interact with public institutions on more equal terms.

There is also a need for financing architectures that recognise and reward qualitative contributions to regeneration—care work, knowledge co-production, and community stewardship—not only the scale and risk-absorption capacities of conventional actors. Otherwise, public support mechanisms will continue to privilege large projects and reinforce path-dependent, high-input models. In addition, biodiversity governance must recognise that ecological regeneration is inseparable from broader questions of justice, territorial identity, and cultural meaning. Policies that neglect these dimensions risk reinforcing inequalities or undermining community legitimacy. A more relational approach

to governance—one that values memory, attachment, local knowledge, and plural ways of inhabiting nature—can foster more durable and socially grounded ecological transitions.

Directions for Future Research and Action

For future research and action within BIOTraCes project and beyond, several priorities stand out. Strengthening comparative learning across territories can illuminate patterns of successful institutional embedding and modes of navigating governance complexity, while also clarifying why some innovations remain marginal or short-lived. Monitoring the long-term institutionalisation of innovations is essential for understanding when and how experimental practices become stable elements of governance routines—or, conversely, why they fail to do so despite initial momentum.

Expanding participatory monitoring and mapping tools, grounded in both scientific and community-based knowledge systems, can support adaptive management and anchor biodiversity governance in local socio-ecological realities. The cross-case work also underscores the importance of trans-local alliances and mutual learning networks that can counterbalance structural power, amplify local experiences, and sustain forms of systemic advocacy that individual territories could not maintain alone.

Finally, future work would benefit from exploring how different forms of territorial identity, cultural heritage, and collective memory influence ecological decision-making, shaping both resistances to change and the emergence of new environmental imaginaries. Understanding these affective and symbolic dimensions can help design interventions that resonate more deeply with local communities, strengthening legitimacy, trust, and long-term commitment. In this sense, biodiversity governance appears not only as a technical or regulatory field, but as a terrain where societies renegotiate their relations with nature, rethink their development trajectories, and experiment with more just, plural, and life-affirming futures.

Table 22 - Forward-looking dimensions and their implications

Observed Dimension	Sub-dimensions / Characterising Actions	Cases Where Particularly Salient
Convergences and Divergences Across Territories	Convergences: shared structural pressures; exclusion mechanisms; hybrid regimes; emergence of grassroots innovations. Divergences: governance cultures; ecological conditions; socio-economic structures; participatory infrastructures. Emphasises the need for context-sensitive pathways to transformation.	Evident across all nine cases.
Implications for European Biodiversity Governance	Need for integrated socio-ecological planning; long-term investment in participatory infrastructures; funding architectures oriented toward learning and continuity; administrative simplification; recognition of qualitative contributions to regeneration; governance attentive to justice, identity, cultural meaning.	Especially relevant in contexts with weak or fragmented administrations like: UNICT, MRU, UBB.
Directions for Future Research and Action	Comparative learning across territories; long-term tracking of institutionalisation; strengthening participatory monitoring and mapping; supporting trans-local alliances; understanding the role of identity, heritage,	Applies across all cases, with heightened importance where

	and memory in ecological decision-making; acknowledging affective and symbolic dimensions of regeneration.	innovations remain fragile: UNICT, CER.

