Article

Relating Social and Ecological Resilience: Dutch Citizen's Initiatives for Biodiversity

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Abstract: Social resilience and ecological resilience are related and distinguished, and the potential of social resilience to enhance resilience of encompassing social-ecological systems is discussed. The value of resilience thinking is recognized, yet social resilience needs to be better understood in its distinctive qualities, while resisting identification of social resilience with one particular form of governance or organization. Emerging self-organizing citizen's initiatives in The Netherlands, initiatives involving re-relating to nature in the living environment, are analyzed, using a systems theoretical framework which resists reduction of nature to culture or vice versa. It is argued that space for self-organization needs to be cultivated, that local self-organization and mobilization around themes of nature in daily life and space have the potential to re-link social and ecological systems in a more resilient manner, yet that maintaining the diversity of forms of knowing and organizing in the overall governance system is essential to the maintenance of social resilience and of diverse capacities to know human-environment relations and to reorganize them in an adaptive manner. Conclusions are drawn in the light of the new Biodiversity Strategy.

Keywords: resilience; self-organization; citizen's initiatives; social-ecological systems; biodiversity

1. Introduction

Resilience has been glorified, vilified, and, in the social sciences, often ignored. In this paper, we argue for its continued importance and believe in its enduring productivity in scientific and policy terms. We emphasize the potential for re-relating people and nature. Biodiversity problems are not going away, alas, and when there is a success, when nature bounces back, the human response is not always beneficial for nature or society. Individuals, communities, and their governance systems are not always equipped with the skills to recognize ecological resilience, and to respond to it in a resilient way. Both social and ecological resilience need work. The unpredictability of plant and animal responses to complex environmental changes, and to attempts to help them by means of conservation and other initiatives, plus the unpredictability of people when confronted with a beaver in their backyard, a swamp in the meadow, or a fence around the forest, makes it hard to speak of social-ecological resilience in a simple and intuitive manner.

Thus, the decline in global biodiversity raises fundamental questions and big challenges. The WWF Living Planet Report 2018 shows a decrease of populations of animals of over 60% compared to 1970 [1]. The Global Assessment Report on Biodiversity and Ecosystem Services is even more alarming by stating that an average of around 25 per cent of species in assessed animal and plant groups are threatened with extinction, suggesting that around 1 million species already face extinction, many within decades, unless action is taken to reduce the intensity of drivers of biodiversity loss [2]. The WWF calls for a 'whole of society approach' in the Convention for Biological Diversity, to counter the loss of species and make the world nature-positive by 2030 [3]. Within the European context,

the Commission correspondingly broadened its biodiversity strategy for 2030. This new biodiversity strategy aims to put Europe's biodiversity on the path to recovery by 2030 for the benefit of people, climate, and the planet [4]. The Commission combines its strategy for the production of fair, environmentally friendly, and healthy food (farm to fork) with policies to bring nature back into peoples' lives. It acknowledges that moving in this direction would require reinforcing resilience, while the result could be a further increase in resilience, as well as biodiversity [4]. This seems to be a significant step on the European level towards a 'whole of society approach'. Resilience in Europe's new strategy is a key concept referring to nature and society.

The new biodiversity strategy responds to the challenges of the IPBES assessment and uses as conceptual framework social-ecological systems thinking, see Figure 1 [5]. It encompasses nature, ecosystem services, anthropogenic assets, direct and indirect drivers of change and good quality of life. However, how does resilience fit in this? It is not considered explicitly in the strategy, despite the fact that there is an impressive body of literature on resilience in social-ecological systems [6–11]. The notion of 'resilience of social-ecological systems (SES)' is widespread in research and policy documents addressing sustainability issues [12]. We start from the idea that resilience of SES deserves greater attention in biodiversity policy, yet also accept the premise that social and ecological systems have their own dynamics, hence their own forms of resilience.
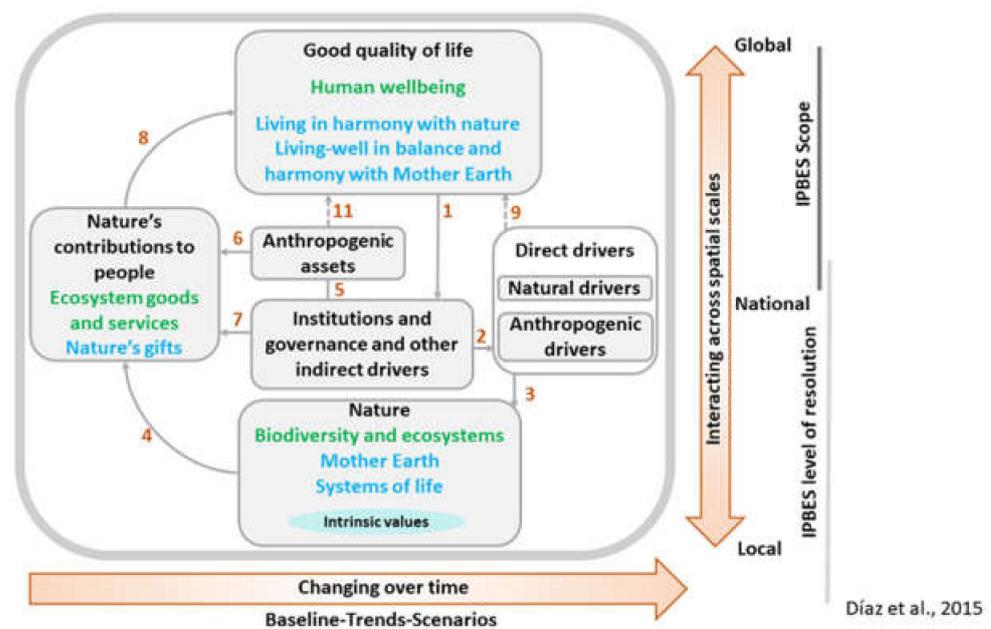

**Figure 1.** Social-ecological systems model in IPBES, based on [5].

The aim of this article is to discuss the logic of resilience in social-ecological systems in the light of this new European biodiversity strategy. The central question we address here is whether resilience in social-ecological systems should be understood as a singular relational characteristic, or as the interplay of ecological and social resilience. The answer will help us in improving social-ecological systems theory to account for social practices wherein citizens are bringing nature back into their lives or are confronted with a recovery of nature in their human habitat. If indeed the EU is right, and nature and society need to be re-integrated in biodiversity policy, then ecological resilience will need to resonate in the social while social resilience needs to be attuned with the rebounding ecosystem. To find the answer, we will discuss the relations between social resilience and ecological resilience mechanisms in three Dutch cases, part of a larger project.

The cases are drawn from a Dutch research project on social resilience and citizens' initiatives on the inclusion of nature in their lives and livelihoods. The cases are instructive as they look at new forms of organization in the context of rebounding nature close to

humans. Based on theoretical considerations and empirical findings in the Dutch project, we will draw the conclusion that the current use of this unified concept, resilience in SES, reduces the complexity of social practices. Drawing on different systems theories, on critiques of resilience thinking and on the literature on resilience in SES itself, we argue for a key role for resilience perspectives in biodiversity strategy, yet a version of resilience where social and ecological resilience are not simply equated or presumed to integrate easily.

2. Materials and Methods

The Netherlands Environmental Assessment Agency (PBL) commissioned a research project to explore the implications of the European Commissions' interest in resilience for Dutch nature policies. A three-year project was defined, ending in 2021, see its structure in Figure 2. It started with a broad literature review on resilience in various scientific disciplines and fields of application. Part of this review consisted of an analysis of matching key words in 50,000 articles, dealing with resilience [13]. This analysis revealed how ecology and ecologically inspired literature rather stands alone, whereas publications from various other academic disciplines show overlap in keywords. The follow up of this exploration was qualitative research on social and ecological mechanisms of resilience in citizens' initiatives and responses to the loss of biodiversity.
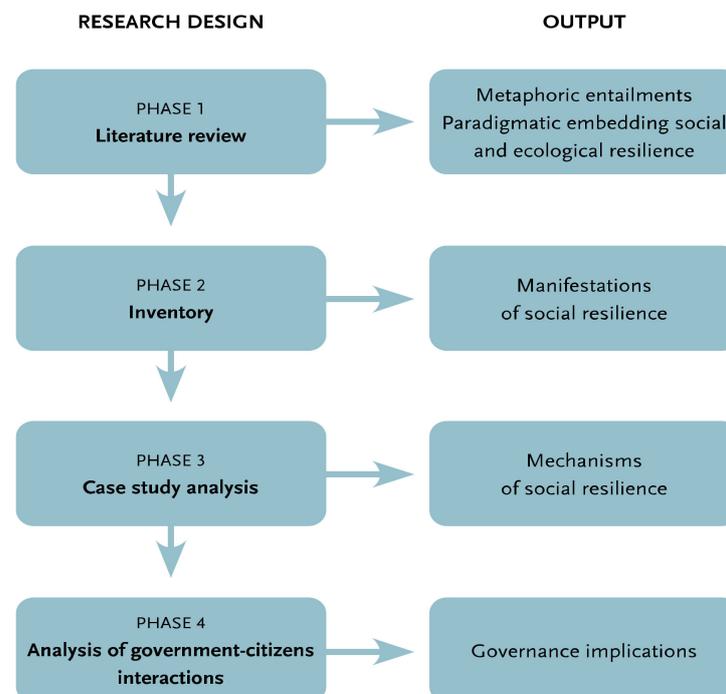
Figure 2. Overall research design.

This second part of the research project started with an inventory of citizens' initiatives related to living closer to or together with nature using internet platforms, media analysis, and by consulting foresters and nature conservationists responsible for public participation. This yielded a long list of well over a hundred potentially interesting initiatives of which forty have been analyzed, with special attention to diversity in the ways the projects and initiatives relate to nature. Criteria for the selection were: running for more than a year, minimum redundancy with regards to institutional nature conservation, dealing with the physical environment, and including a recognizable knowledge component. This part of the analysis provided an overview of the diversity of initiatives, and of various manifestations of social resilience. The presence of self-organization in re-relating to nature we considered a strong proxy for social resilience, and potentially contributing to ecological resilience. When people related to nature in a way that is new, self- created, uncommon, not triggered by institutional structures, and when in this process anxiety, fear, and ambivalence was

overcome, we interpreted these situations as manifestations of resilience, of social resilience with potentially positive implications for ecological and social-ecological resilience. Among those initiatives, we paid special attention to those where a big effort to protect nature was involved, as this hinted at strong links with ecological resilience.

Next, three case studies were analyzed in depth to reveal the mechanisms of social and of ecological resilience. The three cases concern (1) responses to the beaver, a reintroduced species, trespassing their human habitat, (2) re-evaluation of 'weeds' in the city, and (3) establishing green connectivity in a neighborhood ('50 Shades of Green in Assendorp'). For each of the cases, a thick analytic narrative was created, based on literature, media information, and six interviews [14]. Firstly, mechanisms of social and of ecological resilience have been identified and interpreted. In our analysis, a mechanism consists of two or more social actions or natural changes that are linked to each other, either causally or by ideology. Next, a further analysis took place, seeking to identify evolutionary and co-evolutionary pathways of and in SES, in which the mechanisms of resilience have been placed in our proposed theoretical framework (as mentioned, based on systems theory).

Reviewing these cases will shed a light on the main question formulated at the outset of this paper. The cases are particularly interesting because of their relevance for the new biodiversity strategy and can be discussed as social-ecological systems in themselves. Moreover, they lodge complex human–nature relationships, providing opportunities to grasp resilience either as a dual (social and ecological) or a singular concept. Our cases are not problem oriented but merely embedded in community self-organization, which is rather helpful to document the heterogeneity of social ecological interactions.

Before diving into these cases, we need to discuss notions of resilience in social and natural science theory to explore opportunities and problems of interdisciplinarity, options and obstacles for integration. We revisit basic notions grounding the resilience discussion, and we will use general systems theory (GST) as a lens to discuss fundamental differences in ecological and social forms of resilience, while remaining open to possible and hoped-for forms of integration. GST helps to consider the complexity of self-organization, heterogeneity, and evolutionary pathways in any interaction of the social and the ecological. It is general enough to analyze and compare theories focusing on either social or ecological systems, and to integrate observations on social and ecological resilience in the cases. Such inter-disciplinary frame building was the explicit intention of GST founder Ludwig von Bertalanffy.

The cases, both the larger set conducted in the project, and the three focused upon here, represent situations where a form of ecological resilience is observed (by some), and where a form of organized human response takes place, which can be understood as social resilience. We, as researchers, refrained from any projection of political, moral, or other values on these responses, and did not, e.g., start from assumptions about social resilience taking one ideal form, being naturally in harmony with an environment, or coinciding with one model of democratic organization. We observed the diverse responses people displayed to diverse responses of animals and plants to often human-induced environmental change. The cases already represent a subset of possible relations, where a favorable attunement of social and ecological resilience could be reasonably expected, as some nature-oriented action was already taking place, and some positive ecological response already happened.

3. Results

3.1. Understanding Resilience

Resilience has become embedded in different scientific discourses, in which, due to paradigmatic relations, it became a scientific concept. Looking at academic literature it seems appropriate to consider it a boundary object [15,16]. As boundary object it adapts to local contexts, but also retains a certain robustness. Here, we focus on its use to form a connection between the different worlds of ecology and sociology [17]. We are primarily interested in resilience as a concept that tries to capture the relationship between humans and nature. This abstract relationship can be ordered and structured through the use of

concepts and metaphors, creating a field of reasoning with a compelling logic [18,19]. The fields of reasoning in social and ecological sciences are not the same, resulting in inherent complexity, which should be considered [13]. Moreover, the observed systems, social and ecological, appear more different than captured in most versions of resilience thinking. The observed systems become more similar and appear to be more easily integrated when the observing system is unified, imposes one cohesive perspective. This could be social science looking at nature, or ecologists looking at society.

We maintain that moving to higher abstraction, to systems thinking, can retain the possibility of a cohesive observing system going beyond discipline to recognize connections between the social and the ecological worlds and from there, routes towards social-ecological resilience [20]. We define social-ecological resilience as the mutually reinforcing forces in nature and in society to cope with disruptive changes, leading to new development paths of sustainable coexistence and cooperation with nature, which come about through a process of adaptation [21]. Adaptation is seen as a complex non-linear process, in which heterogeneity and co-evolution play an important role [22].

3.1.1. Systems View

The relations between humans and nature can be described as pertaining to an open and functional system. This means that there is no set of rules for interactions; contingency dominates. Following Van Assche et al. [23], we use General Systems Theory (GST) to reflect on system links and interactions. Bertalanffy [24] developed his GST to break away from the simple image of a relatively closed whole and its constituent parts. He assumed that an open system is in continuous interaction with its outside, which causes the elements of the system constantly to be renewed. The use of and reference to general systems theories, such as Complex Adaptive Systems and General Systems Theory, is especially useful when the social-ecological systems theory is linked to social theories and systems theories. These include Luhmann [25], Bourdieu [26], Latour [27], and Boulding [28], and their followers. A certain balance between the natural sciences and the social perspective would make it possible to look more closely at the diversity of Social Ecological Interactions and, thus, also at the diversity of social ecological systems [23]. The concept of system itself can help to transcend disciplinary boundaries and minimize the risk of overly reducing one system to the categories of the other [29]. Here, we also link the theory to very down-to-earth practical cases of citizens initiatives, resonating with their aim of getting nature back in their lives. The fine-grained cases of social resilience can help to elucidate the diversity of forms this can take, the diverse relations with the natural world entailed, and from there, the multiplicity of relations between social and ecological resilience.

Applying GST, we use concepts such as heterogeneity, complexity, evolution, and adaptation. Resilience then lies in the relationship between people and nature, and in all kinds of subsystems of society and nature. The social system and nature are linked and, therefore, also respond to each other [10]. Both systems, open in themselves too, can respond non-linearly due to the high degree of internal complexity and heterogeneity [30]. The natural system is observed by the social and the social may react to changes. This reaction is then followed by a new reaction and, thus, paths of development are created, which can easily traverse the distinction between society and nature. Due to interdependencies, these pathways can develop into evolutionary pathways [31].

Observing is seen here as undergoing an irritation/stimulus (think of the increase in nitrogen in the soil of nature reserves, for example). Adaptation is a contingent process. It refers to changes in the relations between constituent parts of an open system, due to influences of the systems' environment. The more internal complexity, the more possible modes of reactions to sudden changes may occur. Heterogeneity also implies more manners in which a system can be irritated or attacked [25].

Resilience cannot a priori be seen as a singular thing. This would rule out the possibility of differences in resilience between different subsystems, which can also contradict and undermine each other. When using general systems theory as a lens, it becomes necessary

to consider the social-ecological system as an overarching system, which, in itself, also has resilience, in addition to the resilience in the subsystems. How they relate to each other can be different everywhere. Resilience has a certain layering of space and time scales.

The idea that nature in The Netherlands is largely human-made is relevant knowledge for understanding the relationship with nature. Previous policy decisions for nature can also be important for understanding resilience in current practice. These backgrounds can be considered when studying a case. The total social-ecological system in this perspective actually comes to include an assessment of its own relationships. Some relationships are more vulnerable or cause more problems. Categorization of nature is such a relationship. It can be disadvantageous to categorize nature in much detail. If those categories are ingrained everywhere, then it becomes difficult to look at relationships differently, while this may well lead to resilience. The categorization is necessary to a certain extent, but it also makes it difficult to build in flexibility with which to think about alternatives and alternative futures.

The broad theory of GST connects well to our focus on resilience and adaptation because it presupposes openness and constant interaction of any system with its environment. This helps to understand the mutual relations between the systems or subsystems of nature and man. In fact, they can be considered each other's environment. Seen in this way, a multitude of possible relations opens up, far beyond the scope of an ecological or a sociological perspective.

3.1.2. Resilience in the Social Sciences and Humanities

Thinking about resilience does not come out of the blue. It builds on early research into the psychological and physiological aspects of stress. From a physiological point of view, it can be traced back to research on human homeostasis from the 1920s. Psychologically, it harks back to research into defense mechanisms, both conscious and unconscious, dating back to the 19th century. Both lines of research converge from 1990 onwards, when resilience becomes the object of study [32]. Central to this is the homeostasis of the individual, in terms of psyche, physiology, and spirituality. If homeostasis is disrupted, several outcomes are possible: personal growth, return, a return that can be either similar or dissimilar to the previous state, and a slide into dysfunctionality.

Developmental psychology in the 1960s found that a significant proportion of children growing up under difficult circumstances turned out to be surprisingly happy later on. Researchers had no good explanation for this. William Frankenburg noted that if you look at children through pathological models, you also see pathological patterns [33]. The concept of resilience, however, does not emphasize illness, but oppositely the mental strength and health of children. This was seen as a major advantage [33]. Even now, social-psychological resilience is poorly understood [34,35]. The most important facet of resilience seems to be the capacity to adapt in the face of adversity, which requires psychological flexibility [35]. Grotberg [33] speaks of "the universal capacity that enables a person, group, or community to prevent, reduce or overcome damage caused by adversity". One can infer from this line of resilience research that individual resilience is a synthesizing label for a development pattern associated with a set of traits, some more universally enhancing resilience, others working out well because of a fit with a particular environment.

Recently, as a response to the adversities of climate change, social scientists took an interest in resilient societies (e.g., [36]). The Dutch Institute for Social Resilience stresses flexibility and adaptability, but also strength, durability, and ability to recover from setbacks [37]. Awareness and open discussion of threats, the maintenance of a sense of purpose and creativity in responding to problems are all helpful at a community level. One can add, drawing on literatures in policy, administration, and planning, that narrative and institutional dimensions to social or community-based resilience deserve recognition. Indeed, social resilience can be encouraged by resilient individuals, but it cannot be reduced to the sum of individual behaviors. At community level, institutional agility and adaptive capacity plays a role, the cultivation of forms of policy learning [38]—here,

ecologically—inspired SES overlaps. Moreover, there is a dimension that cannot be denied: meaning and narrative can play a role in overcoming difficulties in such a way that society improves [39]. If we consider social identity a narrative construction, and imagined futures as well, then this becomes easy to understand [40].

3.1.3. Resilience in Ecological Theory

In ecology, resilience was initially a measure of the ability of ecosystems to absorb change. Some earlier versions would highlight the return to a previous stable state, while later versions highlighted the sheer persistence or survival of the system and acknowledged the possibility of multiple equilibria. Resilience thinking in ecology emerged out of dissatisfaction with explanation based on concepts of balance and homeostasis. This idea of homeostasis comes from cell biology: cells keep on duplicating in whatever environment. Balance can be traced back to Laplace's 17th century worldview, who describes the world as one large clockwork. If a cog is missing, the clockwork will no longer turn [41]. In ecosystem theory, equilibrium thinking was still very much alive in the 1930s, when it developed the concept of climax vegetation, e.g., by Clements in 1936 [6]. C.S. Holling presented an early synthesis of resilience thinking in the 1970s (1973, 1976) and since the 1980s, the idea of ecosystem dynamics around different stable stages and states has been fully established [42]. In what is called 'disequilibrium ecology', the assumption of equilibrium gives way to a dynamic view of feedback mechanisms and of possible transitions to another state [6]. If we still call this resilience, then resilience thinking makes it possible to regard the constant adaptive change of a system as the normal state and stability as something unusual.

Adaptation herein becomes possible through the ongoing process of self-organization. If self-organization is continuous, then regular re-organization becomes easier to conceptualize and organize. Internal relations after stress, might have to be reorganized, whether the result is a return to a previous state or not. Self-organization as in autopoiesis, or continuous reproduction of elements, structures, and processes based on existing elements, etc., was added to the repertoire of not just ecology but also general systems theory by Chilean biologists Varela and Maturana [43]. It became crucial in the co-evolutionary theory of social systems developed by Niklas Luhmann [30] who regarded social systems, consisting of communications, as autopoietic.

The work on resilience within ecology quickly transcended disciplinary boundaries, and C.S. Holling [7] drew on general systems theory, as well as on the ecological concepts mentioned to see ecosystem change in the modern world in the context of always evolving social-ecological systems. Adaptation and self-organization were key concepts from the beginning, as threats in two directions (social to ecological and vice versa) were considered, and the adaptive capacity of both social and ecological systems needed to be buttressed to avert threats and manage problems [21]. Self-organization in nature was accepted as a given, taken from biology and ecology, while self-organization as social and institutional practice was encouraged, deemed an essential element of good governance, i.e., adaptive governance [23,44]. Adaptation takes place in complex systems and adaptive governance has to replicate some of the environmental complexity internally, to multiply observations and possible responses, hence the idea of multi-level and polycentric governance. Local knowledge and local governance take a central place in the system, for democratic reasons, but mostly because it is expected to infuse the governance system with more observations of change, and more forms of local knowledge [45].

The general systems concepts underpinning the evolution of SES and resilience thinking are not always clear, but (see [23]) it is clear that a combination of general systems theory a la Bertalanffy and complex adaptive systems thinking played a role at different stages. More recent work in the tradition invokes the concept of Panarchy, e.g., [7] which articulates more clearly how both positive and negative feedback loops can work out in the evolution of SES; so, in the positive case, long-term adaptive cycles can occur, while, in more

sinister situations, systems can break down and fall back on a lower level of complexity, hence capacity for observation and adaptation [46].

3.1.4. Integrating Knowledges for Integrating Systems?

The conceptualization of the social, and of governance, by SES thinking has been criticized regularly, for missing the unicity of the social, for missing the limits of observation and steering, for proposing de facto formulaic, so less adaptive forms of governance [47,48]. For general systems theory, integration of perspectives can be possible, given a move to more abstract concepts, and a critical open discussion between or neutral deliberation of the two conceptual systems from the vantage point of a third one (second-order observation [49]). This is, as said, distinct from an operation where one is reduced to the other, and where, thus, some of the useful distinctions in one system are eliminated, and where the capacity to make new observations (in this case in the social) will miss the accumulated insights as well as the more powerful methods of analysis of the reduced, or sometimes simply ignored, discipline cf. [50].

If we are looking to harness social resilience for the benefit of social-ecological resilience, this is a risky proposition. The nature of social organization, governance, and social resilience might not be grasped; hence, the differences with ecological resilience, and the possibilities to relate social and ecological resilience, in a process which we can call adaptive. It is important to note that a solution implied here is not restricted to SES thinking integrating with social science literature using the 'resilience' label. Rather, one needs to envision the broader pallet of social science literatures, and the ideas on possible adaptation, bouncing back, and re-relating to nature one can find there. While this exercise never happened in its entirety, and can certainly not take place in this paper, we do propose that in existing systems literatures and policy-related literatures, attempts in this direction have been made already.

If we consider the issue of adaptive governance of SES an issue of improving and avoiding problematic relations, then it can still not be interpreted as a coordination problem. The two sides remain too different for that. In social-ecological systems, institutional tools for adaptation, and narratives enabling adaptation and resilience pertain only to the social system. Thinking and organizing exist in social systems, and allow the social system to emerge, that is, to function as an entity, more than a collection of individuals [24,51]. It is those collective capacities that have to be harnessed to tinker on the relations between humans and their environment. Observation might be universal to all biological systems, but second-order observation is only found in social systems, that is, social systems of humans. Moreover, in governance, the possibility for a multiplicity of observations to confront each other, to encounter in discussion and deliberation, and to lead to collective learning and to collectively binding decisions, to new rules for engaging with nature, e.g., exist only in social systems. Governance, moreover, entails the possibility of strategy at community level, including strategic adaptation to changing environments [52,53].

One can also understand the difference between social and ecological systems in terms of learning. Social systems are learning systems in a different way from natural systems, and different from individual learners [54]. The psychological literature on resilience already noted that resilience can most easily be observed after a shock, where then, in hindsight, traits of the individual are designated as contributing to resilience (e.g., [55]). Fit with context adds to resilience. In the ecological literatures, and in SES, still close to ecological frameworks, the idea is more that systems are inherently resilient or not, and able to withstand shocks better than others. Here too, we add, backward reasoning is a problem, projection in the past. Here too, the fit with context (always contingent) deserves more attention. A focus on learning in social systems can help to overcome these problems, we argue.

The specificity of social resilience, in our view, lies in the specificity of learning modes in social systems. It also lies in the existence of governance systems, capable of coordinating collective action, and to a degree thinking, in the community. Through the existence of

governance, in all its possible configurations, not only adaptation becomes possible, but also impact of decisions on both social and ecological systems can be amplified [30,44]. Rather than positing one ideal form of governance as optimal, under the name of adaptive co-management, e.g., we prefer to place adaptive capacities in the combination of internal mechanisms for self-transformation and, second, the multiplicity of possible forms of governance [56,57]. This helps to solve the problematic relation between resilience as feature and resilience as fit. In distinction with the mainstream resilience literature, we would also allow for many versions of self-organization, beyond the idea of community-based ecosystems management organized around commons [58]. Self-organization can take other forms, and it should not be glorified as universally positive, as both adaptively and democratically superior [59,60]. Relations between participation and representation can differ, can shift, and concomitantly, relations between levels and scales of governance. Centralization can be more adaptive in one case, decentralization in others.

Avoiding the trap of false similarity (between social and ecological) and the trap of formulaic (hence rigid) resilience prescriptions requires, in our view, a new perspective on social learning and specifically on learning in governance. Self-organization can enable learning and adaptation, but so can all other forms of governance [61,62]. In line with SES, we recognize the importance of learning from experiments and learning from experience. Learning can build social capital, trust, and institutional capacity, but this also works the other way around. We can further distinguish comparative learning, as learning from other places and their attempts at enhancing resilience, e.g., learning from experts and finally, often overlooked, dialectical learning, or learning through discussion and debate [61]. Learning strategies are needed to test and interpret the social-ecological feedback cf [10,45]. As resilience can be achieved through governance, learning for adaptive governance should always go through dialectical learning. At least, if we as resilience thinkers subscribe to democratic values, that, rather than a preference for one form of learning, one level of governance, one form of organization, should be our normative concern. Each governance system will then be marked by its own combination of forms of learning, its own set of couplings between those forms, and, from there, unique and always limited modes of adaptation and self-transformation [63].

Social systems have a different responsibility, and social resilience can take on many forms, driven by the unicity of modes of learning in a particular community. Learning can also refocus learning activities in and beyond governance; it can open up decision-making for new observations of the environment, and of influences on environment on community [64]. Learning can take place outside government, e.g., in citizens initiatives, which can, sometimes, lead to very localized governance of community-environment relations, sometimes to recuperation into formal government, while elsewhere, the learning leads not to institutionalization but to new narratives, new attitudes, to new private relations with nature [65,66]. The diversity of learning processes, of relations between community, government, and governance, between thinking and organizing cf. [51], the multiplicity in all these different relations, can be captured under the term social resilience, and this is what we investigated in the Dutch case studies on citizens initiatives related to biodiversity.

3.2. Manifestations of Social Resilience in Dealing with Manifestations of Nature

Reviewing forty of the citizens initiatives in the longlist revealed five categories of manifestations of social resilience. In each of the manifestations, one can find anxiety, fear, controversies, ambivalences, adversities, and other drawbacks to overcome. They are also loaded with enthusiasm, ideology, sense making, and sometimes connected to social movements. Learning, in thinking and organizing, and the relations with governance could differ within each category. In the citizens initiatives, nature appeared in a new way, unexpected, often unpleasant, and sometimes threatening. These appearances would be interpreted as an increase or sometimes decrease in ecological resilience, yet we focus on organized community responses (initiatives) that tried to interpret and manage the intrusion and can be interpreted as socially resilient. The manifestations are presented below:

1. Allowing nature more and more into the daily living environment and seeing that nature responds favorably to this, so that you can take the next steps.
2. Dealing with new invasive species that could potentially harm humans and their environment, without panic and blanket measures.
3. Standing up as an unfettered nature lover for the importance of nature in the face of threats.
4. Making a sacrifice to nature, being affirmed in this, and adopting a more nature-inclusive lifestyle from there.
5. The collective arrangement and/or management of a privately managed nature reserve.

Each type of manifestation indicates another subset of relations between man and nature. This will be explained hereafter with concrete examples. Allowing nature (1) plays an important role when dealing with bats under the roof. People nowadays are extra frightened because of COVID-19. They stuff bat boxes in their neighborhood with foam. Nevertheless, some very bat friendly examples were found, in which the inhabitants of a house with bats set aside their fear and accept all the nocturnal nuisance. Concerning invasive species (2), with municipal management of the green space, citizens in The Netherlands suffering from processionary caterpillars codeveloped nature-based solutions to decrease their numbers. In the short term, this was less effective than using insecticides but worries about the decline of insects were stronger than fear for this potentially dangerous animal. Standing up for nature is a common practice, which sometimes was done in adverse conditions. Standing up for nature (3) was shown by cleaning up of the mess of the 270 containers that fell overboard at the MSC Zoe (the largest container ship in the world) on 1 January 2019 in bad weather and washed ashore at the Wadden Islands. It is a big job to clean that up. Yet people came from far and wide to do just that: pick up plastic (pyroxide foam) and clean up the mess. A sacrifice for a nature lifestyle (4) is clearly shown by ecovillagers, by greening the neighborhood and developing façade and roof gardens, and abandoning cars and its infrastructure. Collective management of nature areas (5) is becoming more and more popular; an example is the citizens in the city Assen, who protested selling a woodland nature reserve and found ways to reduce management costs by offering voluntary maintenance.

These are just brief examples drawn from the larger pool of 40 projects involving citizens initiatives trying to help nature. Looking at these manifestations, we see a diversity of social practices that cannot be solely described in terms of ecosystem services or nature-based solutions. The current social ecological systems model seems too focused on ecological principles to give a place to these features of social systems.

The three in-depth case studies, which were drawn from the long list mentioned and which will be discussed below, differ in the sense that some positive ecological responses are or are becoming visible. We discuss citizens initiatives related to weeds, the beaver, and polluted soil. In these case studies, nature, sometimes helped by people, is coming closer to the living environment, a sign of ecological resilience, after which a different set of human responses appears. Sometimes, in line with those who were trying to help nature bounce back, sometimes very different in orientation. We explore, in terms of the theoretical framework developed above, how in each case ecological and social resilience can be interpreted and how they relate. We pay special attention to processes of interpretation and organization, as these are particular to the social, allowing for a more precise distinguishing of social and ecological resilience, but also essential for managing the relations between social and ecological systems, and, thus, for understanding the possibilities for working towards resilience of social-ecological systems.

3.3. Mechanisms of Resilience

3.3.1. Social Resilience: A Reversed Perspective on Weeds

There is a growing interest in naming weeds with an app, photography, and foraging of edible or medicinal wild plants. There are online groups on Facebook that focus on 'useful' wild plants, or on gardening with wild plants, which have many thousands of

members. Weeds are getting more positive attention in different ways. There is a 'weeder', a 'day of the dandelion', there are workshops on using nettles, and there is, for example, an artist collective that focuses on green art with new perspectives on weeds. Recently, a French initiative, 'Botanical sidewalk chalk', has blown over to The Netherlands, which draws attention to weeds that appear spontaneously between pavement tiles. It is about nature in miniature, directly in the neighborhood, and moreover, weeds come by its own power. Everyone can encounter them, these sidewalk plants. The chalkers assume that if a resident knows the name of a plant, he will be less inclined to remove it.

The plant lovers argue that 'weeds don't exist'. Weeds in the garden are no longer a difficult problem for everyone. Some garden owners even create a garden reserve, which aims to become a tiny hotspot of nature in the city. This stems from an initiative of a radio program. Both large and small steps can be taken: "A garden reserve does not have to be a messy, disordered gathering place of all kinds of plants that you do not actually want [. . . . . .] If your garden has some specific characteristics, it qualifies for the garden reserve label". The criteria include a recommendation to use native plants, in addition to having "junk corners and boughs". For people who want it even more natural and wild, there is the Garden Forest. They can order a package to plant a patch of 'forest' of at least six square meters in the garden.

If we look for the mechanisms of resilience in this case study, a few things stand out. People apparently enjoy weeds in their everyday urban environment and are learning about them. Determining plants is a beautiful activity that brings someone closer in contact with nature. The resilience of the plants is appealing. They are described as powerful, brave, smart, and 'seizing the opportunity'. People like it when nature takes over neglected spots in built environments. There is a remarkable change of perspective on weeds. This has knowledge effects, because it is well known how to get rid of weeds, but not how to get more plants in a paved environment. This then leads to defying the rules of good gardening and urban landscaping. Breaking through the order, as well as pioneering and improvising, testify to resilience. People see themselves as a kind of nature-loving avantgarde and unite. The slogan 'Weeds don't exist' already shows resistance or opposition.

The case shows self-organization and learning, in response to a problem. The problem, however, is not a new or urgent one (weeds), but rather one that is now being redefined as a non-problem, as a sign of ecological resilience, in the context of much larger ecological problems. Weeds become signs of resilient nature. It is hard to say whether the cluster of initiatives itself is a sign of social resilience, as one could also indicate them as nostalgic fights in the margin of real problems, yet on the other hand, it seems fair to see them as contributing to a form of social resilience that can move collective action towards more resilient nature, in this case by permeating city space with a more diverse flora. Self-organization is practiced, new technologies adopted in this, learning by comparison, learning from experts, and, in discussion groups, dialectical learning takes place, while the national network creates local pods connecting to local governments and enabling experiments. Governance networks can slowly be permeated by motivated semi-experts, possibly shifting the orientation of urban planning and landscaping.

3.3.2. Green Connects and Integrates in the Neighborhood Assendorp

In 2017, in the Assendorp neighborhood of Zwolle, soil contamination was discovered. The residents of the most polluted street and the municipality are using the ensuing excavation of soil to jointly make the street a healthier living environment that is also more nature friendly and climate-proof. It started with one of the residents, who together with neighbors, has been talking to the municipality for some time about a solution for the polluted soil behind his house. Residents remove pavers and bricks from sidewalks and patios to make space for plants, shrubs, and trees, or place planters. Twelve families built an organic vegetable garden within the monastery walls of the Dominican monastery. Façade gardens and green roofs appear in the streetscape as well as rain barrels and innovative water fences. These actions inspire neighbors and acquaintances, and more streets are

participating in the greening. Street ambassadors serve as a point of contact and help to introduce new actions and coordinate activities. Sustainability becomes part of everyday life by means of information evenings, brainstorming sessions, living room games, or exchange of information about energy saving. The greening movement is now called 50 Shades of Green, which captures the diversity of all that is happening.

People experiment and, thus, gain knowledge themselves, then help and complement each other. A gardener and his neighbor experimented for a year with green roofs and are helping with the construction of other roofs. Another neighbor and a garden designer put together a flower mixture consisting of plants that occur in the adjacent IJssel-Vecht delta. The aim is to contribute to an ecological corridor through Zwolle. A far-reaching measure is that several streets are temporarily closed to cars and are labeled as residential streets. Residents are not exempt from the rules. Parking is moved outside the neighborhood in designated lots. Many see this as the beginning of a more sustainable and nature-inclusive lifestyle in this increasingly green neighborhood. The neighborhood website shares stories about this lifestyle, including veganism and package-free shopping.

The resilience in this example grows with each new development that is deployed. People learn and become more and more involved and enthusiastic. Expert learning, comparative learning, learning by experiment, and dialectical learning take place and sustain the process of self-organization and vice versa. The neighborhood is the system, or becoming a self-organizing system, and there are interrelated subsystems focusing on sustainable energy, health, climate adaptation, and nature. Relations between the subsystems manifest in more sustainable lifestyles. According to their website (20 October 2020), 25 houses have been better insulated, 20 roofs have solar panels, and 13,124 m^2 of green roof has been installed for 877 households [67]. Here too, new forms of self-organization do not disrupt but complement local governance and have the potential (signs are there) to transform local, i.e., municipal governance towards buttressing the resilience of the ecological system. One could say that the previous system of local governance, more based on representation, did not fulfil the green aspirations of the residents, and the shock of finding polluted soil had the effect of triggering self-organization towards green goals, which is slowly shifting the balance of participation/representation in local governance, infusing it with new learning processes, and adding a more local and fine-grained form of governance, which can enhance a more fine-grained understanding and reinforcing of ecological resilience.

The projects for greenery, climate adaptation, and health reinforce each other. They can be seen as diverging evolutionary pathways, which remain linked by the discourse of livable neighborhood and changing lifestyle. There is a clear connection between the greener streets and roofs, and the projects that revolve around water storage. The whole approach is creative: not only through information evenings and brainstorming sessions, or the mutual exchange of information about energy saving, but also through a housewarming game (living room conversation).

3.3.3. The Beaver

The third case deals with the reintroduction of the beaver. This animal puts man's resilience to the test. Based on international treaties and EU regulations (Bern Convention, Birds Directive, and Habitats Directive), The Netherlands has an obligation to do its best to improve the conditions for naturally occurring species and, where possible and desirable, to restore species to their original state. This also applies to the beaver. According to the State Secretary, reintroduction fits in with the aim of strengthening biodiversity in The Netherlands.

During the reintroduction, the beaver was supposed to be a vulnerable species that would provide some more variation and diversity in nature reserves, thanks to its gnawing activities. This seemed logical as at that time the beaver was on the brink of extinction in Europe. However, this is now very different. It can now be found almost everywhere in The Netherlands, gnawing trees in gardens and parks, creating flooding areas. It is now

showing up in the middle of big cities such as Groningen and Maastricht. While it is the favorite of many nature lovers, who take trips to the Biesbosch National Park to catch a glimpse of it, it must be shot according to another part of the population. Because the resilience of the beaver has been underestimated, the resilience of humans is put to the test.

In the meantime, the beaver more than fulfills its promise. Beaver numbers are increasing (approximately 3500 in 2019). Beavers change entire landscapes, keeping streams alive in the extremely dry summers of recent years. The variation caused by the beaver in stream valleys creates new habitats for the otter, which occurred in a brook in the province Brabant. However, in a village near the city of Nijmegen, people mainly experience nuisance from the beaver. Places where they normally walk their dogs have suddenly become inundated. People are complaining about it in the local newspaper, not willing to take an extra kilometer in their walk. As a result, the beaver dam in the stream was illegally cleared with a grab from a truck. In various places, the beaver is being shot again: a rather primitive reaction.

Because of the beaver's resilience, it now occurs outside nature reserves in areas that were never intended for it. This leads to discussions about harm and usefulness, based on a 19th century contradictory categorization of harmful and useful animals. It, therefore, also leads to a focus on individual beaver burrows and not to insights into the geomorphological effects of the beaver at the level of, for example, a river basin [68]. Experiments abroad in which the beaver is used to make rivers more natural again show that the resilience of the beaver can initiate an even stronger resilience in nature. Pollock et al. [69] examines the contribution that beavers can make to the problem of deeply incised river valleys, which are insufficiently able to absorb the consequences of long periods of drought. With their dams, they inundate areas, causing the original vegetation to die back and creating a wetland area with wetland plants and animals. Over time, this swamp develops into a moist grassland. These are called beaver meadows. They have very wet soils, which release their water only very slowly. This makes the beaver a potential partner in combating the consequences of severe drought due to climate change [70]. The beaver is not yet seen that way in The Netherlands. The water boards do want to take unorthodox measures to counter drought. Working together with the beaver could be just such an unorthodox measure. This idea is not even mentioned in any context. To the contrary, beavers are seen as a danger to our dikes and to keeping dry feet in a country that lies way below sea level. They cause digging damage to dykes/quays with a risk of breaches, and to banks with a risk of machines sinking. One example is a hole that was 70 cm in diameter and ran 14 meters deep into a dike.

Recently, an initiative has been launched by the Dutch Mammal Society to set up a knowledge center for beavers, in which water management organizations and the provinces (responsible for the state of nature) participate, and wherein the knowledge that each organization possesses can be shared and accumulated. One of the measures taken is the installation of gauze mats in a dike. Institutions see the need for learning here [71]. Unfortunately, we know very little about dealing with beavers in the past or specifically in areas where many people live [72]. Living with the beaver is not easy for the time being.

Thus, even if expert perspectives with a broader historical and geographical scope acknowledge the potential of renewed beaver 'landscaping' to enhance social-ecological resilience (benefiting both people and nature), narrower and dominant expert perspectives and citizen's reactions tend to oppose a resilient beaver to community safety and individual well-being. The industrious and resilient Dutch beaver demonstrates how complex, highly differentiated societies multiply expert roles, individual rights and expectations, learning processes, but also routines, blind spots, obstacles to learning (similar to what can be observed in complex organizations with a long history [73]). Thus, complexity can both enhance and reduce adaptive capacity; in this case the capacity to see the positives in a rebounding beaver population not sticking to the bureaucratic rules, administrative boundaries, and cultural expectations.

The cases, thus, illustrate how social and ecological resilience can enhance each other but not necessarily. Moreover, at a more fundamental level, they support the idea, predicted by the critics of resilience theory, and by social systems theory, that social and ecological resilience are two different things. Social resilience can take many forms and entails many mechanisms (see Figure 3) and not all of those benefit a rebounding ecosystem. The cases, however, also illustrate that synergies can exist, that under particular conditions one can speak of a social and ecological resilience supporting each other. The cases do not allow us to outline in general what those conditions are, but they do allow for the conclusion that they cannot be found in one form of organization which is then expected to benefit social-ecological resilience.

MECHANISMS IN SOCIAL RESILIENCE

Learning

Experimenting

Starting privately managed nature reserve

Getting carried away
Become respected
Frontrunner feeling

Making lifestyle sacrifices for nature

Persuasion
Ideology and pragmatism

Know how
What can we do?
How nature will respond?

Change of perspective
Damage
Enrichment

Standing up for nature when threatend

Ambivalence
Fear and curiosity
Protest and do it yourself
Small and major changes in lifestyle

Accepting unknown invasive species

Emotion
Longing for connection with nature and with each other
Ethical moral sentiment
Care
Battle

Signifying change

Allowing nature in daily living environment

MECHANISMS   **MANIFESTATIONS**

Figure 3. Overview of the manifestations and mechanisms of social resilience in Dutch citizens initiatives.

We can narrow down the analysis, however, based on the cases, and say that situations where people are confronted with new or rediscovered nature are useful to understand the coupling of social and ecological systems. If that nature is just new, and not perceived as negative per se, and if it is doing better and better while people can continue their routines without too much thinking, then an easy positive feedback loop can occur, where ecological resilience is accommodated within the existing forms of social resilience. One can add that

learning in such a situation can still be helpful and make it easier to see if nature is actually doing better, and, possibly, to deviate from routines.

If nature is initially perceived as negative, e.g., as with invasive species, the effort to accommodate the resilient ecosystem is more complicated, starting with the need to scrutinize the categories of natural, indigenous, and invasive species, and the categories of weeds and pests. Whatever the contingent choice is in a given case, it makes sense to say that a reflexive approach in governance can be helpful to increase both social and ecological resilience. As we noted before, panic and blanket measures are likely to cause harm to ecosystems, and also increase the rigidity of the governance system. One can add here that the possibility for individuals to speak up, to persuade others, to persuade decision-makers of a more tolerant attitude to new creatures appearing or persuade them to find new ways to accommodate nature and humans in the new space, require new forms of planning. Here too, the adaptive capacity and the participatory character of the governance system play a role. Moreover, individual resilience, or psychological resilience, might play a role, as it might be necessary to openly disagree and face backlash from annoyed or scared neighbors, or from bureaucrats unwilling to question procedures.

The cases also indicate that self- organization is a manifestation of social resilience, but not necessarily the only one, and that formal support of self-organization in governance, either through procedures of observation and acceptance (a posteriori), or through predefined spaces for participation and self-organization (a priori) can make a difference for managing the coupling between social and ecological systems [74]. What will emerge as positive for enhancing social and ecological resilience is not always predictable, and new local observation and organization can create new couplings that can help to find such synergies. Such openness for new and functional forms of observation, of knowledge in governance is easier though, as the cases illustrate, when the governance system is already used to managing a variety of different knowledges and capacities to know human–environment relations.

4. Conclusions and Discussion

Our case studies and theoretical inquiries emphasize two points that are, for many reasons, difficult to accept at the same time:

- First, that social resilience can strengthen ecological resilience, producing situations which can be labelled as social-ecologically resilient.
- Second, that social and ecological resilience are quite different things, logically leading to the insight that they do not necessarily support each other.

World history shows unambiguously that societies can respond to change in ways that deteriorate their environment, and then exist for a long time. Power structures tend to stick to their cultural repertoire, values, and status relations [26]. Cultural effects of identity, self-worth, and esteem on social resilience are of utmost importance and further research is needed to understand their ecological impacts, in which citizen's initiatives can be analyzed as a polysystem [75]. A nature positive society requires fundamental mediation of cultural repertoires of those in power that believe that nature can just be exploited. Only total collapse, as in the cases famously described by Jared Diamond, proves the point, for many, that social resilience ought to favor, or at least respect, ecological resilience.

Self-organization, much favored in the SES literature on adaptive governance and resilience, can indeed be an indicator of social resilience, and the Dutch citizen initiatives seem to confirm this. It is also likely that they can enhance the resilience of the larger social systems, if they maintain local observation and learning, and at the same time link up to governance configurations, whose powers of steering and adaptation can then be harnessed, which brings us to the point that the Dutch cases are not only cases of self-organization but also Dutch. This means that they take place in a context of many shared values, and a context marked by a well-developed welfare state, a fine-grained system of multi-level governance, and a highly institutionalized environmental policy system full of experts.

Few conflicts occur, scarcity is rare, and livelihoods are not often threatened by either green policies or green citizens initiatives.

This lowers the stakes, makes it easier to agree, and to find common ground in organizing or self-organizing for ecological resilience. It also helps to find adaptive capacity, both observation and responses, in the more formalized and higher-level governance configurations. Seeing and organizing effects and new relations between the social and the ecological can take place through representation and participation, can take place in new self-organizing initiatives, some of which can transform local governance later, and in existing administrations, by their internal and advising experts, as well as through the existing lines of political representation. Social resilience lies in the functioning of this whole system, in maintaining and expanding its capacity to observe and respond. Strengthening ecological resilience can happen more comprehensively and more sensitively when the whole social system is resilient in this sense.

Even if the stakes might be low in comparison to less prosperous, less organized, and more risky settings, there are difficulties in organizing for nature when it shows up in unexpected ways, and there are environmental shocks. One case started with the discovery of soil pollution, and in other cases, values were challenged and emotions were difficult to manage. Nature is redefined and re-evaluated continuously, and ambiguity cannot be vanquished. What helped is the emergence of new discourses that underpinned self-organization and helped learning and linking to governance: new images of the good neighborhood, new understandings of environmental threats, the value of nature and biodiversity, new stories on quality of life, and, last but not least, a growing awareness of interdependence and embedding, of individuals in communities and communities in their environment. The experience of remaining resistance against emerging green ideas, some of it visible in lingering modernist institutions, contributed to self-organization. Those same green ideas were, however, not alien to many people in administration.

Processes of self-organization leading to more complexity and by this, to more resilience are features of social and ecological systems. However, if we want to develop the theory of SES, and grasp better what social resilience could mean, and how it relates to ecological resilience, how it could, thus, boost social-ecological resilience, we need to re-emphasize that self-organization in ecosystems, and in social systems, differ fundamentally [74]. An ecosystem is seen as a knowable structure with structuring processes [42], while the social system is the dynamic and contingent product of ideology, discourse, and institutionalization. The two different systems cannot be understood with each other's theoretical concepts, and they do not respond to intervention in the same manner. The presence of learning in different forms, of second-order observation, the binding capacity of governance and the self-referential nature of social systems make it very difficult to steer social systems towards a particular adaptation and very difficult to assess its resilience in general and a priori. Each intervention, each new idea, new value, emerging form of organization, and, more basically, each observation of the system has the potential to change the social system.

Furthermore, the a posteriori character of ascriptions of social resilience, and the always partly opaque combination of inherent features and contextual fit generating social resilience contribute to the difficulties in envisioning social-ecological resilience as a feature of SES, leaning on one particular idea of good governance, and one particular form of (self-) organization. Rather, the maintenance of diversity in level of governance and perspectives within governance, the maintenance of checks and balances, the cultivation of openness for local self-organization, and the encouragement of diverse forms of learning throughout social systems, in general and aiming at environmental knowledge—all this can contribute to social resilience, to enhanced observation and adaptation of the couplings between humans and nature.

In terms of the biodiversity discussion, one can simply and boldly conclude that it is tough to get nature back in people's lives, in a physical, social, and a psychological sense. The IPBES SES concept starts from the presupposition that humans inevitably affect nature

negatively. Its idea of resilience is about bouncing back, to keep biodiversity loss within certain boundaries. The idea of nature back in people's lives resonates with bouncing forward. The problem with bouncing forward is that it involves a leap in the dark. It requires fundamental flexibility of a system to move away from previously conceptualized human nature relations. Nevertheless, our empirics show that there are conditions under which social resilience can strengthen ecological resilience. Social resilience in the context of climate stress in cities, going beyond the actual nature policy repertoire, creating citizens' science and turning emotions into actions, can invigorate ecological resilience, which in turn—highly appreciated—can lead to further actions.

If, as EU intentions indicate, biodiversity policy has to be more than the protection of spaces far from humans and go beyond the exclusion of people from purely natural areas, it is clear that more creatures will appear close to more humans, and that those humans will have to get used to this, possibly changing their ideas, attitudes, and routines. This puts a pressure on individuals and on communities. Furthermore, it puts pressure on governance systems, which will have to keep an eye on both ecosystems and social systems, and their couplings, acknowledging that neither people nor nature behave entirely predictably, and that new forms of observation, knowledge, and organization will have to be tested continuously, so ecological resilience does not end up triggering backlash, but rather inspiring new forms of accommodation, new forms of social resilience. This analysis reaffirms the common plea in the resilience literature for adaptive governance, yet makes it slightly more complicated, by distinguishing social and ecological resilience, and the task of governance to couple them productively. Moreover, resilience appears here not as an emergent property but as something that comes and goes, as the coupling between social and ecological at a local level can shift easily and sometimes imperceptibly at first.

Thus, the optimistic assessment of Adger [76] more than twenty years ago, about the coupling of social and ecological systems, and the resonance of their forms of resilience, has to be qualified though not simply rejected. Indeed, on the social side, the questions regarding power, justice, and conservatism are not entirely answered and the basic consideration whether resilience is always good and regarding the selection of community and governance features to be preserved is sometimes absent (cf. [77,78]). The question whether simplified ecosystems, or altered ecosystems, even depletion of a particular resource, is necessarily damaging for a community and its resilience, has not been fully addressed. We would argue that both ecological and social resilience are understood better now and that the resilience of overarching social-ecological systems is as real and as important as ever before. Yet, social and ecological resilience have to be understood as features of subsystems, each reproducing themselves according to their own logic, and sometimes benefiting, sometimes ignoring, sometimes damaging each other. What makes it possible to work towards greater resilience of the social-ecological system is that individuals can take initiative and that social systems can develop governance in modes which can encourage diverse forms of observation, of organization, and of re-coupling the social and the ecological. Understood in this manner, the social system can—and here we are normative—avoid situations as described by Walker and Salt [79], where questionable governance systems immunize themselves very effectively against change.

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