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Making Rivers, Producing Futures: The Rise of an Eco-Modern River Imaginary in Dutch Climate Change Adaptation

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Abstract: In the field of climate change adaptation, the future matters. River futures influence the way adaptation projects are implemented in rivers. In this paper, we challenge the ways in which dominant paradigms and expert claims monopolise the truth concerning policies and designs of river futures, thereby sidelining and delegitimising alternative river futures. So far, limited work has been performed on the power of river futures in the context of climate change adaptation. We conceptualised the power of river futures through river imaginaries, i.e., collectively performed and publicly envisioned reproductions of riverine socionatures mobilised through truth claims of social life and order. Using the Border Meuse project as a case study, a climate change adaptation project in a stretch of the river Meuse in the south of the Netherlands, and a proclaimed success story of climate adaptation in Dutch water management, we elucidated how three river imaginaries (a modern river imaginary, a market-driven imaginary, and an eco-centric river imaginary) merged into an eco-modern river imaginary. Importantly, not only did the river futures merge, but their aligned truth regimes also merged. Thus, we argue that George Orwell's famous quote, "who controls the past, controls the future: who controls the present, controls the past" can be extended to "who controls the future, controls how we see and act in the present, and how we rediscover the past".

Keywords: climate change adaptation; futures; river imaginary; water management; Border Meuse project

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1. Introduction

In the field of climate change adaptation, the future matters [1,2]. Mills-Novoa et al. [3] showed that, through participatory practices, certain futures that are deemed desirable by ruling parties are linked to required actions in the current era by those who are to follow. These attitudes, behaviours, and actions are internalised and normalised as the best way to adapt to climate change. Future climate change projections, therefore, influence the way adaptation projects are developed. Muiderman et al. [4] formulate this practice as a strong anticipatory governance paradigm, in which the use and power of future projections are central. In this context, the scientific adaptation community focuses on concepts like resilience, vulnerability, and adaptive capacity and mitigation, with a recent interest in green infrastructure or 'nature-based solutions' that are all proposed as solutions to climate change impacts [5]. In river research, many studies focus on future increases in floods and

drought as a consequence of climate change [6]. Generally, the simulated impacts of climate change describe an increase in floods and droughts that impact rivers, amongst others.

Beyond climate projections, river futures are also shaped by ideas about the ways rivers are managed. Duarte-Abadía [7], for instance, described how river futures in Spain and Colombia standardised water governance practices toward a specific idea of progress, namely capital growth. Moreover, Jaramillo and Carmona [8] described how dominant mining futures led to the reallocation of a Colombian river by presenting normalised, inescapable futures. Hommes et al. [9] described how large infrastructural river projects reflect specific ideas, morals, and values on how rivers should be managed. As such, we agree with Jasanoff and Kim [10] (p. 14) that "*More needs to be done [. . .] to clarify why, at significant forks in the road, societies opt for particular directions of choice and change over others, and why those choices gain stability or, at times, fail to do so*".

While we acknowledge the empirical existence and rapidly proliferating impacts of climate change and align ourselves with the urgent need to act, we challenge the ways in which dominant paradigms and expert claims dominate policies and designs of river futures, thereby sidelining and delegitimising alternative river futures. There is limited research on the power of river futures in the context of climate change adaptation. This highlights the need to scrutinise the future-making processes in climate change adaptation and to elucidate power structures that shape such processes. We argue that George Orwell's famous quote "who controls the past, controls the future: who controls the present, controls the past" [11] (p. 87) can be extended to 'who controls the future, controls how we see and act in the present, and how we rediscover the past'.

To study future-making processes and their influence on river management, we adopt an interpretive and empirical approach, using a combination of concepts to analyse empirical findings. We combine a conceptualisation of sociotechnical imaginaries [10] with that of hydrosocial territories [12]. We adopt a Foucauldian understanding of the relationship between power, knowledge, and truth in specific epistemic communities [13,14]. Using a case study, we focus on the European Meuse River, specifically on the Border Meuse trajectory in the Netherlands. A large nature-based solution project is being implemented and legitimised by a variety of river futures. We first empirically ask which river futures and truth regimes are present in the case study, and secondly how the power of river futures is at work in truth regimes, leading to a dominant river future.

2. Materials and Methods

2.1. Theoretical Framework: River Imaginaries

To study the power of river futures in the context of climate change adaptation, we integrate the concepts of 'sociotechnical imaginaries' [10] and 'hydrosocial territories' [12], which we align with the concepts of 'epistemic communities' [14,15] and 'truth regimes' [13]. We adopt an interpretative approach and use these concepts as lenses to analyse empirical findings. By combining the four concepts, we define the concept of river imaginaries. The intention is not to develop a new conceptual approach, but rather to introduce the groundwork for a novel way to study the power of futures in river management.

2.1.1. River Futures: Sociotechnical Imaginaries and Hydrosocial Territories

The concept of sociotechnical imaginaries has been used to study how ideas on technology and their contribution to 'progress' reinforce specific ideas on what progress is, could be, or should be. Davoudi and Machen [16], for instance, studied how imaginaries materialise specific ideas on how to address climate change. For us, this materialisation is key; sociotechnical imaginaries are more than a product of imagination and exist outside the mind [17–21]. Jasanoff and Kim [10] (p. 19), in their definition of sociotechnical imaginaries, for instance, emphasised that imaginaries are about *performed* visions: "*collectively held and performed visions of desirable futures (or of resistance against the undesirable),*" and they are also, "*animated by shared understanding about social life and social order attainable through, and supportive of, advances in science and technology*".

Their definition also demonstrates that imaginaries, in their collective nature, surpass the individual. With regards to 'visions of desirable futures', in our understanding of imaginaries, we extend beyond the desirable because they also include assumptions about what is possible, probable, plausible, imaginable, and unimaginable. Sociotechnical imaginaries provide an entire demarcated framework in which some elements fit well and others do not. Moreover, futures are shaped through histories, past memories, and actively constructed memories about the past, often influenced by idealised wishes to go back to the past by redefining and prioritising pasts, presents, and futures [22]. In addition, rulers in every society have always legitimatised their power by actively devising 'convenient histories' that confirm their origin, position, knowledge, and authority. All of these codetermine river imaginaries: river imaginaries are about what a river is, what a river was, what a river ought to be, and what a river cannot be.

The concept of hydrosocial territories helps us to think through the intertwined sociomaterial nature of rivers, defined as "*the contested imaginary and socio-environmental materialization of a spatially bound multi-scalar network in which humans, water flows, ecological relations, hydraulic infrastructure, financial means, legal-administrative arrangements and cultural institutions and practices are interactively defined, aligned and mobilized through epistemological belief systems, political hierarchies and naturalizing discourses*". [12] (p. 2).

Rivers thus entail more than water. Understandings of riverine socio-natural life and socio-natural order include both human and non-human elements and particular ways of defining and entwining social and ecological communities. These understandings can be shared, but are also contested [23,24].

2.1.2. Power of River Futures: Epistemic Communities and Truth Regimes

Both concepts of sociotechnical imaginaries and hydrosocial territories state that these shared or contested understanding(s) of riverine socionature are mobilised through "*advances in science and technology*" and through "*epistemological belief systems, political hierarchies and naturalizing discourses*". To operationalise the idea of collectively held (and contested) sociotechnical visions, we employ the notion of epistemic communities, which Haas [14] (p. 3) defined as "*a network of professionals with recognized expertise and competence in a particular domain and an authoritative claim to policy-relevant knowledge within that domain or issue-area*".

Such communities are not restricted to the professionals' worlds but also include those who know rivers through different practices and ontologies. Members of an epistemic community share a trust or faith in the existence of a certain truth and the applicability of certain methods to come to specific knowledge or truth.

Truths become powerful through regimes that couple power to particular knowledge while disempowering other forms and agents of knowledge. We understand power as omnipresent, "*. . . not because it would be in the privileged position of being able to group everything under its invincible unity, but because it is produced at every moment, at every point or, rather, in every relationship between different points*" [13] (p. 98). Power is thus relational in networks and often exists unintentionally. Foucault connects power to knowledge and truth by introducing discourses. For Foucault, a discourse establishes what is 'true' based on socially accepted modes of knowledge production. By separating legitimate forms of truth production from illegitimate forms of truth production, epistemic communities determine how and which 'truth' is reproduced, empowering or disempowering other forms of knowledge.

We distinguish three dimensions of power and knowledge: visible, hidden, and normalising powers (adapted from [25,26]; see also [27,28]). Visible power is the power that is demonstrated through formal rules, visible hierarchical valuation of expert epistemes, and recognition of established knowledge institutes. Hidden power refers to the manipulative and purposeful exclusion of alternative epistemes that aim for agenda setting. Normalising power links to the control of knowledge and truth production to unconsciously shape the legitimacy of those in power and demoralise others. In this normalising approach to power,

those who produce the dominant and most trusted knowledge thus have the power to shape the legitimacy, probability, plausibility, and imaginability of river futures.

In riverine struggles over knowledge and intervention projects, each of these three forms of power and knowledge gain responses or are actively contested in their own way [29]. Visible power may often be contested by presenting counter-facts that are presented as 'more objective' or 'more grounded' through the production of social and environmental information and data. Hidden power may be challenged by involving sidelined or marginalised actors (e.g., class, gender, and ethnic groups that hold alternative river wisdom) in the dominant river debate, challenging unequal (institutional) epistemic structures. Normalising power may be contested by scrutinising dominant knowledge production practices and steering toward their de-normalisation while building and advocating for other ontologies, thus challenging the way a shared understanding of social/natural life and order is produced.

In conclusion, we study the power of river futures through river imaginaries, which we define as collectively performed and publicly envisioned reproductions of riverine socionatures mobilised through truth claims of social life and order.

2.2. Methods

We can gain insight into the content of imaginaries by comparing the holders of certain imaginaries [10]. For instance, imaginaries can be found in the expression of values, symbols, norms, institutions, perceptions, emotions, and social relationships. In the context of climate change, Davoudi and Machen [16] described how visual images, fiction, metaphors, stories, and calculations shape imaginaries of climate change and how different mediums (models and poems) materialise different climate imaginaries.

For this research, we adopted a case study approach focusing on the Border Meuse River. Although this river trajectory forms the border between Belgium and the Netherlands, we study the river in the Dutch context and the Border Meuse project because "projects may themselves reflect animating sociotechnical imaginaries" [10] (p. 20). Within the formal water expert community, the project is presented as a 'best practices' example of nature-based solutions for climate change adaptation. This case study is thus suitable for studying how normative statements of 'best practices' are linked to futures, knowledge, and truth.

2.2.1. Case Study: The Truth Regime of Climate Change Adaptation in The Netherlands

The Dutch water sector has recognised a need for climate change adaptation and formalised this in a national delta plan developed by the Ministry of Infrastructure and Water. The executive branch of the national water authority (Rijkswaterstaat) and the regional water authorities (Waterschappen) are responsible for its implementation. The national authority is responsible for the large watercourses and rivers, while the regional authorities are responsible for the tributaries and smaller rivers and channels outside urban areas. The ministry states that "*doing nothing* [on climate change adaptation] *means that until 2050, between €77.5 and €173.6 billion of climate damage can occur. This is why climate change adaptation is needed*" [30].

The national policy that describes how to adapt to climate change through river management argues that "*a forceful interplay of giving space to rivers and dike reinforcement*" is the way to adapt to climate change [31] (p. 6).

The national and regional authorities focus on determining water 'risks', 'vulnerability', and 'safety' through the consultation of experts from different fields. By law, it is the authorities' responsibility to guarantee a certain level of flood safety during periods of high water levels. Flood safety is calculated through statistics that determine the return periods of high water levels that caused damaging floods in the past. In this process, numerical models are a common tool to simulate the effect of high water levels that determine the risk of flood. Risk, in this context, refers to the risk of societal and economic losses, implying that protection measures are more strict in areas with a high economic value and a dense

population. For instance, dikes and other protection measures against high water levels have stricter specifications in the densely populated region in the west of the country.

Potential economic impacts of climate change through floods, among other effects, are provided on a public platform 'de klimaatschadeschatter' (the climate damage estimator) initiated by the Delta Commission, the Ministry of Infrastructure and Water, the national water authority (Rijkswaterstaat), the applied water science association (STOWA), regional water authorities, the Dutch association for scientific research (NWO), the Topsector Water, water knowledge institute Deltares, Wageningen University, applied natural science institute TNO, Royal Dutch Meteorology Institute (KNMI), and the (water) business community [32]. Historically, water management was mainly approached through technocratic solutions provided by engineers, yet a turn in green technocratic solutions invited ecologist to join the safety debate, as nature is seen as potentially contributing to flood and drought so-lutions [33]. The formal policies around climate adaptation and implementation of solutions are thus shaped by a (eco)technocratic alliance.

The national and regional authorities that implement flood measures often operate through participatory processes that are framed to be inclusive, although crucial decisions are often already taken and the methods rather serve to mo-bilise allies for the project [34]. Experts from the field of behavioural change, e.g., applied psychology or participatory arts, are asked to be involved in change management that, for instance, emphasises what citizens can do themselves, in a process of slowly moving away from guaranteeing safety at all time [35]. By stating that climate change and the adaptation toward climate change is a common problem that can only be solved together, 'good citizenship' is normalised.

2.2.2. Case Study: The Meuse River and the Border Meuse Section

The Meuse River is born in France, flows north through Belgium and the Netherlands, and meets the North Sea in the port of Rotterdam. The Dutch part of the river is 196 km long, 100 m wide on average, and stabilised through 8 weirs, 1 movable bridge, and 4 dams for navigation [36]. Flood events in 1993 and 1995 in the south of the Netherlands led to a focus on flood management and the development of flood scenarios, further reinforced by floods in 2021.

The Border Meuse trajectory of the river Meuse marks the Belgium/Netherlands frontiers. The Meuse enters the Netherlands south of Maastricht and is named the Border Meuse from upstream of the Borgharen dam until the downstream Linne dam. In this stretch, the river is free-flowing. The Meuse is rain-fed and has a mean flow of 230 m^3/s (Borgharen station), with fluctuations between 20m^3/s and 3000m^3/s [37]. Historically, this stretch of the river was navigable, but many meanders and accidents led to the construction of the Dutch Juliana channel and the Belgian Albert channel. These two channels were built to optimise navigation through Belgium and the Netherlands, and the Border Meuse is no longer used for navigation. The agreement between water use sectors and the governments is that the Border Meuse receives a base flow of 10m^3/s. Minor daily fluctuations (hydro peaks) are caused by the hydroelectric power plants and the opening and closing of the weirs upstream.

This section of the Meuse has seen substantial changes over the last decade through the implementation of the Border Meuse project (2008–2027). This project is one of the proclaimed success stories of climate change adaptation through nature-based solutions in the Netherlands. A key aspect of the project's success is that it combines enhanced flood safety and nature without the need for society to pay for the costs. The Border Meuse consortium (the Grensmaas consortium) is a partnership between the public and private sectors, in which the national water authority, nature organisations, the province, and gravel extraction companies worked together to design the river. Gravel extraction has widened the riverbed to increase space for flood events, with the sale of gravel to co-finance the project.

2.2.3. Research Activities

Primary data were collected through semi-structured interviews, co-organising student/practitioner fieldwork activities, observations during public river events, and ecological fieldwork sampling with ecologists and activists in the area. Secondary data were collected through unstructured grey document analysis, as well as academic literature. An interview protocol was designed to inform interview participants—prior to their participation in this research—of the goal of this research, the use and privacy of data, and the aftercare. Oral consent to use anonymised quotes was collected for all individual interactions.

Nine in-depth interviews were conducted between May and August 2022. A total of 6 river walks were organised, during which semi-structured interviews of 2 h were conducted alongside the river course. The interviews were conducted during river walks because it visually highlights the materiality of the river and the project, it enables the interviewee to make observations about the river, and it is a shared experience rather than mere information extraction. It is an embodied way of connecting self and place and there is room for spontaneity, silence, and awkwardness. Through walking, a different balance between the interviewee and the interviewer is created. Two additional semi-structured interviews of 2 h were conducted with those who did not have the physical capacity for long walks, and 1 interview of 30 min was conducted online. The interview questions were set up according to themes that reflect our conceptualisation of river imaginaries: the river and the river project, past–present–future dynamics, the future and future ontology, and epistemic communities (Appendix A).

Additionally, 2 Climate Cafés were organised in June 2021 and April 2022, involving one week in which a group of students and practitioners learned and talked about water management (for details on activities, see [38]). The organisation and execution of Climate Cafés provided insight into differences and interactions between communities that hold certain imaginaries. The co-organisation of the activities together with practitioners and scientists in a Living Lab setting gave insight into current (applied research) interests and debates on the river and facilitated relationship-building through these debates. Moreover, the combination of (young) students and practitioners embodied the topic of the future for new generations.

Further observations during river symposia and ecological fieldwork sampling activities provided insight into current struggles around the river and specific ecological knowledge production methods. Ethnographic observations and embodied experiences were used to understand truth regime dynamics, for instance, in knowledge production processes and the role of generally accepted truths. Moreover, topics that brought discussion or emotion were thoroughly documented.

Finally, the unstructured grey document analysis included events and policy documents that were mentioned or that were related to the information given during the interviews and observations. These included policy/vision documents, news articles, laws and outcomes of legal processes, social media platforms of fish advocates, art installations of the river, and websites of organisations and their activities.

Data were processed through a qualitative thematic analysis based on our interview questions, following grounded theory, which indicates that the researcher interprets qualitative data through an inductive process in order to build a theoretical understanding of observations in practice. In this process, the researchers' own presence and interpretations unquestionably influence the results at every stage of the research process. Inspired by a 'follow the money approach' and the work of Sara Hamilton [39], we first identified the imaginaries and truth regimes at work in a 'follow the knowledge making' process, where we followed the date, uptake, and trust building of specific visions and related knowledge products mentioned during the interviews. This resulted in a detailed timeline of local river knowledge production and related future visions, developed by specific stakeholders. In the analysis, 15 river and climate adaptation documents/visions, 2 legal processes, 3 news articles, 2 websites, and 3 flooding events were selected to demonstrate this process.

Although a myriad of stakeholders were involved in different river debates, we present those that were found to be most prominent in (contestation of) knowledge making and vision development for the case study. However, we realise that these are not exhaustive and that more imaginaries exist. Stakeholders in this study are seen as individuals who hold aspects of multiple imaginaries and sometimes express conflicting or contracting standpoints. We assume that one person can hold, perform, and support multiple aspects of several imaginaries. As such, we chose to use quotes of individuals without revealing their identity as this is not crucial for the purpose of the quote. Therefore, we present quotes that were mentioned as illustrations of the imaginaries, indicating a (power/influential/job) position and an organization.

We chose to not describe the imaginaries as individual storylines because they interact with each other, evolve, and are dynamic through time. Therefore, we separated the results and discussion, where the results entail a chronological description of knowledge making and vision development around which the imaginaries interact to stay close to our data, while in the discussion, we interpret this process through the lens of our theoretical framework.

3. Results

3.1. The Emergence and Merger of Three River Futures

In the mid 1980′s, the Dutch landscape was seen as vulnerable and boring; acid rain, dead rivers, and biodiversity loss were associated with anthropogenic activities [40]. The recognition of the overexploitation of nature gained weight in the political debate. In a national contest with the theme "the Netherlands-river land", a plan named "Stork" ("Ooievaar" in Dutch) presented a new and unconventional ecological view on river management and agricultural development. The project team won the contest in May 1986 [40]. The plan sketched ideas around rivers as connecting features of a landscape, in which ecology could thrive in the riparian zones and valley lands of the rivers. In their vision, rivers were seen as wild and free, full of life, and with space to meander. Specifically, forest and marshland development in the floodplain, combined with mineral and sediment extraction, was seen as bold because nature and gravel extraction were seen as opposite river futures. The plan focused on new interactions between the natural dynamics of the river, land use, and landscape quality.

In 1987, a book was published to elaborate on the plan with the same name—Stork ("Ooievaar") [41], from which two organisations emerged: a consultancy office named "Bureau Stroming" and an environmental management/lobby/research foundation named "stichting ARK", which first operated together and were later split [42]. Moreover, the plan led to a more detailed national plan developed by the World Wildlife Foundation in the Netherlands, named "Plan Living Rivers" in 1992 [43]. Because their visions were seen as unconventional and sceptical, the feasibility of the plans was questioned and several strategies were employed to convince others of their future river vision. For instance, campaigns were organised for policymakers to visit other rivers in Europe, such as the Allier in France, to show how the aesthetics of such a river could become a potential future river in the Netherlands. Similarities in hydrological and morphological characteristics between the Border Meuse and the Allier River, for instance, in bathymetry, hydrological regime, and sediment type (gravel), were further explored. Moreover, historical studies were conducted to understand how the natural river looked like in the past, for instance, which vegetation grew on the sides of the river and how old river meanders were situated. Based on this, it was thought that the Border Meuse was that the river could be rewilded, i.e., a free-flowing river in which ecology could develop freely and where flow regimes could be determined based on ecology instead of navigation because there is no navigation on this stretch of the river as the canal runs in parallel.

At the same time, the province of Limburg was obliged to supply a large amount of gravel to the national government. Extracting gravel was a sensitive issue in this specific province due to problems with historical deep mining, deep gravel extraction, and other

cases of pollution [44]. This part of the Meuse is one of the few places in the Netherlands where gravel can be excavated. The national government put pressure on excavation because the Netherlands had to source a certain amount of gravel from its own territory in order to be able to buy gravel from Germany (pers. comm., prominent project member of local authorities, 22 August 2022). The inability to buy gravel was considered to be a problem for the Netherlands, being a highly infrastructuralised state (pers. comm., a representative from the gravel and sand industry, 19 August 2022). In 1991, the province commissioned the newly emerged consultancy company Bureau Stroming to develop a plan for the development of nature in combination with gravel extraction called "Future for a Gravel River" for this specific trajectory of the Meuse [45]. The covers of the books presenting both this plan and the earlier plan, Stork, carry romantic images of a river with vegetation around it, feeding into both historic and futuristic images of the river as a free, wild, and romantic place (Figure 1a,b).

(**a**) (**b**)

Figure 1. Front covers of the river's future plans demonstrate a romantic view that represents a wild and natural river as it presumably was in the past. The vegetation is an eye-catching feature. The illustrations were made by (**a**) Natuur en Milieu Gelderland [39] and (**b**) Bureau Stroming and reused with the owner's permission [41,45].

The national ministry supported the call for a more eco-centric way of water management in combination with gravel extraction. However, the legal obligation of the national water authority (Rijkswaterstaat) was limited to 'robust and adequate' water safety. This meant that the organisation did not have the legal role to develop nature unless it would contribute to a safer river. In addition, at the bare minimum, nature development and gravel mining should not have hampered water safety in any way. The extreme water levels in 1993 and 1995 flooded many households in the Border Meuse area and showed that current flood safety was not up to the desired standards. This provided the political incentive for the water authority to improve water safety against flooding in this part of the river, resulting in the development of the Deltaplan Main Rivers in 1995 [46]. In order to realise this, studies on flood safety were implemented, which leaned heavily on hydraulic and hydrological models.

The obligation for gravel extraction, an increased political will to pursue increased flood safety, and the lobby for eco-centric water management, together made it possible to negotiate designs for the future of the Border Meuse. Crucially, the gravel revenue would pay these 'win-win-win' scenarios (pers. comm., a representative from the gravel and sand industry, 19 August 2022). The negotiation process over the future river design stilted a few times. In 2001, the project almost collapsed because of a sudden increase in the planned amount of gravel extraction. Inhabitants contested, and protest groups started to rise, but motivated key people remained to negotiate, and in 2008, the work began (pers. comm., prominent project member of local authorities, 22 August 2022).

Three river futures had to be entwined in one project. The main claim from the gravel miners to be involved was that a total of 35 million tonnes of gravel would be made available for the gravel company as this amount was needed to make the investments profitable for them. The main requirement for the national water authority was that new flood safety standards would be developed and achieved. In addition, the principal demand from the nature organisations that created the initial Stork river vision was that the floodplain would contribute to rewilding the river. In order to realise this, landowners close to the river, mainly farmers, needed to be bought out. The project and excavation were set to finish in 2021, and the targets for flood safety were set to be reached in 2017. After this, the nature targets were set to be reached in 2018. However, an economic crisis with low gravel prices around the start of the work in 2008 gradually delayed the project to 2027 in order to make the project economically feasible.

3.2. Contestation and Negotiation of Rewilding Principles

Throughout the process of developing this future river, the vision of a free-flowing river was contested. It was, for instance, posited that a flexible river course is not possible according to international agreements between Belgium and the Netherlands as the deepest point of the river should remain the border between the two countries (pers. comm., prominent project member of local authorities, 22 August 2022). Thus, the river can only be free-flowing if the deepest point stays in the same place. Although in Belgium, some villages were gradually deserted to make room for a free-flowing river, on the Dutch side of the river, all villages along the river remain protected:

"*We cannot destroy all the villages to let the natural river exist, but within the constraints we succeeded in doing the optimum. A natural river is a river which can do its thing, while we look at how things evolve*" (pers. comm., project implementation team member Grensmaas consortium, 23 August 2022)

Furthermore, gravel barriers were included in the design of the river to increase the water level of the river, with the aim of preventing drainage and subsequent lowering of the groundwater table in a Belgian nature reserve nearby. In 2005, a study was conducted to determine the effects of the barriers on the ecosystem next to the river, and it was found that it would have a positive impact on the Belgian nature reserve and would not have a negative impact on the river ecology [47]. However, another study, conducted in 2006, advised against the implementation of gravel barriers as it may negatively affect aquatic ecology [48].

This study and other similar studies fuelled resistance against the designs, most vocally expressed by the Anglers Association (Sportvisserij Limburg and Visstandverbetering Maas). With some 600,000 members, the Dutch Anglers Organisation is the second-largest sports association in the Netherlands. They systematically collect and share information on fish population and fish spotting. They were critical for the establishment of nature organisations that initiated the plan "Stork". For instance, at the inlet of the trajectory, a fish nursery was designed, but hydropeaking events and the lack of water decreased fish survival. The organisation actively campaigned to raise this issue, amongst others, through a social media campaign by using pictures of rapid hydro peaks that caused fish deaths (Figure 2a). Established nature organisations responded sceptically and stated that, as it is a rainfed river, fluctuations are natural and beneficial to birds and other fauna in the

ecosystem because they can eat the fish. Moreover, the angler's morality was questioned by stating that catching fish is not fish-friendly at all (pers. Comm., program lead Border Meuse, nature organisation, 24 April 2022).

(**a**) (**b**)

Figure 2. Pictures shared internally and posted by the Anglers Association on their Facebook account and to create allies for a more fish-friendly river and to visualise a lack of focus on fish ecology around the Grensmaas. The photo on the left (**a**) was taken by Henk Houben and reused with the permission of the owner David Vertegaal, Sportvisserij Nederland. The photo on the right (**b**) was taken by Thijs Belgers and reused with the owner's permission [49].

The advocacy for fish through the Anglers Association was thus largely ignored in the designs. When visiting an area where a fish nursery was planned, a representative of the Anglers Organisation described that "*this is the only place* [in the Border Meuse, red.] *where fish-ecology was even a point of discussion* [in other parts of the river, fish-ecology was not an agenda point, red.]. *There have been discussions about the inlet, on how much water should be let into Boscherveld* [the fish nursery, red.]. *For fish, more water is better, but this was chosen differently*" (pers. Comm., a prominent member of the Anglers Organisation, 24 August 2022).

This inlet has been subject to more fish debates. The Anglers Association filed a court trial in 2007 against permits for a hydroelectric installation. The association researched how the propellors of the plant were killing fish (Figure 2b) and stated that this was not according to the allowable rate of fish death caused by a turbine. Representatives of the Anglers Association stated that, in the first part of the trial, the court considered the Anglers Association to not be knowledgeable enough because their research was not formalised. It considered the organisation to be too biased for the results to be trusted in court. It was only in 2011, following new studies conducted by organisations with recognised authority (VisAdvies, Deltares, and Vivion) [49], the court decided in favour of the Anglers Association and against the construction of the hydroelectric installation.

More studies on fish wellbeing were conducted, specifically on salmon because it is one of the target species in the vision. Discussions remain around the question of what is optimal for what fish as fish are not a homogeneous group. In 2017, another study indicated that low discharge is not optimal for the desirable fish types [50]. When new research on fish was announced, representatives of the Anglers Organisations decried, "*again a new study*", indicating their scepticism on the need for more research by the state, only to prove a point already established.

The idea to rename the Border Meuse as the 'Common Meuse' was formalised in 2016. This was intended to emphasise the view of the river on both sides as one natural area and to eliminate the constraints of the middle of the river being an international border

(pers. comm., project member of Dutch-Flemish nature-culture organisation, 2 August 2022). Political and discursive inclusion had clear results; the influence of the fish ecology lobbyists increased when dominant nature organisations provided room to contribute to debates about river futures. A vision of the river that connected a living river with fish and underwater life emerged. As fish came to be seen as representing this 'liveliness', the fish-friendly river vision was considered by the national water authority, where expertise on freshwater ecology increased. Slowly, the Anglers Association gained more trust in the water governing bodies.

In 2018, 25 years after the first Plan Living Rivers of the Dutch World Wildlife Foundation, a new document on national river vision was published by established Dutch nature organisations [51]. This document was presented as a counter-document to the dominating national delta plan [52], where they stated that the dominant plan does not combine landscape quality with flood safety. In their new plan, more attention was given to a living river, including the development of reserves for underwater life (Figure 3). Moreover, the background document included an elaborate history that described how the natural river started to be canalised and diked to protect people against flooding, thereby breaking away from the rivers' natural behaviour. In this reflection, the Border Meuse project is seen as a positive example of nature development and flood safety by nature organisations because ecological targets were present in an early stage of the process. The absence of navigation in this stretch of the river made it easier to focus on such ecological targets.

Figure 3. Visualisation of a living river with thriving underwater life in the new living river vision of the World Wildlife Foundation. This vision includes fish as an important indicator of life and indicates that, in addition to fish, macro- and microfauna in the river exist and are considered to be valuable for the underwater reserves. The rewilding image is extended from only having trees on land in the original plans (Figure 1) to including underwater wildlife in this image. The illustration includes tekst in Dutch arguing why river wood is crucial for underwater life and was made by Jeroen Helmer, ARK Rewilding Nederland and reused with the owner's permission [51].

3.3. The Border Meuse as a Success Story

In 2020, the project received a prize from the Dutch water sector and was presented as one of the best examples of a 'nature-based solution' for inclusive flood protection and climate change adaptation. The prize was awarded based on the "*effective, innovative and promising implementation of the national Delta program*" [53]. Overall, public acceptance of the

project was high. In order to facilitate a smooth implementation of the project, the Border Meuse consortium was established, which carried out an extensive participatory process.

The Border Meuse consortium had the status of a private entity and could thus have flexibility with their expenditures. In almost all villages near the river, local citizen groups ("Klankbordgroepen" in Dutch) were created to include local wishes and doubts during the execution of the project. The participatory process was designed to facilitate a smooth execution of the work and to create a local alliance for the project's objectives. This resulted in formal, but mostly informal, subtle, and strategic actions. Deviants and opponents had to be converted into proponents. As an example, in one of the villages, there were a dozen people who would experience nuisance due to the installation of sheet piles during the day. Because they had to sleep during the day due to their night jobs, the company compensated the whole street and gave them a free stay in a holiday park for a few days. This would have been far more difficult if the consortium only consisted of a bureaucratic public entity. Upon initiation, critical groups, such as the BOM (see [44]), existed, but strong gravel contestation slowly vaporised. Many inhabitants of river villages from the Dutch side of Grensmaas gradually embraced the plans, adopting the ontological perspective of the consortium's epistemic community: (person 1) "*The consortium is very open with information so they are to be trusted. Also because the project did end-up the way they said. Before the implementation there was some unrest. Because of stupid people. Fear for change*". (person 2): "*But I find it really beautiful. I feel way less fearful when there is high water. From the house you can see the water increase. Also in '93 this was very scary. Now it is safe and it feels better*". (pers. comm., inhabitants of Dutch village near river, 26 July 2022).

Through this process, the image of the consortium and national water authority shifted as they were previously seen as mere technocrats and were now also seen as entities who created nature and cared for the river and the people around the river. The consortium and the national water authority actively supported the rewilding future as an absolute solution to the problems of flooding and biodiversity loss. The studies that supported environmental findings were supported and framed as additional benefits to secure flood safety and gravel extraction. An activist on the Dutch side of the river stated this shift in perspective as follows: "*RWS'* [the national water authorities, red.] *view on the river in the past was very different, because of stichting ARK* [the nature organisation] *the wild nature is the base*". (personal communication with activist and inhabitant on the Dutch side of the Grensmaas, 4 August 2022).

Moreover, the image of gravel extraction companies shifted. By positioning themselves as the creators of wild natural areas, they were considered proponents of the future of a wild and natural river. Reports in collaboration with the Butterfly Association positioned the gravel industry as creators of natural areas as they changed the previous agricultural grounds on the sides of the river into 'wild nature' by exploiting the ground [54]. Supported by this report, the gravel industry described this shift in perspective as follows: "*We* [the gravel miners, red.] *create nature by our activities, mining is therefore good for biodiversity and we are the largest nature-development organization*". (pers. comm., a representative gravel and sand industry, 19 August 2022).

These examples illustrate how the Border Meuse became a story of inclusive water governance through normalising practices that aligned with the dominant river future.

3.4. Continued Debates on River Futures—A Dominant Eco-Modern River Imaginary

It is interesting and important to see how Dutch society, policymakers, and institutions have historically embraced their self-image of a 'poldering' and participatory 'water authority culture', convinced by the idea that they have a tradition of solving the core problems by open discussions and inclusive stakeholder negotiations. Dutch water governance is a prime example of this. This water history-based self-image connected to 'participatory pride' has remained sturdy even when challenged by, for instance, critical scholars or outsiders who would point at the discrepancies and power plays behind the Dutch 'polder model'. The relational, network-like, and omnipresent power in Dutch water thinking

('*we Dutch have water in our genes*' and '*God made the world but the Dutch made The Netherlands*'—as if it were not a selective group of rule makers and power institutes who decide on water governance) is deeply ingrained in rule makers and rule followers. The way in which norms and behaviour are normalised shows that Foucauldian discursive power and epistemological belief systems are not just 'soft' but have real, material effects, including in river intervention projects.

In September 2022, an article in The Guardian described the Border Meuse project as a nice example of river management but also one that would have been impossible to implement in the political context of the United Kingdom [55]. Contrary to the Dutch citizens' and water governance self-image and the deeply ingrained self-perspective of the Grensmaas as a strongly participatory project and process, the interviewee of the Rivers Trust characterised it as heavily top-down and stated that the United Kingdom "*tend to take a much more bottom-up approach and look to incentivize landowners and farmers by working collaboratively*" [55].

Illustrations of this paradoxical divergence between participatory self-image and perceptions from outsiders are abundant. For instance, in 2022, two of the Dutch nature organisations filed a lawsuit against the plan of the water authority to remove trees in the riparian flood zones of the Border Meuse for flood safety reasons [56]. As a result of model studies, the trees were found to hamper flood safety and thus needed to be cut down. The nature organisations contested this but did not have sufficient proof. In early 2023, the court decided in favour of the national water authority and the trees had to be cut. In a news interview, the national water authority responded in one of the practitioners' news journals: "*We give as much space as possible to nature, but we have to take high-water safety into account*" (spokesman of the national water authority, 8 February 2023 [57]). The nature organisations expressed disappointment but were still convinced that poldering-style collaboration would be possible: "*We hope that despite this ruling, Rijkswaterstaat* [the national water authority, red.] *will still join us in our efforts to give natural processes along the river more time and space*" (van Schijndel, 8 February 2023 [57]).

Since the development of the plan "Stork", an ecological research agenda has been added to the dominant technocratic research agenda, which broadened traditional river truth regimes. Figure 4 summarises a selection of the events, visions, and studies that were part of this process. Although ecological research was initially seen as biased, it became more formal because established institutions adopted facts and truths that neatly aligned technocentric and eco-centric futures. Through the newly developed trust that nature could contribute to water safety, dominant actors were able to execute within their legal responsibilities. As such, the dominated technocratic truth regime was broadened with more eco-centric sciences, supported by market-driven, exploitative river use.

As mentioned earlier, the deep trust in, and the interconnection of, consensus-based participation and top down-water management led to the adoption of diverse participatory methods. The involved parties in the consortium employed a variety of strategies to create acceptance and allies for the project, from organising trips for policy makers in the planning process and the compensation of whole streets during the implementation of the project to framing river management as a common problem that has to be solved in consensus.

In summary, the historically dominant truth regime that focused on safety is using past flooding events to construct river futures in which the water safety of the river is dominant. The court case about the removal of trees after the 2021 flood indicates that, even in the new constellation of actors, interests and objectives, safety still prevails above nature. This corresponds to a strong modern and market-driven river imaginary in which the river has to be controlled for the purpose of safeguarding and optimising economic use and minimising economic and personal losses. Reproducing the past is central in the modern imaginary, and the episteme is based on this reproduction in combination with empirical evidence of the current situation. Through the past and the present, future visions are assessed on (im)probability. This has historically materialised in the form of canalised, fast-draining rivers. The truth regime that contested this has provided a strong

alternative river future, which started in the '80s and introduced formal studies on water quality and biodiversity. It also added new river histories to the river's future-making process of riverine histories with deeply ecological values and functions and pristine-like wild rivers.

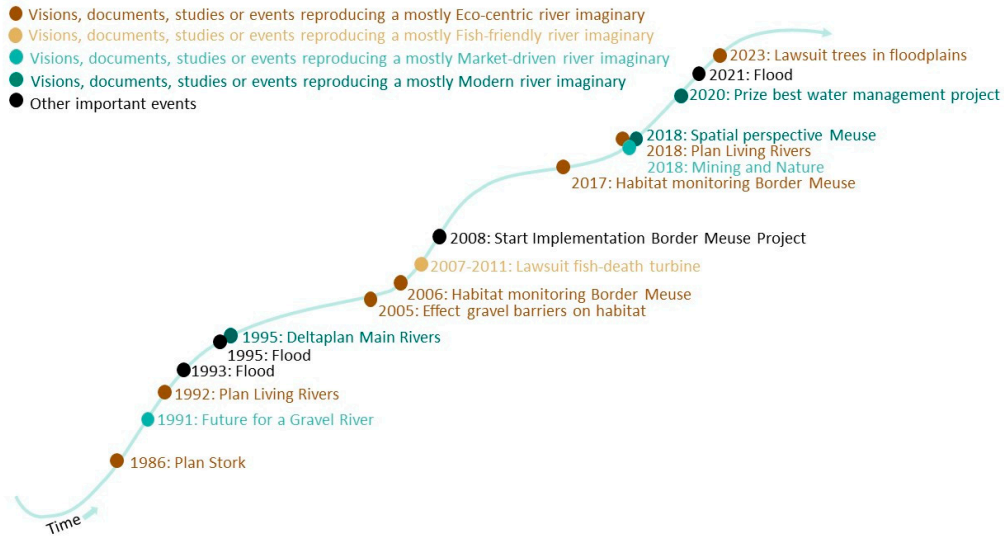

Figure 4. Timeline of visions, studies, and events that shaped an eco-modern river imaginary.

Throughout the process of the project, in which an eco-modernist river was materialised, the truth regimes 'borrowed' arguments from one another. For instance, nature as a contribution to safety has helped to develop the idea of nature-based solutions and the gravel industry as 'creators of wild natural areas' maintained their privileged position. In this process of borrowing arguments, the three imaginaries (the modern river, the market-driven river, and the eco-centric river) merged into an eco-modern river imaginary: a river that is controlled and optimised for safety and ecology, in which the execution is financed by the private sector.

4. Discussion

Through this research, we aimed to understand why societies choose particular directions of change over others, in the context of climate change adaptation in river management. To this end, we scrutinised the future-making process of river futures in the Border Meuse River adaptation project as river futures legitimise and steer adaptation in rivers. The power of river futures, conceptualised as river imaginaries, shows how visible power, hidden power, and normalising power are employed by different epistemic communities to support their river truth. The results suggest that the dominant mode of river knowledge revolved around a modern and market-driven river imaginary, which is safe and economically sound. The contesting river knowledge revolved around an eco-centric river imaginary, which is wild and free-flowing. In this section, we further interpret how the truth regimes use visible, hidden, and normalising structures and strategies to make their river future dominant. We summarise this in Table 1. The outcome of this confrontation materialised in the Border Meuse as an eco-modern river imaginary: a controlled river that is safe, economically sound, and somewhat biodiverse. Figure 5 shows how three imaginaries merged, while the fish-friendly imaginary split from the eco-centric imaginary during the project. However, in 2018, the fish-friendly imaginary aligned again with the eco-centric imaginary after the floods of 2021, and close to the finalisation of the project in 2027, the modern, eco-centric, and market-driven imaginaries are split.

Table 1. Summary of visible, hidden, and normalising powers of dominant, contested, and merged river knowledge.

	Dominant Truth Regime	**Contesting Truth Regime**	**Merged Truth Regime**
	Modern and Market-Driven River Imaginary	**Eco-Centric River Imaginary**	**Eco-Modern River Imaginary**
Visible power	River future: a safe river, calculated through safety standards that are determined in the water law. The leading vision is described in the formal Delta programme. River experts: hydrologists and hydraulic engineers River rules and laws: draw on flood safety laws River institutes: Ministry of Infrastructure and Water, national water authorities, and knowledge institutes partially financed by the state	River future: a wild river, determined by the amount of human interventions in the area (desired as minimum) and the amount of ecological processes that can exist (desired as maximum). The vision is part of a broader re-wilding movement. River experts: ecologists River rules and laws: draw on environmental laws River institutes: NGOs and environmental consultants	River future: a wild but safe and economically feasible river where ecology can develop if it does not hamper flood safety. River experts: A strong alliance between technocratic river management and eco-centric river management. Both draw on empiricism and historical data to gain knowledge about the future, which strengthens their imaginary. River rules and laws: draw on flood safety and environmental laws and aim to find compromises or synergies between the two River institutes: Partnerships between public and private parties, such as the Border Meuse consortium
Hidden power	River agenda: To understand water safety, research should be dedicated to quantifiable knowledge of risks and vulnerability. Included views: market partners (gravel industry) Exclusion strategy: diminish trust in ecological knowledge by ignoring counter-facts on the implications of the project on ecology	River agenda: To understand river ecology, research should be dedicated to quantifiable knowledge of biodiversity, with a focus on the whole ecosystem and species-specific interactions. Included views: market partners (gravel industry) Counter strategy: producing counter-facts and demonstrating the impact of the dominant truth regime on certain ecologies	River agenda: To understand how river ecology and water safety can be combined and optimised and benefit from each other, research should be focused on opportunities to couple the research domains and quantify their complementarity in reaching optimised and cost-effective water safety Exclusion strategy: framing species-specific ecology such as fish/aquatic ecology as biased and single-minded
Normalising power	River moralisation: Controlling the river for flood safety is/should be a common goal of subjects and rulers. Thus, subjects need to be educated by the ruling parties. Protecting people from floods is a common task and is best realised by top-down collaboration between the public and private sectors.	River moralisation: A healthy river is/should be a common goal of subjects and rulers. Thus, subjects need to be educated by the ruling parties. Protecting the river ecology is a common task and is best realised by tow-down river management.	River moralisation: A healthy river can contribute to a safe river and is/should be a common goal of subjects and rulers. Thus, subjects need to be educated. A safe and healthy river is a common desire best realised by top-down collaboration between the public and private sectors where participation is aimed at creating allies.

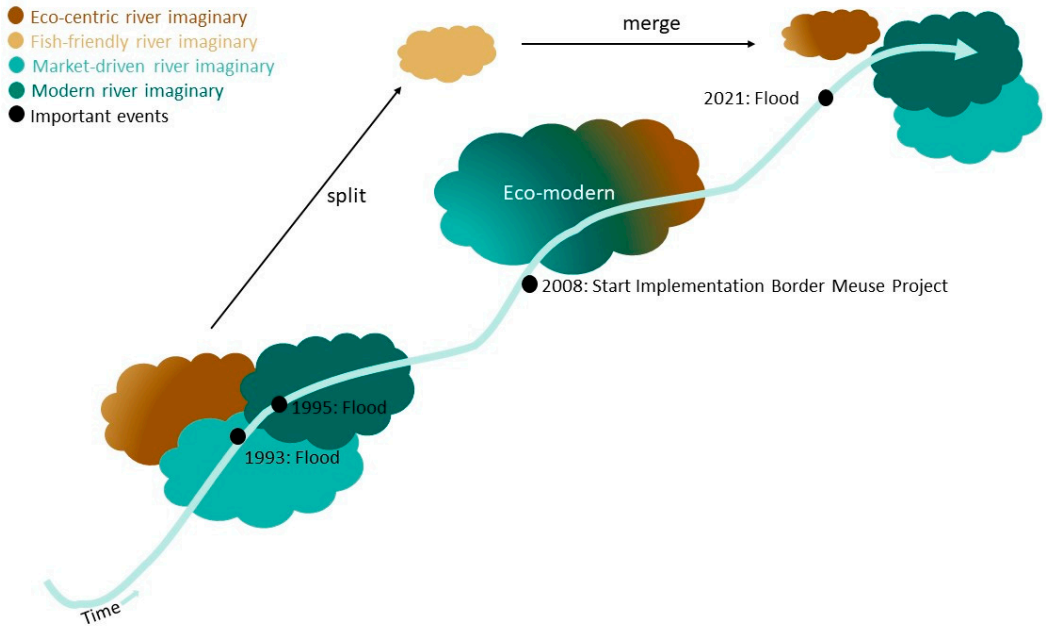

Figure 5. Illustration of the dynamics of the river imaginaries over time, highlighting important events in the Border Meuse. In the floods of 1993 and 1995, three imaginaries moved toward each other and started negotiating toward an eco-modern river imaginary. Yet, during this time, the fish-friendly imaginary split from the eco-centric imaginary. After the 2021 floods, the eco-centric imaginary split off from the modern and market-driven imaginaries.

4.1. Visible Power: Power over River Futures

The dominant mode of river knowledge lies within the realm of the national water authorities. They have the legal role of securing water safety and have to use a set of tools that are pre-determined by national water law to assess flood safety. Flood safety is inevitably about the future; therefore, this type of future is visibly dominant. The experts in the institutes, concerned with water safety estimations, have backgrounds in civil engineering, hydrology, and hydraulics and have epistemic dominance in producing a river truth. Water safety levels are informed by potential economic and life losses, influenced by a market-driven river imaginary. The visible river future is formalised in the national delta plan, developed under the supervision of the Ministry of Infrastructure and Water, which is led by a minister in the government. The respective epistemic community relies on a combination of historical empirical observations and model simulations to formulate probable futures. Interventions to adapt to the river futures are calculated through cost-benefit analyses and climate damage estimators.

Visible power is contested by the plans that relate to the living river future. Counter-facts are produced by presenting alternative ideas on water safety, in this case, by widening the riverbed, driven by a market-driven imaginary and by emphasising that this was also economically feasible. Accepting these counter-facts highlighted several knowledge gaps in the water safety paradigm, for instance, on how to calculate water safety with a widened river bed and with vegetation in the flood plains.

4.2. Hidden Power: Power to River Futures

The water authorities (at ministry, national, and regional levels) set the agenda on the questions that are of importance to study. The national water authority primarily involved the views and agents of those who were willing to work on water safety. Studies that addressed other issues were seen as biased and unimportant, as illustrated by the lawsuit of the Anglers Association. In this lawsuit, the Anglers Association was first seen as not knowledgeable enough, and after they presented formal studies, these were seen as biased. Additionally, the lawsuit of the nature organisations against the national water authorities

once more illustrates how alternative views on water safety are marginalised. As such, authorities employed their hidden power by silencing counter-facts.

The sole focus on water safety in river management was, however, shortly contested, introducing the relevance of water quality and biodiversity. This was performed by showing what happens to water quality and biodiversity if only water safety is taken into account, for example, with studies on the influence of the gravel barriers on the Belgian nature reserve. Other types of studies by the ecology epistemic community challenge unequal prioritisation of safety and state that safety should also consider ecological quality.

4.3. Normalising Power: Power within River Futures

Water safety is unquestionably moralised through actively framing flood protection as the only way to protect people from floods. Market-driven arguments are used to define the way to adapt to this by the technocratic design of (green) infrastructure. The use of water safety is supported by arguments of feasibility (the economic feasibility of the project/local support, creating allies/subjects), desirability (a clean/safe river), probability (chances of flood/chances of invasive species establishment), and plausibility (reproduction of the past).

Inhabitants are approached as subjects and are made into allies during the intensive participatory process, where internalisation and externalisation of the imaginary occur. In this process, safety, which is statistically defined as being protected from events with a certain return period, and the belief in safety, is naturalised. This makes it hard to propose something that does not comply with safety, creating moral superiority. Those who become proponents of a certain future are also the ones who further seek allies. First, the imaginary is internalised, then normalised, and finally, externalised.

However, a debate about the rewilding river future led to the contestation of the eco-modern river imaginary. The particular position of the Anglers Association in the debate indicates that, although they were invited to the debate on river futures, they had to use the legal system to contest decisions. Nature organisations weakened the position of the Anglers Association by framing fish death as a natural process and by casting doubt on whether they are advocates for fish. A fish-friendly river future as foreseen by the Anglers Association thus became a separate counter imaginary of the eco-modern imaginary. Contestation of river knowledge through their own data collection was considered biased at first, which then was formalised to be used in court. Despite their activism, they aligned with the way knowledge is produced by the dominant actors. They first conducted studies, deploying their own vernacular methods, but later adopted methods that were recognised by the national water authority.

5. Conclusions

We scrutinised the future-making processes in the context of climate change adaptation in river management. We conceptualised the power of river futures as river imaginaries to understand our climate change adaptation case study. Through the Border Meuse project, a climate change adaptation project in a stretch of the river Meuse in the south of the Netherlands, we elucidated how three river imaginaries, i.e., a modern river imaginary, a market-driven imaginary, and an eco-centric river imaginary, merged into an eco-modern river imaginary. Importantly, not only did the river futures merge but their aligned truth regimes also merged. We have shown how the emerging eco-modern river was normalised through extensive participatory practices. However, we also found subtle contestation that influences the river agenda and river futures.

The current-day powerful support those imaginaries that keep them in power. For instance, widening the riverbed is perfect for the exploitation of gravel as it changes the perception of gravel extraction from a solely economic activity to a societal and environmental activity, enhancing the ecological value and the flood safety of the river. To come back to Orwell, we can see how those who control the present, control the future: those that control the future, reinvent the past. However, those who do not have control in the

present, have some control over the future, as parts of their futures are borrowed to be used by those who are dominant in the present. For instance, the gravel industry leaned on the eco-centric river imaginary as they supported the widening of the riverbed and rewilding of the area after their activities ended. As such, futures matter, even for those who are not dominating the present, as they can inspire, change morality, and change the dominant practices.

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Conflicts of Interest: The authors declare no conflicts of interest.

Appendix A

Table A1. Interview themes and questions.

Theme	Example Questions (Translated from Dutch)
Introduction	• Why did you take me here/why did we meet in this place? • Do you come here often? When often, when less? • Is this a special place/nice place/what makes it special/nice? • Can you tell me more about your background and how you became connected to the river? Have you worked long on this river? What type of work? • Why did you take me here/ why did we meet up here?
Materiality: The role of nature/rivers/water/climate	• What is considered a natural river? • Is this what a natural river should look like ideally? How would it/would it not be ideal? • What elements make this an ideal river? Which ones do not? • How do these elements relate to each other?
Epistemic communities: the role of the other	• Who is considered to know the river best? • Who is important to the river and the area? • What interests are represented best/well/less or not represented? • Who has knowledge about the river? Who has knowledge about the future of the river? What information do you trust the most? • With whom is it pleasant/not pleasant to work in this area? • What discussions are there now? Between whom?

Table A1. *Cont.*

Theme	Example Questions (Translated from Dutch)
Past–present–future dynamics: the role of change	• What changes are considered natural/manmade? • Why does the river look the way it does now? • Is the dynamic of change strong/slow? Do you notice it well? • What has changed the most in the river? • What processes lead to change in the river? • Is there a specific order of change? • What are changes in the river and around that scare you/make you happy? • Are there aspects of the river that you would like to see differently? • What are memories of the river that you like/will not forget? • Did something ever occur in this area that you deemed strange/unexpected?
Future and time ontology: the role of the future	• Who/what is important for the future of the river? • Is the future possible? Do current actions influence the future? • Do you think a lot about the future? • Is the future important for you? • Who has the most power over the future? Whose interests are represented in this? • Is it important to think about the future, and are there certain interests that need to be prioritised? • When you think about the future, how far ahead do you think? In years? Months? Why? What is most realistic?
Materiality 2: The role of infrastructure/the Border Meuse project	• What is the impact of this nature-based infrastructural project? • Who/what has won the most in this project? • Whose interests do you see reflected in the project? And whose are not reflected? • Who has had influence on the results of the project, and by whom is the project being led?
Wrap-up	• What do I need to know about the river that I may not already know? • What is something that is not publicly known about the Border Meuse?

References

1. Farbotko, C.; Boas, I.; Dahm, R.; Kitara, T.; Lusama, T.; Tanielu, T. Reclaiming open climate adaptation futures. *Nat. Clim. Chang.* **2023**, *13*, 750–751. [CrossRef]
2. Muiderman, K.; Zurek, M.; Vervoort, J.; Gupta, A.; Hasnain, S.; Driessen, P. The anticipatory governance of sustainability transformations: Hybrid approaches and dominant perspectives. *Glob. Environ. Chang.* **2022**, *73*, 102452. [CrossRef]
3. Mills-Novoa, M.; Boelens, R.; Hoogesteger, J.; Vos, J. Governmentalities, hydrosocial territories & recognition politics: The making of objects and subjects for climate change adaptation in Ecuador. *Geoforum* **2020**, *115*, 90–101.
4. Muiderman, K.; Gupta, A.; Vervoort, J.; Biermann, F. Four approaches to anticipatory climate governance: Different conceptions of the future and implications for the present. *Wiley Interdiscip. Rev. Clim. Chang.* **2020**, *11*, e673. [CrossRef]
5. Nalau, J.; Verrall, B. Mapping the evolution and current trends in climate change adaptation science. *Clim. Risk Manag.* **2021**, *32*, 100290. [CrossRef]
6. Blöschl, G.; Hall, J.; Viglione, A.; Perdigão, R.A.; Parajka, J.; Merz, B.; Lun, D.; Arheimer, B.; Aronica, G.T.; Bilibashi, A. Changing climate both increases and decreases European river floods. *Nature* **2019**, *573*, 108–111. [CrossRef] [PubMed]
7. Duarte-Abadía, B. Utopian River Planning and Hydrosocial Territory Transformations in Colombia and Spain. *Water* **2023**, *15*, 2545. [CrossRef]
8. Jaramillo, P.; Carmona, S. Temporal enclosures and the social production of inescapable futures for coal mining in Colombia. *Geoforum* **2022**, *130*, 11–22. [CrossRef]
9. Hommes, L.; Hoogesteger, J.; Boelens, R. (Re) making hydrosocial territories: Materializing and contesting imaginaries and subjectivities through hydraulic infrastructure. *Political Geogr.* **2022**, *97*, 102698. [CrossRef]
10. Jasanoff, S.; Kim, S. *Dreamscapes of Modernity: Sociotechnical Imaginaries and the Fabrication of Power*; University of Chicago Press: Chicago, IL, USA, 2015.
11. Orwell, G.; Macmillan, D. *Nineteen Eighty-Four*; Secker & Warburg: London, UK, 2013.
12. Boelens, R.; Hoogesteger, J.; Swyngedouw, E.; Vos, J.; Wester, P. Hydrosocial territories: A political ecology perspective. *Water Int.* **2016**, *41*, 1–14. [CrossRef]
13. Foucault, M. *The Will to Knowledge: The History of Sexuality*; Penguin: London, UK, 1998; Volume I.
14. Haas, P.M. Introduction: Epistemic communities and international policy coordination. *Int. Organ.* **1992**, *46*, 1–35. [CrossRef]

15. Haas, P. (Ed.) Epistemic Communities. In *Lavanya Rajamani, and Jacqueline Peel, The Oxford Handbook of International Environmental Law*, 2nd ed.; Oxford Academic: Oxford, UK, 2021. [CrossRef]
16. Davoudi, S.; Machen, R. Climate imaginaries and the mattering of the medium. *Geoforum* **2022**, *137*, 203–212. [CrossRef]
17. Flaminio, S.; Rouillé-Kielo, G.; Le Visage, S. Waterscapes and hydrosocial territories: Thinking space in political ecologies of water. *Prog. Environ. Geogr.* **2022**, *1*, 33–57. [CrossRef]
18. Beck, S.; Jasanoff, S.; Stirling, A.; Polzin, C. The governance of sociotechnical transformations to sustainability. *Curr. Opin. Environ. Sustain.* **2021**, *49*, 143–152. [CrossRef]
19. Ženko, M.; Menga, F. Linking water scarcity to mental health: Hydro–social interruptions in the Lake Urmia Basin, Iran. *Water* **2019**, *11*, 1092. [CrossRef]
20. Flaminio, S.; Reynard, E. Multipurpose use of hydropower reservoirs: Imaginaries of Swiss reservoirs in the context of climate change and dam relicensing. *Water Altern.* **2023**, *16*, 705–729.
21. Escate, L.R.; Hoogesteger, J.; Boelens, R. Water assemblages in hydrosocial territories: Connecting place, space, and time through the cultural-material signification of water in coastal Peru. *Geoforum* **2022**, *135*, 61–70. [CrossRef]
22. Feola, G.; Goodman, M.K.; Suzunaga, J.; Soler, J. Collective memories, place-framing and the politics of imaginary futures in sustainability transitions and transformation. *Geoforum* **2023**, *138*, 103668. [CrossRef]
23. Paerregaard, K. Power in/of/as water: Revisiting the hydrologic cycle in the Peruvian Andes. *Wiley Interdiscip. Rev. Water* **2018**, *5*, e1270. [CrossRef]
24. Götz, J.M.; Middleton, C. Ontological politics of hydrosocial territories in the Salween River basin, Myanmar/Burma. *Political Geogr.* **2020**, *78*, 102115. [CrossRef]
25. Gaventa, J.; Cornwall, A. Power and knowledge. *Sage Handb. Action Res. Particip. Inq. Pract.* **2008**, *2*, 172–189.
26. Gaventa, J. Finding the spaces for change: A power analysis. *IDS Bull.* **2006**, *37*, 23–33. [CrossRef]
27. Shah, E.; Boelens, R.; Bruins, B. Reflections: Contested epistemologies on large dams and mega-hydraulic development. *Water* **2019**, *11*, 417. [CrossRef]
28. Boelens, R.; Shah, E.; Bruins, B. Contested knowledges: Large dams and mega-hydraulic development. *Water* **2019**, *11*, 416. [CrossRef]
29. Boelens, R.; Escobar, A.; Bakker, K.; Hommes, L.; Swyngedouw, E.; Hogenboom, B.; Huijbens, E.H.; Jackson, S.; Vos, J.; Harris, L.M. Riverhood: Political ecologies of socionature commoning and translocal struggles for water justice. *J. Peasant Stud.* **2023**, *50*, 1125–1156. [CrossRef]
30. Ministry of Infrastructure and Water Nederland Voorbereiden op Gevolgen Klimaatverandering. Available online: https://www.rijksoverheid.nl/onderwerpen/klimaatverandering/klimaatadaptatie (accessed on 19 December 2022).
31. Anonymous. Adaptieve Uitvoeringsstrategie Maas. *Deltaprogramma Maas*. 2019. Available online: https://www.deltaprogramma.nl/binaries/deltacommissaris/documenten/publicaties/2019/10/24/adaptieve-uitvoeringsstrategie-maas/Adaptieve+Uitvoeringsstrategie+Maas_DEF.pdf. (accessed on 19 December 2022).
32. Anonymous. De Klimaatschadeschatter. Available online: https://klimaatschadeschatter.nl/ (accessed on 9 January 2024).
33. Disco, C. Remaking "nature": The ecological turn in Dutch water management. *Sci. Technol. Hum. Values* **2002**, *27*, 206–235. [CrossRef]
34. Roth, D.; Vink, M.; Warner, J.; Winnubst, M. Watered-down politics? Inclusive water governance in the Netherlands. *Ocean Coast. Manag.* **2017**, *150*, 51–61. [CrossRef]
35. Roth, D.; Warner, J.F.; Winnubst, M. *Een Noodverband Tegen Hoog Water: Waterkennis, Beleid en Politiek Rond Noodoverloopgebieden*; Wageningen UR: Wageningen, The Netherlands, 2006.
36. Rijkswaterstaat, Maas. Available online: https://www.rijkswaterstaat.nl/water/vaarwegenoverzicht/maas (accessed on 6 February 2024).
37. Asselman, N.; Barneveld, H.; Klijn, F.; van Winden, A. Rijksoverheid. The Netherlands. *Het Verhaal van de Maas*; 2018. Rijkswaterstaat. Available online: https://www.helpdeskwater.nl/publish/pages/160185/het_verhaal_van_de_maas.pdf (accessed on 16 December 2022).
38. de Jong, L.; Boogaard, F.; Daumal, M.; Lima, R. Klimaat-café: Samen denken en praten over waterbeheer. *J. Land Water* **2023**, *9*, 10–11.
39. Hamilton, S.R. *Cultivating Nature: The Conservation of a Valencian Working Landscape*; University of Washington Press: Washington, DC, USA, 2018.
40. de Bruin, D.; Hamhuis, D.; van Niewenhuijze, L.; Overmars, W.; Sijmons, D.; Vera, F. *Het Plan "Ooievaar": Een Bespreking*; Stichting Gelderse Milieufederatie: Arnhem, The Netherlands, 1987; ISBN 90-72010-01-9.
41. Bruin, D.d.; Hamhuis, D.; Nieuwenhuijze, L.v.; Overmars, W.; Sijmons, D.; Vera, F. Ooievaar: De toekomst van het rivierengebied. *Sticht. Gelderse Milieufederatie Arnh.* **1987**, *9072010019*, 29–40.
42. Anonymous. 25 Jaar Ark: Hoe Het Begon. Available online: https://www.ark.eu/over-ark/ark-organisatie/25-jaar-ark/hoe-het-begon (accessed on 29 September 2023).
43. Anonymous. Ruimte Voor Levende Rivieren. *Achtergronddocument. Sticht. ARK Natuurmonumenten Vogelbescherm. Landschappen NL World Wildl. Found.* 2018. Available online: https://www.levenderivieren.nl/sites/default/files/2018-08/Achtergrond%20Ruimte%20voor%20Levende%20Rivieren%20jul%202018_0.pdf (accessed on 29 August 2023).

44. Warner, J. *Framing and Linking Space for the Grensmaas: Opportunities and Limitations to Boundary Spanning in Dutch River Management*; Water Governance as Connective Capacity; Routledge: London, UK, 2016.
45. Helmer, W.; Overmars, W.; Litjens, G. Toekomst Voor een Grindrivier. *Hoofdrapport.Strom. BV Nijmegen Neth*. 1991. Available online: https://open.rijkswaterstaat.nl/publish/pages/110487/481228.pdf (accessed on 1 January 2024).
46. Valkering, P.; Rotmans, J.; Krywkow, J.; van der Veen, A. Simulating stakeholder support in a policy process: An application to river management. *Simulation* **2005**, *81*, 701–718. [CrossRef]
47. Peters, B.; de Vocht, A. *Effectbeoordeling van Grinddrempels op Beschermde Soorten en Habitattypen in de Bedding van de Grensmaas*; Bureau Drift: Nijmegen, The Netherlands, 2005.
48. Anonymous. Rapport Bedding Grensmaas. *Maas Beeld*. 2006. Available online: https://maasinbeeld.nl/publicaties/Bedding_Grensmaas.pdf (accessed on 26 July 2023).
49. Seerden, R.J.G.H.; Schelfhout, T.M.; Sledders, J.N.F. Hoger beroep: ECLI:NL:RVS:2012:BV3249, BEKRACHTIGING/Bevestiging. 2011. Available online: https://uitspraken.rechtspraak.nl/details?id=ECLI:NL:RVS:2012:BV3249&showbutton=true&keyword=Hoger+beroep%253a+ECLI%253aNL%253aRVS%253a2012%253aBV3249&idx=1 (accessed on 1 January 2024).
50. Liefveld, W.M.; van Kessel, N.; Achterkamp, B.; Dorenbosch, M. Maas in Beeld Grensmaas—Zomerbed Gebiedsrapportage 2017. *Bur. Waardenburg*. 2017. Available online: https://www.maasinbeeld.nl/wp-content/uploads/Zomerbed-Grensmaas-eindconcept-29-nov-2017.pdf (accessed on 26 July 2023).
51. Beekers, B.; Van den Bergh, M.; Braakhekke, W.; Haanraads, K.; Litjens, G.; van Loenen Martinet, R.; van Winden, A. Ruimte Voor Levende Rivieren—Want Levende Rivieren Geven Ruimte. *Ruimte Voor Levende Rivieren—Want Levende Rivieren Geven Ruimte*. 2018. Available online: https://www.levenderivieren.nl/sites/default/files/2018-03/Visie%20Ruimte%20voor%20Levende%20Rivieren%208%20maart%202018%20(LR).pdf (accessed on 26 July 2023).
52. Deltaprogramma Maas Ruimtelijk Perspectief Maas Positionering, Kansen en Ambities in Relatie Tot Maatregelen Hoogwaterveiligheid. 2018. Available online: https://www.deltaprogramma.nl/binaries/deltacommissaris/documenten/publicaties/2018/09/18/ruimtelijk-perspectief-maas-positionering-kansen-en-ambities-in-relatie-tot-maatregelen-hoogwaterveiligheid/180709+Werkdocument+Ruimtelijk+Perspectief+Maas_downloadversie.pdf (accessed on 12 December 2023).
53. Glas, P. Award Session. Available online: https://magazines.deltaprogramma.nl/deltanieuws/2020/04/zonnetje (accessed on 29 September 2023).
54. Vliegenthart, A.; van der Zee, F. *Delfstofwinning en Natuur.*; Wageningen Environmental Research rapport; Wageningen Environmental Research: Wageningen: The Netherlands, 2018; p. 95. [CrossRef]
55. Weston, P. 'This is What a River Should Look Like': Dutch Rewilding Project Turns Back the Clock 500 Years. *Guard*. 2022. Available online: https://www.theguardian.com/environment/2022/sep/20/dutch-rewilding-project-turns-back-the-clock-500-years-aoe (accessed on 1 January 2024).
56. Visser, V.E.H.G.; de Vries, E.; Klijn, A.R. Zaaknummer UTR 22/1262. 2023. Available online: https://uitspraken.rechtspraak.nl/details?id=ECLI:NL:RBMNE:2023:402&showbutton=true&keyword=natuurmonumenten+rijkswaterstaat+uiterwaarden+vegetatie+grensmaas&idx=1 (accessed on 1 January 2024).
57. Anonymous. Natuurmonumenten en ARK Verliezen Rechtszaak Riviernatuur Grensmaas. Available online: https://www.h2owaternetwerk.nl/h2o-actueel/natuurmonumenten-en-ark-verliezen-rechtszaak-riviernatuur-grensmaas (accessed on 29 September 2023).