

Why does geography matter in big dam removal projects? Lessons from a comparison between the Sélune and Elwha River cases

Marie-Anne Germaine, Laurent Lespez

▶ **To cite this version:**

Marie-Anne Germaine, Laurent Lespez. Why does geography matter in big dam removal projects? Lessons from a comparison between the Sélune and Elwha River cases. Frontiers in Ecology and Evolution, 2023, 11, ⟨10.3389/fevo.2023.1250857⟩. ⟨hal-04240178⟩

HAL Id: hal-04240178

https://hal.science/hal-04240178v1

Submitted on 2 Jul 2024

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons CC BY 4.0 - Attribution - International License

frontiers | Frontiers in Ecology and Evolution

TYPE Original Research
PUBLISHED 12 October 2023
DOI 10.3389/fevo.2023.1250857

Check for updates

OPEN ACCESS

EDITED BY
Jeffrey J. Duda,
Western Fisheries Research Center,
United States

REVIEWED BY
Peter Brewitt,
Wofford College, United States
Jeffrey John Opperman,
World Wildlife Fund (United States),
United States

*CORRESPONDENCE
Marie-Anne Germaine
marie-anne.germaine@parisnanterre.fr

RECEIVED 30 June 2023
ACCEPTED 21 September 2023
PUBLISHED 12 October 2023

CITATION
Germaine M-A and Lespez L (2023) Why does geography matter in big dam removal projects? Lessons from a comparison between the Sélune and Elwha River cases. *Front. Ecol. Evol.* 11:1250857. doi: 10.3389/fevo.2023.1250857

COPYRIGHT
© 2023 Germaine and Lespez. This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.

Why does geography matter in big dam removal projects? Lessons from a comparison between the Sélune and Elwha River cases

Marie-Anne Germaine[1]* and Laurent Lespez[2]

[1]Laboratoire Architecture, Ville, Urbanisme, Environnement LAVUE-CNRS UMR 7218, Department of Geography, Université Paris Nanterre, Nanterre, France, [2]Laboratoire de Géographie Physique LGP-CNRS UMR 8591, Department of Geography, Univ. Paris-Est Créteil, Créteil, France

The dam removal movement is resulting in numerous projects worldwide, especially in Western countries. Whether completed or in progress, these undertakings often trigger conflict. Nearly 30 years after the initiation of the first major projects, this article examines the conditions for the local appropriation of dam removal projects. From the perspective of two pioneering and emblematic projects in France (Sélune River) and the United States (Elwha River), this article highlights the geographic specificities of dam removal projects carried out in European rural areas. The aim is to discuss how to implement ambitious ecological projects without running the risk of local people losing their sensitive relationship (history, experience, landscape) with the areas once they have been restored. In other words, ecological restoration should not result in a loss of meaning and quality in the relationship between local people and newly restored spaces; it should instead enrich it. In fact, the removal of a dam is not just a technical project; it profoundly affects landscapes, disrupting uses and creating new places. We identify the modalities by which a new space is produced and appropriated by local populations based on a comparison of the relevant spaces (national park vs. rural agricultural space), the populations involved (river users, Native American tribes, residents, and NGOs), and, finally, the governance processes and interactions between expertise and politics, all to highlight the need to take geographical context into account. Based on a detailed knowledge of the formation of the Sélune dam removal project, which has been the subject of continuous participant observation since 2011, we examine these projects' singularities and commonalities to identify the factors that contribute to their success. This study highlights the importance of the spatial scale at which the dam removal project should be framed, the role of government, and the importance of considering people's attachment to local places. Finally, this comparison makes recommendations for improving the socio-territorial quality of ecological projects, especially in Europe, with the aim of ensuring their sustainability and success.

KEYWORDS

dam removal, river restoration, governance, geography, scale, place attachment

1 Introduction

Among the various projects regarding the ecological restoration of rivers, the dismantling of dams has been one of the most extensively studied, both from a biophysical (Foley et al., 2017a) and social (Sneddon C. et al., 2017; Habel et al., 2020) perspective. The removal of small dams and weirs are by far the most common in both Europe and America (Bellmore et al., 2016; Belletti et al., 2020). However, in the last twenty years, a few large dams have been removed that are over 30 m high with reservoirs extending over several hundred hectares. Work on these projects has been concentrated in the Western world, where the dam removal movement is active, and predominantly in the US, where it first gained momentum in the 1990s (Doyle et al., 2003; Barraud, 2017; Grabowski et al., 2017). The social sciences have mainly addressed governance processes, as dam removal is an emblematic process, but also one of the most conflictual (Lejon et al., 2009; Germaine and Barraud, 2013a; Fox et al., 2016). The literature describes the obstacles and difficulties that developers face when implementing these projects. In particular, the often long and chaotic phase leading up to the decision is studied by analyzing the various actors' arguments and the negotiation processes, as Brewitt (2019) has done for three cases in the US (Hilbert-Wolf and Gerlak, 2022) have also shown how the role of science, economic analysis, and stakeholder interactions have kept the debate ongoing over the removal of four dams on the Snake River. The debates that accompanied the relicensing and subsequent decommissioning of four dams in the Klamath Basin have also been well documented (Allen, 2010; Gosnell and Kelly, 2010; Chaffin and Gosnell, 2017; Albertson, 2019; Yigit, 2021). Several works have demonstrated the role of the representations of nature (Jørgensen, 2017), heritage (Germaine and Barraud, 2013b; Fox et al., 2016), and attachment to place (Drenthen, 2009; Germaine et al., 2016; Howard et al., 2017). In fact, these works deal with the reasons for opposition (Diessner et al., 2020; Hommes, 2022), and several have examined the arguments for adherence. On the other hand, research on the material dimensions, i.e., landscape configuration and transformation, and the process of space appropriation[1] and place attachment[2] remains rare (Drapier et al., 2023; Gonin et al., 2023).

Nearly 30 years after the initiation of the two pioneering programs in the United States and in France, this article compares dam removal projects on the Elwha (Washington, USA) and the Sélune (Normandy, France) rivers (Duda et al., 2008; Germaine and Lespez, 2014). In particular, it highlights the specificity of geographical dimensions in the formation of dam removal projects implemented in European rural areas, even though the majority of feedback comes from the United States. In ecological river restoration projects, geography is still too often approached as a context that is analyzed mostly as a "study area." We believe that the geographical dimensions should be better taken into account, as already shown by a comparison of landscape transformations caused by the removal of dams in France, North America, and England (Lespez and Germaine, 2016). Not only does the landscape context weigh on the biophysical responses of the system warranting such a consideration (Foley et al., 2017b), but these construction sites also profoundly affect the landscapes' configuration. Dam removal cannot be reduced to an engineering operation. It disrupts spatial configurations by removing reservoirs, transforming associated uses, and producing new places. Geography is invoked here not to describe the context of projects, rather to analyze environments and their transformations insofar as they generate relationships between socio-economic actors, human and non-human, through the affordances[3] created in this process (Ingold, 2002; Gonin et al., 2023). By shifting the focus from intrinsic to relational values, relational thinking (Chan et al., 2016; Eyster et al., 2023) invites us to consider more precisely the relationships between human and non-human entities. This approach also situates contemporary projects within the historical trajectory of these relationships (Drapier et al., 2023). In this perspective, the removal of large dams is seen as an opportunity to repair the relationship between people and their environment (Higgs, 2012).

After introducing the two study sites and the approach used, we will present the theoretical framework for our work. Then, we present the results of this comparison, proposed for the first time, which helps identify important insights into the carrying out of dam removals. Finally, we discuss the question of reference scales, the role of the state as a territorial actor, and the relational aspects of implementing ecological projects. Thus, while we concluded in 2017 (Germaine and Lespez, 2017) that the consultation process on the Sélune had failed, this comparison instead inspires us to suggest ways to help ensure the success of such projects.

2 Research framework and methods

2.1 Study area

Located on the Olympic Peninsula of Washington State in the western United States, the Elwha watershed is mountainous. It covers an area of 833 km^2 dominated by ridgelines rising to over 2,000 m where the river originates. The river flows north for 72 km to its mouth in the Strait of Juan de Fuca. This tectonically active area has very steep terrain. Located at 48° N, it is exposed to westerly winds from the Pacific Ocean, which explains the Elwha's high discharge and velocities during flood periods. It is a gravel-bed river that runs through the middle of an often narrow alluvial plain

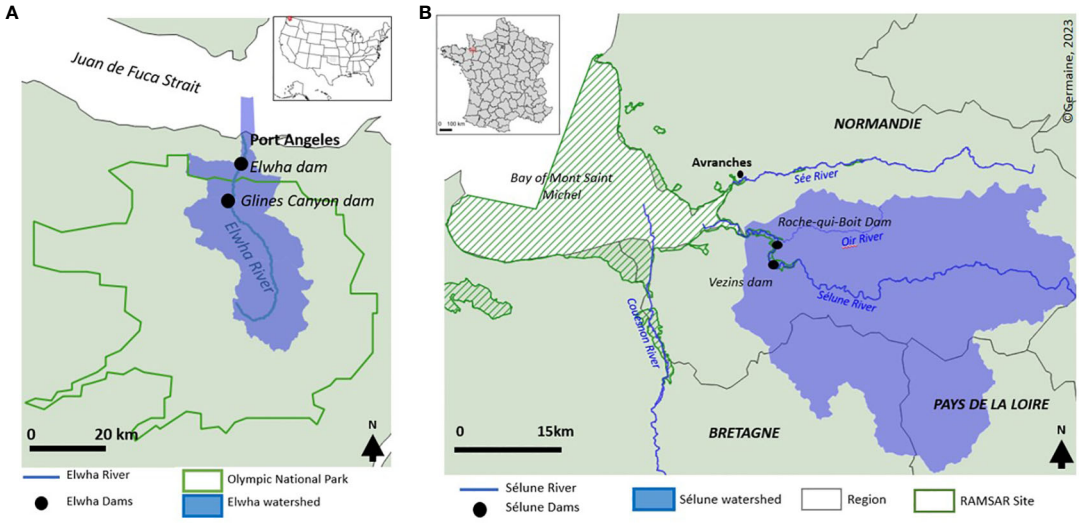
1 Appropriation has been studied as a mechanism by which space is transformed into place (Benages-Albert et al., 2015) through uses as well as representations.

2 Place attachment has been defined as "the bonding that occurs between individuals and their meaningful environments" (Scannell and Gifford, 2010).

3 Affordance refers to the fact that we perceive an environment as an optical arrangement structured in a meaningful way that addresses our vital behaviors by "inviting" us to engage in this or that type of interaction (walking, lying down, grabbing, climbing, etc.).

which alternates with several gorges that provide habitat for juvenile fish and other aquatic organisms (East et al., 2018). The Sélune watershed in northwestern France has comparable dimensions. This coastal river drains a catchment area of 1,014 km² and flows for 68 km before entering the Bay of Mont Saint-Michel. It is located on a passive continental margin, and its relief is generally modest (elevation of the headwaters <200 m). The Sélune is generally a sinuous to meandering river of low energy. On the same latitude as the Elwha, it is fed by precipitation from the westerly winds that circulate over the North Atlantic Ocean. In this context, the area formerly occupied by the reservoirs stands out, with gorge landscapes over 80 m deep and a river characterized by more energetic flows.

Along with the Edwards Dam removal on the Kennebec River (Crane, 2009), the demolition of the Elwha dams between 2011 and 2014 represents the one of the more iconic dam removals in North America. The removal of the Sélune dams from 2018 to 2022 is considered unprecedented in the European context (Germaine and Lespez, 2017; Basilico et al., 2021) (Figure 1). These pairs of dams were similar in height and in the size of the water impoundments affected (Figure 1; Table 1). Both were hydroelectric dams built by private companies at the beginning of the twentieth century in the downstream section of rivers frequented by migratory fish, especially salmon. These two projects took a very long time to be completed. Roughly 20 years passed between the first discussions and the removals of the structures: from 1992 to 2014 for the Elwha,



C

	Length	Watershed area	Discharge	Source elevation	Mouth
Elwha	72 km	824 km²	43 m³/s	1 114 m	Strait of Juan de Fuca
Sélune	68 km	1 038 km²	11 m³/s	180 m	Mont Saint-Michel Bay

FIGURE 1
Localization and characteristics of the Elwha and Sélune Rivers: **(A)** Elwha watershed; **(B)** Sélune watershed; **(C)** main characteristics of each watershed.

TABLE 1 Characteristics of the Elwha and Sélune dams.

Dams	Building	Removal	Height	Impoundment length and surface	Water volume	Distance to the mouth	Installed capacity	Owner	Dam removal total cost	Scientific monitoring
Elwha	1910–13	2015	33 m	7,9 km 110 ha (Lake Aldwell)	10 million m^3	8 km	14.8 MW	Successive owners from logging industry	$324.7 million	2000–now Fish ecology Vegetation Fluvial dynamics Community science
Glines Canyon	1927	2012	64 m	4 km 168 ha (Lake Mills)	28 million m^3	21 km	13.3 MW			
La Roche-qui-Boit	1916–19	2022–23	16 m	5 km 72 ha	4 million m^3	14 km	1.6 MW	Private energy company + State (Vezins) and EDF (Roche qui Boit) since 1945	€60 million	2012–2023 (may be continued) Fish ecology Vegetation Fluvial dynamics Social sciences
Vezins	1929–32	2019–22	36 m	19 km 200 ha	19 million m^3	22 km	12.8 MW			

and from 2005 to 2022 for the Sélune. In both cases, the decision to remove the dams was made at the highest level of government (US federal government, French state), but the Sélune case was more controversial (Germaine and Lespez, 2017).

2.2 Material, methods, and previous work

The approach used lies within the conceptual framework of hydrosocial territories, defined as "socially, naturally and politically constituted spaces that are (re)created through the interactions amongst human practices, water flows, hydraulic technologies, biophysical elements, socio-economic structures and cultural-political institutions" (Boelens et al., 2016). Even though geographical context clearly matters, few works demonstrate this, focusing instead on discourses, representations, and governance processes. The aim here is to pay more attention to the links with the materiality of places, distinguishing between what falls under the heading of spatial configuration or history on the one hand, and political organization on the other. To do so, we describe how a new space is produced and appropriated by local populations by comparing the different dimensions of the hydrosocial territories: hydraulic technologies (the dams removed), water flows (modified by the removal of the dams as much as by their construction), biophysical environments (consisting of the river's material heritage and ecological potential, and its constituting an object of attachment), people involved (the various local or external actors who participate in, or react to the project), and institutions (that promote, finance and direct the project). More specifically, we examine the governance processes, scales, and the relations between people and their environment throughout the project. Mobilizing the field of hydrosocial territories helps identify how a new space is produced and then appropriated by inhabitants and users.

On the Sélune, this analysis is based on several survey methods (Table 2). We addressed the positions of institutional actors and elected representatives through continuous participant observation beginning in 2011 (Germaine and Lespez, 2014; Germaine and Lespez, 2017). We used participant observation to follow up on the two studies that proposed new pathways for the valley's landscape and economic transformation. We also participated in the thematic workshops conducted at the prefecture's request to build a socio-economic conversion project, as well as in the infrequent informational meetings. We analyzed the interim documents and final reports delivered by consultants, as well as the rare communication documents produced by the entities promoting the dams' removal (Germaine et al., 2019). At the same time, we conducted more than 150 semi-structured interviews with local stakeholders (Drapier et al., 2023) to explore the forces driving the conflict and people's attachment to the valley. We also organized two focus groups with local residents, one dedicated to the history of the valley (2018) and the other to its future (2022). Finally, a photographic landscape observatory was set up to monitor the transformation of the valley's landscapes[4].

4 http://www.bassin-selune.fr/content/suivi-photographique-de-la-vidange-des-barrages-de-la-s%C3%A9lune

TABLE 2 List of academic publications resulting from the socio-geographical work on the removal of the Sélune dams.

Topics	Sources	Language
Relations to salmon (history, fishing)	Thomas and Germaine, 2018a, 2019a	French
Place attachment and relation to nature / landscape (inhabitants, users, lake sheds users)	Germaine et al., 2016, 2019; Le Lay and Germaine, 2017; Germaine and Thomas, 2023 Germaine and Thomas, 2019 (movie)	French Movie in French (subtitles in English)
Governance processes and conflicts	Germaine and Lespez, 2014, 2017	French + English
History of social hydro-territories	Lespez et al., 2023 Drapier et al., 2023	French English
Materiality, affordances: space appropriation processes after dam removal	Gonin et al., 2023	English
Relational thinkings: emergence of a multifunctional valley	Germaine and Gonin, submitted	English

All this work has documented the social failure of the project to date. A conversion project has yet to see the light of day due to a lack of ownership by local stakeholders. Today, the dams have been removed and no trace of them has been preserved, while spontaneous vegetation is growing in the former lake areas (Figure 2B) and jeopardizing access to the valley (Germaine and Gonin, submitted).

The Elwha case study is based on an extensive review of scientific publications and grey literature (e.g. Duda et al, 2008; Pess et al., 2008; Crane, 2011; Sadin et al., 2011; Brenkman et al., 2012; Johnson, 2013; East et al., 2015; East et al., 2015; Warrick et al., 2015; Foley et al., 2017a; East et al., 2018; Brewitt, 2019; Morley et al., 2020; Hess et al., 2021; Quinn et al., 2021; Brown et al., 2022; Chenoweth et al., 2022), supplemented by a field visit to the restored sites and lengthy specific interviews with the project's managers (NOAA, NPS) conducted in April 2022. We did not meet with Lower Elwha Klallam Tribe representatives who were central players in the removal; we instead used various available peer-reviewed papers (e.g. Duda et al., 2011; Guarino, 2013; Bauman and Kardouni, 2018; Duda et al., 2018; Mauer, 2020).

3 A comparative study: from ecological projects to geographical differences

The comparison is based on the role of non-humans, specifically salmon, the socio-political situation around the dams, the involvement of local communities, and different understandings of nature.



FIGURE 2
Photographs of landscapes along the Sélune River (after the dam removals): **(A)** Former Vezins dam (summer 2021); **(B)** Former Vezins Lake (summer 2021); **(C)** Former La Roche qui Boit Lake (summer 2022); **(D)** Former Vezins Lake (fall 2022).

3.1 The decisive role of salmon, a charismatic umbrella species

Salmon restoration is the primary goal of both projects (Pess et al., 2008; Forget et al., 2018). Removal of the dams should restore access to most of the river's length and spawning grounds, which have been inaccessible for nearly a century, to allow fish populations to recover.

3.1.1 Salmon, the iconic migratory fish

The Elwha is one of the rivers with the greatest salmon recovery potential in the Northwest, which justified its restoration (Duda et al., 2008; Pess et al., 2008). Salmon numbers declined from 500,000 in the early twentieth century to 5,500 prior to the dams' removal (Duda et al., 2021). Of the ten migratory fish runs still present, five are salmon: Chinook (*Oncorhynchus tshawytscha*), chum (*O. keta*), coho (*O. kisutch*), pink (*O. gorbuscha*), and sockeye (*O. nerka*). While steelhead (*O. mykiss*) are politically and ecologically important, the return of the chinook has captured the spotlight; the size and weight of these legendary "kings," which can exceed 100 pounds, have become the focus of restoration rhetoric. Other anadromous species include Pacific lamprey (*Entosphenus tridantus*) (Hess et al., 2021). On the Sélune, Atlantic salmon (*Salmo salar*) is the main species targeted for restoration, although other migratory species such as Pacific lamprey (*E. tridentatus*) and eel (*Anguilla anguilla*) also frequent the river. Although the dams prevented reproduction upstream, salmon continue to spawn downstream and in the nearby Sée and Couesnon Rivers, thus maintaining the species' presence in the Bay of Mont Saint-Michel. According to France's Biodiversity Office, if ecological continuity were restored, more than 1,300 additional adult salmon (over 7% of the national stock) would swell the spawning contingent of the Bay of Mont Saint-Michel complex, bringing the total average number of salmon returning to these three coastal rivers each year to 3,150 (18% of the national stock). While the goals and potential in terms of numbers are different in each case, their importance at the regional level legitimizes the ecological project in both instances.

3.1.2 The fishermen's interest

Keeping salmon in the river is a powerful lever for dam removal projects because it raises the prospect of a more active fishery. Salmon are central to the economy and culture of the Lower Elwha Klallam Tribe (LEKT), a federally recognized indigenous nation living in the Lower Elwha River valley and adjacent bluffs on the north coast of the Olympic Peninsula. They are known as the "salmon people" (Sadin et al., 2011; Guarino, 2013). Fish are an important economic resource: tribes depend on them for subsistence and economic well-being. Salmon have always been an important food source and year-round activity; they have long been fished, preserved, and traded (Warrick et al, 2015; Johnson, 2013). While indigenous people can continue to fish along the coast, the restoration of fishing in the river is at the heart of their demands. The tribes have fishing rights derived from nineteenth century treaties. After much litigation, these were reaffirmed in 1974 by the Boldt Decision, which granted all Washington tribes half of the total catch. Despite the replenishment of fish stocks by hatcheries, these rights have not been respected because the dams have deprived the indigenous population of access to the resource, which entitles them to demand compensation from the government. Furthermore, commercial and recreational fisheries are multi-billion-dollar industries in the Pacific Northwest of the United States (National Park Service, 2005).[5] Economics play a crucial role in controversies regarding salmon, and NGOs that promote the conservation of fish are often closely tied to recreational pursuits (e.g. Trout Unlimited).

Salmon net fishing has become part of the heritage of the Bay of Mont Saint-Michel. Salmon remain an important symbol of the local fishing history in the Sélune, as embodied by the Auberge de la Sélune (Thomas and Germaine, 2018a). Salmon are embraced by

5 According to the NPS, the benefits to the region from sportfishing from the Elwha River stood at roughly $9.5 million in 2001.

anglers, who continue to frequent downstream areas,[6] even though after a century of lake and dam construction, a decline in catches has been accompanied by a decline in the importance of salmon to the general population. Initial discussions on the future of the dams, organized within the local water commission (CLE), a local governance body that brings together elected officials, user representatives, and state services, led to the highlighting of a very significant fishing potential. The benefits of recreational fishing were estimated at around 20 jobs over 30 years and 150,000 to 470,000 euros per year (Salanié et al., 2004). The French national fishermen's federation, the regional one, as well as several local fishermen's associations outside the Sélune Valley took up these arguments when, in 2011, they formed the group "Les Amis de la Sélune" together with other environmental associations. This group is also supported by several specialized NGOs.[7] It advocates for a return to "the salmon-filled river of yesteryear," placing a salmon at the center of its logo (Figure 3C).

3.1.3 The alliance of environmental NGOs and scientists

Migratory fish, particularly salmon, are charismatic species (Lorimer, 2007) and salmon are an integral part of the American conservation movement (Garibaldi and Turner, 2004). The long distances that they travel between the headwaters of rivers and the oceans has granted them a strong cultural and symbolic value among many people. The salmon's strong swimming and jumping abilities are used to promote ecological restoration. Salmon is also described in scientific literature as an umbrella species because many species depend on its presence. Thus, the Pacific salmon has become the object of a symbolic battle over the dams installed on the Columbia River (Kareiva and Carranza, 2017). On the Elwha, the LEKT became the first major advocate for complete dam removal in the 1980s (Blumm and Erickson, 2012). They received support from environmental NGOs (Seattle Audubon Society, Friends of the Earth, Sierra Club, and Olympic Park Associates). Government agencies,[8] mediated by the National Park Service, or NPS, would later endorse and technically defend the removal scenario as the best alternative (Crane, 2011). The LEKT received federal funding to conduct studies on the impacts of the dams. This marked the birth of a coalition between the tribe, government agencies, environmental groups, and fishermen that proved instrumental for the passage of the Elwha River Ecosystem and Fisheries Restoration Act in 1992 (a federal law). In France, scientists identified threats to salmon and highlighted the potential of small coastal rivers along the English Channel and Atlantic coast to support salmon populations (Baglinière and Porcher, 1980; Ombredane et al., 1998; Perrier et al., 2013). The Atlantic salmon is a threatened species in France, where it has been on the IUCN Red List since 1996. The first salmon plan was adopted in 1976 with the aim of improving fish passage. In 1994, the Diadroumous Decree marked the organization of migratory fish management at the level of large river basins (Thomas and Germaine, 2018b). Fishermen and scientists have joined forces to protect migratory populations by influencing regulatory changes (Barthélémy, 2013; Bouleau and Gramaglia, 2015).

An alliance was thus formed between the scientific world, a section of the fishing world, environmental NGOs, and indigenous people on the Elwha that uses salmon as a lever in a political struggle to restore the ecological continuity of the two coastal rivers. As a result, salmon were featured prominently in numerous brochures and posters promoting the dams' removal (Figure 3). Even if the effects of dam removal on salmon populations take a long time to materialize, and the focus temporarily shifts to other anadromous species such as lamprey in both basins (Morley et al., 2020; Hess et al., 2021), it is clear that the ecological success of the two decommissioning efforts will be judged first and foremost on the return of this emblematic fish to these coastal rivers.

3.2 Two government projects

3.2.1 From the start: the questionable legality of dams

In both watersheds, the dams, which were not *per se* illegal, nevertheless flouted the spirit of the rules. Once built, they posed environmental problems that had been identified from the start. The lower Elwha dam was not licensed by the Federal Energy Regulatory Commission (FERC)[9] because it was built before the federal law establishing its authority was passed. Nevertheless, in response to an 1881 Washington state law that prohibited obstructing salmon passage, the dam's owner had to build a hatchery, which was considered a way to circumvent the spirit of the law (Chasan, 2000). No effective fish passage device was ever built, and the hatchery closed in 1922. When the Glines Canyon Dam's license came up for renewal in the 1980s, the owners argued that the old dam should be included in the Glines Canyon Dam license. This is when people began advocating for the dam's removal (Brewitt, 2019). The Sélune is classified as a migratory river by a 1924 decree prohibiting any obstacle to fish migration; therefore, the Vezins dam, built in 1932, was illegal from the start. Here too, compensatory measures were taken. These included the release into the river of thousands of juvenile salmon from Brittany and southwest France to compensate for the loss caused by the dams, estimated at 20,000 smolts/year, which was respected for the first few years. The obligation to allow the free movement of migratory species was reactivated in 1986 by a ministerial decree that gave the

6 Only 25 fishing permits were issued in 2013, compared to over 300 in the 1960s.

7 For instance, the Association Bretonne pour la Pêche à la Mouche, Atlantic Salmon Federation, North Atlantic Salmon Fund, ANPER Truite Ombre Saumon, and the Association Nationale de Défense du Saumon Atlantique.

8 The US Fish and Wildlife Service and the National Marine Fisheries Service.

9 FERC is responsible for issuing licenses for hydropower and determine licensing conditions for a term of 30–50 years. When a hydroelectric dam license expires, the dam owner must renew it through a complex, administrative process known as re-licensing.



FIGURE 3
Images of migratory fish: **(A)** Interpretative display at the former Glines Canyon Dam; **(B)** Touristic board along the highway near Ducey; **(C)** Friends of the Sélune flyer.

dam owner, EDF (*Electricité de France*[10]), five years to bring the structures into compliance, which proved to be technically impossible. The Fishermen's Federation has repeatedly denounced this non-compliance in legal actions. In 2010, the administrative court of appeal ruled in their favor and ordered EDF to restore river continuity by the end of 2013; however, work to remove the dams would not begin for several years.

3.2.2 Local situations favorable to environmental projects

In both cases, the decision to remove the dams was the result of a long process in which the state played a major role, first by failing to ensure strict compliance with regulations, and then by initiating and directing the removal process. This is one of the arguments widely mobilized on the Sélune by the Fishermen's Federation when the Water Framework Directive (WFD) of 2000 and French legislation stimulate projects to restore river continuity (Drapier et al, 2018). The government announced the removal of the Sélune dams in 2009 (Germaine and Lespez, 2017). The Agence de l'Eau Seine Normandie, a public water management agency funded by water utility bills, was the main financier of this project, with EDF taking over part of the La Roche-qui-Boit Dam site. The proximity of the Bay of Mont Saint-Michel has been an additional argument for improving the Sélune River's water quality. The bay, known for its tidal range, one of the highest in the world (over 10 m), has been a UNESCO World Heritage Site since 1979 and is protected for the quality of its natural heritage (RAMSAR Convention, Natura 2000) (Lefeuvre and Bouchard, 2002). The Amis de la Sélune Association uses the famous monument in its logo and highlights images of the bay in its brochures, while scientists communicate the importance of exemplary environmental management to improving the quality of this highly significant wetland.

The Elwha dams were instead privately owned. The controversy has grown with the relicensing process for the Glines Canyon Dam in 1986. Negotiations began due to the complexities of licensing in a national park, and because the stakes in hatcheries had become higher for FERC. The LEKT and its allies established a strong partnership with the NPS which brought together all the stakeholders (Guarino, 2013; Johnson, 2013). This led to the 1992 Elwha River Ecosystem and Fisheries Restoration Act, which provided federal support and funding for the project. The Department of the Interior was authorized to purchase the dams and the Secretary of the Interior, to conduct the studies and the dam removal project (Crane, 2011). The US Congress appropriated funding for the Elwha dam removal project in over 20 appropriation bills over several years after their acquisition by the federal government in 2000 (Blumm and Erickson, 2012). Commissioned by the Department of the Interior, the National Park Service held a leadership role in planning, permitting, and conducting the restoration project.

3.3 Local communities with opposite positions

3.3.1 The settlement of the Elwha: between dispossession and urban development

Over 80% of the Elwha basin is forested and has no visible material heritage. On the other hand, it is rich in a long human

10 A multinational electric utility company owned by the French state.

history, which is also the starting point for a sense of attachment. This absence is not due to an absence of people in the valley, but to their eviction (Guarino, 2013). For at least three millennia, the LEKT living along the Juan de Fuca Strait had settled along the banks of the Elwha. The advance of the US frontier led to the displacement of these peoples, who were not granted any legal claim to the land, unlike the settlers who benefited from the Donation Land Claim Act (1850) and the Homestead Act (1862). The LEKT members were forced to cede their lands under the Treaty of Point-No-Point in 1855, which ceded 438,000 acres to the United States. The land allotment was not made available to them until 1875, after the land had already been distributed. The indigenous peoples then found themselves deprived of access to the river, as their fishing and hunting rights, recognized in 1855, were reserved only for the unclaimed lands. The Indian Reorganization Act of 1934 allowed the tribe to purchase 324 acres in 1937, but the reservation wasn't officially established until 1968. Today, the tribe owns 1,014 acres, forming a discontinuous territory that is situated primarily on the Elwha Delta. The tribe has 882 members.[11]

Within the National Park, development is limited to the network of old logging roads and the National Park Service's administrative and lodging infrastructure. In addition, there are the preserved and developed remains of the Glines Canyon Dam. Nevertheless, given the central location of the Elwha in relation to the rest of the National Park, it is a heavily visited[12] site for recreation purposes, mostly hiking and fishing. In addition, the city of Port Angeles, founded in 1890 and with a population of 20,000, also stimulates the use of this area, in an initial phase, for forestry and timber production and then for recreational activities, as the city is located only 10 km east of the river. Furthermore, suburban sprawl is now arriving at the park's doorstep, and there are dozens of homes and properties between the Elwha and Glines Canyon Dam outside the tribal reservation. Very few homes have a direct view of the river due to the thickness of the riparian forest.

3.3.2 The rural world of the Sélune

The main difference between the two basins is the existence of an age-old farming landscapes in the Sélune Valley, which, like almost all stretches of the European countryside, were established between the Iron Age and the Middle Ages at the latest (Lespez et al., 2015). Today, there are almost 200 dwellings within 500 meters of the former reservoirs (Drapier et al., 2023). These include main residences overlooking the lake, as well as numerous temporary fishing huts, called *cabanons*, with direct access to the water and, in most cases, a mooring pontoon (Germaine et al., 2016). The lakes were renowned fishing grounds for whitefish enthusiasts. From the 1990s on, the shores of the lakes were largely monopolized by the owners of these *cabanons*, but they were also developed with hiking trails. At the time of the decision to remove the lakes, there was a leisure center (la Mazure), a recreational park (le bois d'Isigny) and a café-restaurant (l'Autre Café) which are still in business (Figure 4). With 10,300 inhabitants, the nearest town to the dam is Avranches, 15 km away.

Local European populations, as well as Native Americans and newcomers to the United States, tell the stories of places based on their own experiences and those of their ancestors. In the case of the Sélune, this leads to the transmission of knowledge predating the dams, as in the case of Amerindian populations (Lespez et al., 2023). Although the old hydraulic structures of the Sélune disappeared almost a century ago with the valley's flooding, they have remained present in the local memory and are known to a number of inhabitants. These memories are particularly vivid for farming families, where memories of land expropriation from energy company by grandparents or great-grandparents were passed down through the generations and then revived with talk of removing the dams. The valley floor below the lakes is therefore not seen as a natural space without a social history, instead as a space linked to individual and collective histories, as evidenced by postcards and old pictures of the meadows and mills that used to line the rivers before the dams were constructed.

3.3.3 The role of local populations

On the banks of the Sélune, Avranches has become the main political decision-making center. It is the capital of the Mont Saint-Michel–Normandie agglomeration of municipalities, which brings together 95 townships, including the entire Sélune valley. It is also the seat of one of the sub-prefectures in the La Manche administrative department. It centralizes administrative functions and has been identified as the preferred contact point by the government services managing the dam removal project. Most elected representatives at the town and higher levels (Department, Region) have refrained from intervening in the project. Although the hydroelectric potential of the dams was often presented as able to supply a city like Avranches, the inhabitants of the city have generally remained indifferent to, and unaware of the project. In fact, the local scene has been dominated by the Association des Amis Du Barrage (ADB), created in 1993 to celebrate the statutory, ten-yearly emptying of the lakes. Since the first rumors of their removal, it has become a defense and advocacy association. Bringing together fishermen, *cabanon* owners, and residents, especially from hamlets and villages in the flood zone, the association, with the support of local elected officials, campaigned to keep the dams in place. It organized demonstrations and numerous public meetings, and it occupied public spaces with protest banners. The removal of the Elwha dams was opposed by some residents of Port Angeles. Gathered in 1994 in the REAL (Rescue Elwha Area Lakes) collective, they feared an increase in energy prices, especially for industrial activities, and they were committed to the scenic and recreational role of reservoirs. They also denounced the federal government's interference.

In this way, the geographical conditions played a role in creating an inverted front between the two case studies. The urban centers defined different positions. Port Angeles was home to the only opposition movement to the ecological project, while Avranches cultivated its indifference to the Sélune project. But the most important factor lay elsewhere. The people of the Elwha Valley,

11 https://www.ncai.org/tribal-vawa/sdvcj-today/the-lower-elwha-klallam-tribe-in-washington

12 The park receives ~2,000,000 visitors per year.

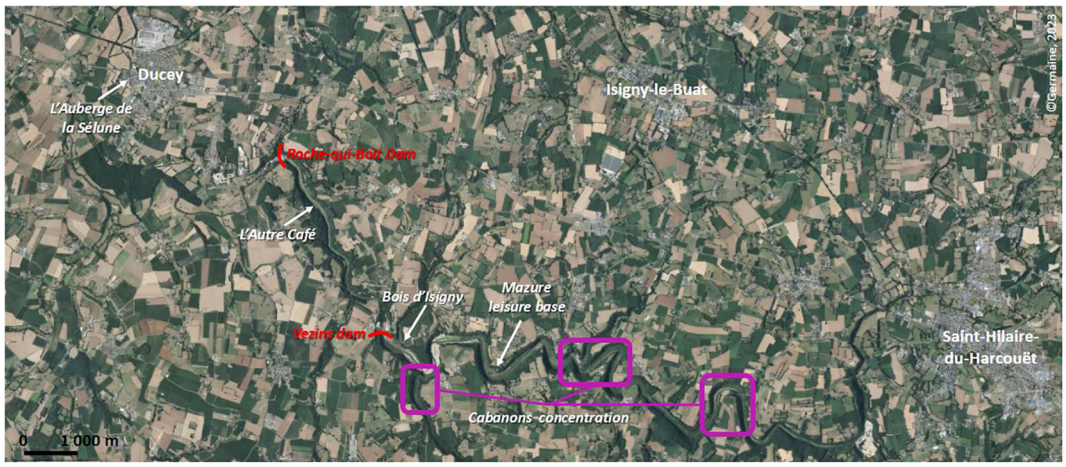


FIGURE 4
Landscape structures in the Sélune watershed.

mainly the Lower Elwha Klallam Tribe, were committed to dismantling the dams. In fact, they were the driving force behind the project, which they saw as a way to mitigate the effects of their despoliation and to reconnect with the river, the life it supports, and the fishing practices at the heart of their culture (Mauer, 2020). On the other hand, the people living in smaller communities along the Sélune, who are attached to a way of life that has existed for a century and around which they have developed a social life, practices, and a sense of attachment to the lake environment, were for the most part strongly opposed to the dismantling of the structures (Drapier et al., 2023). The demolition of the dams was perceived as a process alien to the territory, driven from the outside by the state and its local representatives. While the tribes were victims of the dispossession associated with colonization and were fighting to recover their rights to the river, members of the ADB experienced the opposite; it was the dismantling that deprived them of their resource and stimulated their active and persistent opposition.

3.4 Unmatched environments but nature everywhere?

At first glance, the two rivers may seem incomparable, given their different fluvial styles and watershed landscapes (Figure 2, 5). The Elwha is representative of American nature, which ecological restoration projects aim to keep as wild as possible, regardless of direct or indirect human pressures on the environment. The Sélune is instead an example of European nature, which can be described as hybrid (Latour, 1991; Lespez and Dufour, 2021), and in this context, the restoration project aims to help restore spontaneity and even wildness. Despite these obvious differences, it is worth noting that both discourses are characterized by abundant references to nature and the desire to recover a natural river.

3.4.1 Very different environments...

The landscape of the Sélune watershed is representative of the rural landscape of northwestern France. Land consolidation has led to the opening up of the landscape and a sharp degradation of the bocage,[13] with many hedgerows being torn out, while cornfield plots and above-ground livestock buildings have multiplied. At the same time, towns and small cities have expanded, while the number of single family homes on the outskirts of towns has increased. This situation reinforces the role of the Sélune valley as a green corridor, especially in the gorges. The forests on the slopes are dominated by oak, beech and chestnut, with occasional stands of conifers; they have been little studied. Along the lakeshore, a few stands of trees and shrubs have survived, characterized by a dozen riparian species. Initial vegetation studies have shown that the many woody species reclaimed since the disappearance of the lakes are locally available species, suggesting the possibility of a passive restoration of the 200 ha of Vezins Lake (Ravot et al., 2020). This structuring of the landscape distances agricultural activities and creates a situation where the valley floor appears to be protected from the effects of intensive agriculture, although nitrate concentrations remain high, thus demonstrating the link between the aquatic environment and the rural landscapes of the watershed.

The Elwha watershed is mainly occupied by forest landscapes organized by a stratification of biophysical conditions. The low-elevation forests (below 400 to 500 m) are mixed, temperate rainforests with dense, mossy undergrowth, abundant epiphytes, and dead trees (Figure 5). They can support very old trees (100 to 300 years), in particular Douglas fir, grand fir, and western hemlock,

13 Bocage is a characteristic landscape of parts of northern France, southern England or Ireland resulting from the enclosure of open fields with hedgerows, stone walls, and fences. This landscape is composed of mixed woodland and pasture used mainly for pastoral farming.

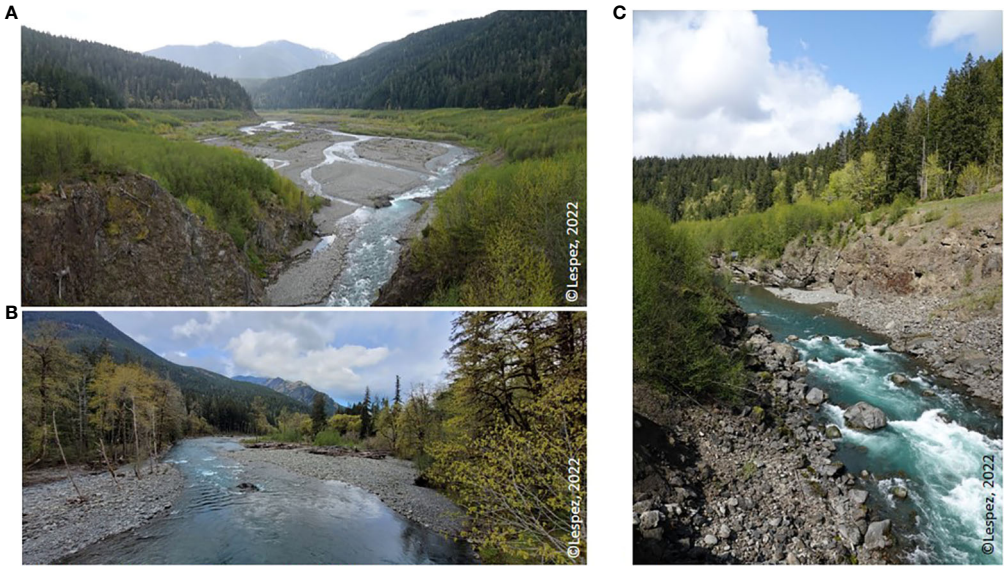


FIGURE 5
Photographs of landscapes along the Elwha River (after dam removals): **(A)** The former Glines Canyon Dam; **(B)** Elwha River; **(C)** Elwha River (former Elwha dam), April 2022.

which can reach very large heights (50 to 60 m), as well as the Sitka spruce (Chenoweth et al, 2022). A narrow band of deciduous trees can be observed along the river and wetlands, including red alder, willow, big leaf maple, black cottonwood, and balsam poplar. Between 400–500 m and 1,200 m, this forest gives way to a mixed forest, where the most common species are western hemlock, western red cedar and Douglas fir. Although indigenous peoples have long used these areas and modified their ecology, these forests were primarily exploited with the development of European settlements. The forests were first exploited for timber, with cut logs floated to sawmills for processing. Later, the wood was used to fuel the pulp mills in Port Angeles. Old forest industry practices prior to 1938 were often destructive, with clearcutting leading to soil erosion and the degradation of the forest ecosystem. The creation of reservoirs also led to the destruction of riparian forests. At the same time, agriculture developed downstream of the watershed, with a few small farms devoted to livestock and fodder crops.

3.4.2 … that are both valued in relation to their geographical context

Beyond the differences between the watersheds, the assessment of the restoration potential of the two valleys is based on an identical observation. The Elwha and Sélune dams are not as economically significant as those on the Columbia or Snake Rivers, or even Poutès Dam, located on a tributary of the Loire River[14]. For this reason, these dams were identified as realistic projects by the environmental activists who saw them as ideal restoration sites. But more importantly, they contain landscapes that are valued in relation to their surrounding regional environments. As such, they offer original, even exceptional potential.

The Elwha watershed is characterized by spectacular forest landscapes, home to a rich biodiversity that led to the creation of Olympic National Park in 1938, and covering 83% of the watershed. Olympic National Park is a World Heritage Site and Biosphere Reserve. The nature of the basin enabled a return to pristine nature, as the restoration project has sought to do. Scientists insisted on the unique opportunity to restore a wild river that this project represented (e.g. Duda et al., 2008; Warrick et al., 2015), as the dams were located downstream from a protected natural area; the physical restoration took place in a context where the physical and chemical quality of the water was very good. This situation was considered ideal to obtain the necessary funding for conducting comprehensive research and monitoring studies.

The mouth of the Sélune, the Bay of Mont Saint-Michel, is recognized for its natural heritage of major interest. The downstream section (from Ducey to the river mouth) is listed in the national inventory of natural areas of ecological, flora, and fauna interest. In contrast, the former dammed section is not a protected area. Nevertheless, the gorges of the Sélune, which are hard to access due to their steepness, offer a unique setting away from the surrounding agricultural plateaus. The presence of rocky outcrops reinforces their originality in the context of Northwest France, where the relief is generally not very marked. This intimate landscape is enhanced by the absence of roads along the river and a low number of crossings. The gorge section is identified as a space that stands out from ordinary valleys, not only because of the

14 This dam was slated for removal but was finally reconfigured to maintain hydroelectric power production while meeting ecological connectivity requirements. See more: https://www.nouveau-poutes.fr/vers-le-nouveau-poutes/le-barrage-actuel/

presence of lakes, but also because of its relief, its hidden character, and the perception of its scenery as "natural" (Germaine et al., 2019).

3.4.3 The weight of representation: nature everywhere

References to nature are ubiquitous in the planning documents or public dialogue around the projects. This is obvious in the Elwha project, since the entity promoting of the operation is the NPS. Its objectives were clear from the very start and were reiterated in the Elwha River Ecosystem and Fisheries Restoration Act (Public Law 102-495): there was a stated need to return the Elwha River and the ecosystem to its "natural, self-regulating state" to fully restore the Elwha River ecosystem and native anadromous fisheries through the decommissioning of Elwha Dam and Glines Canyon Dam. And it was fully supported by the LEKT, which sought to restore its cultural relationship with nature by dismantling the dams. People in Port Angeles were incredulous about the removal project, claiming they wanted to preserve the opportunities the lakes offered to experience nature. Stakeholder groups "saw fundamentally different things" looking at the dams, the lakes and the river (Brewitt, 2019). Crane (2011) describes how the project to re-imagine the river was supported by preservationist attitudes inspired by John Muir. Indeed, the Sierra Club and Friends of the Earth, along with fishing group such as Trout Unlimited, played an important role portraying the dams as symbols as destruction. This vision of nature has been largely reappropriated by the people of Port Angeles, who have continued to use the area for outdoor activities after the dams' remval. Due to a very different history and environment, the relationship with nature is more complex in the Sélune Valley. The announcement of the removal revealed a strong place attachment (Germaine et al., 2019). Surveys showed that the attachment to the lakes was especially strong among residents. Their experiences were commonplace. As a part of people's daily lives, these landscapes were also seen as a restful environment, ideal for relaxation and contemplation. The owners[15] of the 150 or so *cabanons* built on the banks of the river had a special relationship with nature. This is evident in the construction and maintenance of shelters and pontoons using local materials, and the skill with which they harnessed a spring, built a path on a steep slope, and ensured views of the water while remaining hidden by the surrounding trees, as well as in the broader practice of outdoor activities, in which fishing often took a back seat to gathering (mushrooms, berries), observation, or boating (Lespez and Germaine, 2016; Germaine et al., 2019). For example, the vice-president of the ADB association organized several outings to discover *Lathraeas clandestinas*, of the orobanchaceae family, located in the wetland at the end of the Vezins Lake. He participated in nature photography exhibitions with pictures of animals taken on the lakeshore, which testifies to his attachment to living things. The reservoir was seen as a living ecosystem in its own right, perceived and known simply as "nature".

This relationship with nature has been reconfigured by the removal of the lakes, but it remains a fundamental element in the appreciation of the area. The transitional period following the removal of the dams shows that the interest in these landscapes was not just in the water, but also in the environment, considered as a preserve. While there were strong fears that the valley would become overgrown, the spontaneous growth of vegetation (Figure 2) now seems to be welcomed as a means of maintaining the spirit of the place (Germaine and Gonin, submit). While maintaining their desire to keep open landscapes for physical and visual access to the water, several stakeholders have expressed an interest in wooded landscapes that contribute to the intimate character of the area. These inaccessible gorges have encouraged the emerging perception of an island of nature within an agricultural area that inspires a sense of tranquility (Figure 2D). The afforestation contributes to the difficult access to the valley floor and the longitudinal division of the space, reinforcing this hidden, intimate character.

Both valleys have been considered exceptional from an ecological point of view, although scientists, institutions, and NGOs have insisted on their degraded nature as a way to justify their restoration. Despite the different sense of materiality in each case, once the structures were dismantled, the sense of place in both instances is strongly influenced by the natural character attributed to the places and the relationship to nature that they provide.

4 Discussion

By placing the relationships between material forms (biophysical elements and infrastructures), local populations and their practices, and cultural and political institutions at the center of the analysis, the hydro-social territory approach highlights the importance of taking into account the local scale and all populations connected to the river or lakes to ensure the success of a dam removal project. If these precautions are not taken, there is a risk that the project will be carried out in an overly restrictive approach which deals with ecological issues by developing appropriate operational techniques, but ignores the dimensions of the living environment of the people and users to which they are attached and which they value. This may restore the river, but it does not guarantee that the relationship of the inhabitants with it will be restored. The comparative approach highlights the convergence of the two projects. The role of state authorities clearly raises the question of their responsibility for the successful completion of the process and their relationship with the local population. It also raises the question of the spatial scale at which the ecological project should be designed. At the same time, the attachment to nature shared by local populations in different ways and on specific cultural bases raises the question of how relational dimensions can be taken into account in ecological restoration projects. These are the questions we would like to discuss to highlight several useful lessons for a better understanding of dam removal projects.

15 A part of them live in the valley and another part live in cities near the valley like Avranches, Rennes or Fougères (Germaine et al., 2016).

4.1 At which spatial scale should large dam removal projects be framed?

Long and conflict-ridden (Crane, 2011; Germaine and Lespez, 2017; Brewitt, 2019), the two projects demonstrate the multiplicity of spatial and temporal frames of reference of the actors involved. This raises the question of the relevant scale at which to build a common project.

4.1.1 A lack of consideration of inhabitants and outside NGOs on the Sélune River

On the Sélune, the people most affected were those closest to the river: those who inhabited the gorges overlooking the lakes or who had the opportunity to visit it every day, as well as those downstream who feared a worsening of the risk of flooding. *Cabanon* owners used the valley seasonally for fishing and vacation. Recreational users (fishing, hiking, kayaking) encountered the valley on a more intermittent basis. Scientists and environmental NGO activists lived outside the region and visited the valley only occasionally. Their relationship to the river was therefore distinct over time. The proximity of the participants' residence to the river influenced their opinion of the removal works; people living near the old lakes found it more difficult to imagine themselves in a new valley without the lakes. Conversely, occasional users found it easier to project themselves onto the new landscape and to recognize its new potential. This dichotomy observed in the post-removal surveys echoes the results of the public survey organized in 2014. Participation was high, with 4,565 opinions submitted. Most of the favorable opinions were expressed electronically, reflecting outside support. Opening the survey to the Internet raises the question of who has standing to express an opinion on the future of a territory. This has reinforced the sense of dispossession of inhabitants. Furthermore, successive territorial reforms contemporaneous with the project have further distanced local elected representatives from the power process. Until 2017, a dialogue was organized at the level of the cantons (Ducey, Saint-Hilaire-du-Harcouët, Isigny-le-Buat, and Saint-James), all of which are affected by the river. The merging of these townships into an agglomeration has shifted the decision-making center to the bay-oriented town of Avranches, which has little interest in the future of the Sélune. This reorganization has stressed that decision-making spaces are different from use spaces, since power is located outside the valley. More generally, the merger has marginalized the elected representatives of the riverside communities, making it difficult for them to force the agglomeration of municipalities to take charge of the Sélune's rehabilitation. Although the local community has not been the only reference scale for political decision-making, it should have been taken into account as such, since it has its own specific issues.

On the Sélune, the fishermen's federation is the only environmental NGO who advocated for the removal from the beginning, and which attended some public meetings organized by the ADB locally. The other advocates of the dam removal arrived later without any local contacts. The "Amis de la Sélune" collective is a dormant network of associations that share the same vision of the river and which are capable of organizing themselves to express their position when necessary. The collective is active on the Internet with a website, which has been replaced by a page dedicated to the project on the European River Network (ERN) website. Rather than inform the valley's inhabitants, the aim is instead to use the project as a showcase in Europe, as evidenced by the mobilization of media networks. Taking advantage of this project, considered "the largest dam removal operation in Europe," the ERN organized the international symposium "Renaissance of the Sélune Valley" in September 2019. This event could have been an opportunity to present the results of the scientific program carried out on the Sélune, but this part took place in Rennes (over one hour away), while the second day, held in Avranches, instead presented the international feedback. While NGOs and local tribes managed to work together on the Elwha, the support for the dismantling of the Sélune dams was exclusively external to the area.

4.1.2 The building of a coalition at the local level on the Elwha River

For the Elwha, the question of local actors and their political power was equally complex. The dams initially benefited the industry and energy sector of Port Angeles, while at the same time depriving LEKT members of their land and key resources. Thus, while the Lower Elwha has regained power and legitimacy through the ecological project (though not completely, as the area is managed by the NPS), Port Angeles inhabitants have largely remained outside the project, despite numerous community information meetings. Building the political basis for the decision was not easy either.

Because most of the Elwha River is in a national park, its situation is unique. A coalition of NGOs was formed locally with the tribes and have been engaged in defending the removal project. They were formed before the relicensing process and were well organized to challenge FERC's authority. They were based in Washington State (Audubon Society and Sierra Club chapters), while Olympic Park Associates was locally based. They became involved in 1986, when they intervened in the Lower Elwha FERC proceeding, and they participated in the preparation of several motions and petitions over three decades to win approval and funding for the river restoration project. By the early 1990s, the coalition had grown stronger as government agencies also began pushing for removal. But the finalization of the Elwha River Ecosystem and Fisheries Restoration Act (1992) consolidated the opposition to the project, as many local residents resented what they saw as outside interference. LEKT members and environmental groups (Olympic Park Associates and Trout Unlimited) occupied the local stage to collectively debate the future of the dams, while this local opposition fueled federal debates and slowed the negotiations for purchasing and remove the dams (Brewitt, 2019). The Elwha Citizens Advisory Committee was an informal body that formed just as opposition began to grow in Port Angeles. The locally formed group brought together 16 citizens with opposing views on the removal, who spent six months developing a report that presented a shared vision. In the end, this informal group concluded that the energy produced by the dams was modest

(Lydiard, 1996). In addition, after the removal, scientific symposia were organized, each of which was open to the public and included presentations by scientists on the monitoring of the dams' removal.

4.1.3 The need to expand the range of actors considered

This situation also testifies to the limits of global environmental movements, which come up against the specificities of a given area and whose demands can be perceived as ecological interference by local residents. It is also interesting to compare the ERN's involvement on the Sélune with the history of this environmental association, which was created on the Loire in the 1980s from local roots to fight against the construction of dams on that river. The association, then known as SOS Loire Vivante, stood out for its combination of local mobilization and national and international connections, which enabled it to influence the debate. Transformed into a Europe-wide association since its victory on the Loire, the ERN struggled to cultivate local partners and thus appeared as an outsider (Hayes, 2002; Barraud, 2011). Dam removal advocates often appear as outsiders who underestimate the potential for opposition to the removal of the structure and who may even exacerbate this resistance (Fox et al., 2016).

All these observations reveal the need of organizing consultations at various levels, not because they make it possible to find a solution outside the legal and democratic bases on which states operate, but because this is the only way to ensure that the people concerned are heard and taken into account in the legal and democratic process. There is no easy solution to propose, but broadening the range of actors involved is a *sine qua non* for the long-term acceptance of the project (Germaine et al., 2021). This is essential to limiting resentment, both towards the project itself, and the legal and democratic process by which it was promoted (procedural justice), and thus to avoid permanently discrediting the institutions that took charge of this process.

4.2 The state as a territorial actor?

In both cases, the state played a key role, firstly in the decision-making process, because of the regulatory dimension, and secondly in the implementation process. But beyond these similarities, crucial differences emerge in the in the way government action is organized and implemented at the local level.

4.2.1 A state with powerful local leverage that supports the political project at the local level

In the case of the Elwha, the environmental rationale permeated the entire process. The federal government was both the primary funder and operator of the removal process, as well as the environmental champion, since the dewatered areas and most of the river lie within the national park. The NPS has been on the ground since the Olympic National Park was established and places environmental issues at the core of its mission. There is a large staff (100 employees and as many seasonal workers) which is local; they know the watershed and all the local actors. One of the various departments is specifically dedicated to education. The information challenge was not anticipated, however, and the NPS was overwhelmed by requests from local and international media. Important but routine processes that are used on a nationwide basis led to the organization of a stakeholder dialogue. The first was FERC process, which since the late 1980s has included topical commissions, public meetings, and workshops to produce a report to Congress. Then there was the Environmental Impact Statement (EIS) process, which took place in the early 1990s. The Department of the Interior and the NPS prepared this process, which consisted of a public comment period (600 comments) and a series of public meetings in Port Angeles and on the Peninsula that were attended by up to 200 people. The goal of this phase was to reach a decision among several options. The entire process was publicized in the local press and communicated to the various communities. In particular, one of the NPS representatives, Brian Winter, led this project for about twenty years and was able to rally a large community around common goals. The Elwha Citizens Advisory Committee was one of the tools used to build the project and create the "glue." The trajectory of the Elwha dams is specific due to their partial location within the boundaries of a national park. FERC was initially set to rule on the renewal of the Glines Canyon Dam license, but LEKT members and NGOs demanded that FERC be recognized as lacking jurisdiction over this issue due to the presence of the national park. This dispute was the subject of several legal rulings and contributed to the rise of the controversy at a national level (Busch, 2008). Ultimately, the potential for a lengthy legal quagmire over the question of federal jurisdiction led to the decision to opt for a compromise involving the removal of the works from federal funds.

A community and citizen science initiative was launched in 2004, which has involved members of the LEKT (Diver et al., 2022; Eitzel et al., 2023). The national park brought scientists and local people together in the Elwha Research Consortium. In this way, local people have been encouraged to participate in field data collection. There was a moratorium on fishing, which was prohibited until 2022 for both commercial and tribal purposes. LEKT members participate in the decision-making group that renews the diagnosis every year to determine whether the state of the populations allows for the authorization of fishing. Thus, the National Park Service operates within its boundaries as the exclusive decision maker, working with partners cooperatively wherever possible, including the long-standing Fisheries Technical Committee (members including the LEKT, Washington State Department of Fish and Wildlife, NOAA, US Fish and Wildlife Service, and the US Geological Survey). This situation is quite unique as most US dam removals do not take place on federal land.

4.2.2 A state that decides and steers, but has no desire to engage in local politics

The situation at the Sélune has been very different, since the ecological restoration is taking place in an unprotected environment. It is not, therefore, a controlled area whose functioning and evolution are controlled by a major environmental protection agency such as the NPS, instead by a

multitude of actors with divergent interests. The decision to dismantle the dams was announced more than 150 km away, and then the local offices of central government departments and EDF were entrusted with its implementation. The department in charge of managing the project was located in Saint-Lô, in the La Manche prefecture, which is one hour away by car. The unit dedicated to the dams consisted of a single full-time project manager and a secretary to support the administrative aspects. The project manager was an engineer by training, responsible for managing the project and coordinating the various engineering firms involved in the project. Lacking naturalist skills, and with the expectations of successive prefects limited to regulatory aspects, the unit has adopted a technical approach and has few resources to lead a consultation process. Instead of relying on the local water commission (CLE), which promotes a watershed scale management, the government set up three interlocking working groups. A project group composed of government departments, EDF, AESN and three local councils oversaw the studies. A steering committee, open to other elected representatives, validated the studies and directed the work as necessary. A local information commission met infrequently and by invitation only. This configuration has evolved over time, but governance remains characterized by a lack of dialogue with local elected representatives, with most exchanges taking the form of letters that are mailed months apart. At the same time, the French government communicates very little, at a late stage, and on purely technical aspects (the work), making no significant educational effort to explain the reasons for the dismantling and to support the ecological process. Except for the distribution of a few leaflets (four during the project's construction, and three during the works), the public authorities did not organize any public meetings and never went to meet the residents. This stimulated the emergence of opposition and its organizing among people whose daily lives or practices were directly affected by the project. Although entities that promote smaller projects make an effort to conduct door-to-door consultations and/or organize community meetings ahead of their project (Germaine et al., 2021), the Sélune restoration project has been characterized by an absence of consultation.

In practice, the project was divided into a technical project, which is handled by the state, and a local conversion project, which the state has sought to entrust to elected representatives. The State itself did not want to take on a territorial project, proposing the allocation of the drained areas to an overall environmental project led by the Ministry of Ecology (a National Nature Reserve or a "Natura 2000" contract), which would have legitimized its role. Nor was it willing or able to rely on local authorities such as the Normandy Region or the Department of La Manche, which would have anchored the environmental project in the territory by creating a Regional Nature Reserve or a Departmental Sensitive Natural Area. As a result of old regulations that have not been complied with as well as several new laws, the project has therefore mainly been technical, with regulatory (WFD, ecological continuity) and safety objectives (preventing polluted sediments from flowing downstream, controlling flood risks). All other aspects have been considered to be the responsibility of the local authorities, to whom the French government has sought to entrust the released land. These local authorities have therefore been invited to draw up a program for the landscape and economic conversion of the valley. However, in their opposition or indifference to the dam's removal, they have struggled to take ownership of the project, especially since the dismantling was temporarily questioned by the Minister of the Environment in 2014 (Germaine and Lespez, 2017). In the past five years, the dismantling operation has mainly been a vast site for the deconstruction and management of sediments from the erosion of the agricultural watershed that have accumulated since the last emptying in 1993, and the stabilization of polluted sediments in one of the Sélune's tributaries, caused by decades of industrial activity. Ultimately, the two projects were built in parallel, but the two aspects never came together, leaving a number of unforeseen dimensions. This process is responsible for the current uncertainties over the future of the dewatered areas and, more generally, the relationship between the ecological project and the local territory.

4.2.3 Considering the role of the state and its territorial dimension from a project's outset

In the case of these two large-scale projects, central governments play a key role in initiating and steering an environmental project through their departments, even more so when the projects can rely on regulatory aspects. However, as the example of the Sélune shows, state commitment is not everything; it's also a question of knowing how, with whom, and through which local institutions it can support the environmental project. The way in which the state acts does depend to a large extent on the regulatory and financial framework on which it can rely. Our previous research has shown that the regulatory framework influences the emergence of bonds between an environmental policy and community development projects (Drapier et al., 2018). A clear divergence appears between France and the US when it comes to environmental policy and its link to the territory into which it is embedded (Drapier et al., 2023). Projects in the US involve non-profit associations that allow for the creation of stronger links across a longer timeframe between the dam's removal and which contribute to local development, whereas in France, regulations impose a timetable and a standardized approach that is more often focused on the ecological project and its acceptance by riparian owners. This greatly limits the potential for projects to be used as tools for local development. The formation of dam dismantling projects in the United States is part of a project-based approach (building a collective, seeking funding) that forces players to collaborate, whereas the top-down approach imposed by French regulations is not conducive to ownership and collaboration. Thus, the Sélune project is rooted in a very different culture of restoration project management. Our study of the Sélune process shows that in cases where the state is responsible for restoration projects, territorial cooperation is crucial to the project's success, over and above the initially targeted biophysical aspects. In fact, the territorial dimension of the initiative must be identified from the outset, and the governance issues at stake must be considered before the project is implemented (Ohno, 2019; Fostvedt et al., 2020). From there, the question arises of whether and how the state should play an active role in producing restored

areas and their geographic consequences, undertaking initiatives and accepting responsibilities itself, or whether and how it should play a supportive role by encouraging co-construction dynamics in conjunction with local authorities.

4.3 Attachment: an impossible environmental reset

A decommissioning project cannot be based solely on redefining a biophysical trajectory (Dufour and Piégay, 2009; Lespez et al., 2015); it is essential to work with local communities, their specific relationships to the environment, and their histories (Eden et al., 2000; Germaine et al., 2019). It cannot involve wiping the slate clean or returning to an illusory past. It must pay attention to people's relationships to the river, and it must create the conditions for restoring relationships when they seem to have disappeared, rather than impose new ones.

4.3.1 The pivotal role of indigenous peoples in North America

The removal of the Elwha dams is part of the Native American movement to regain their rights and their land. These two movements cannot be separated (Linton and Pahl-Wostl, 2023). Though displaced by colonization, the tribes have been the NPS' most important partner. This alliance is strategic because they have the ability to take legal action under nineteenth century treaties, which the NPS does not have the authority or political will to do (Sweetser, 2019). They participated in FERC negotiations that led to the 1992 Elwha Act, and today, as co-managers with the Washington Department of Fish and Wildlife for commercial and recreational salmonids and the NPS, they participate in defining the yearly fishing moratorium.[16] Mauer (2020), however, explains that what is at stake is not just dispossession, but rather the mechanisms that led colonial and capitalist occupiers to transform the physical world into an instrument of colonialism itself. Hatcheries, as adopted by the LEKT, serve as an eloquent example of the imposition of technological devices aimed at dominating nature and legitimizing infrastructure (Crane, 2009). Since their removal, the tribes still do not have the right to fish in the Elwha. Symbolically, ceremonies celebrating the return of salmon can be held again, but the number of returning fish remains insufficient to authorize their harvest. Until 2022, the Klallam will only be allowed to fish at sea and will continue to farm salmon to meet their economic needs. The LEKT has retreated to peripheral struggles and focused all of its attention on restoring the river, leaving a number of injustices in place (Crane, 2011) and discussions with the NPS are ongoing.

The role of indigenous peoples is often crucial in dam removal projects in North America. Tribes have been involved in at least thirty projects, most often through direct participation in the demand for removal (Fox et al., 2022). This is the case, for example, with the Penobscot Indian Nation on the Penobscot River (Opperman et al., 2011), the Hoopa Valley Tribe, Yurok Tribe, and Karuk Tribe on the Klamath River (Gosnell and Kelly, 2010; Diver et al., 2022), and the Yakima Nation on the White Salmon River (Gimblett et al, 2017). As described by Linton and Pahl-Wostl (2023), Indigenous peoples have traditionally held a different kind of relationship with what Westerners call "nature." This relationship sees the environment as a living being to be cared for, not as a resource or a fixed state. The dismantling of dams is undoubtedly a crucial stage in the redefinition of the relationship between indigenous peoples and the environment. However, restoration is underpinned by an ecocentric approach that values the intrinsic value of living things rather than the relationship between humans and non-humans. Thus, the dismantling of the dams alone cannot complete the process of decolonization, i.e., restoring indigenous peoples' relationship with their environment, and the durability of the alliance between the advocates of ecological restoration and the tribes remains questionable.

4.3.2 What place is there for local people and local knowledge in Europe?

The lack of consideration for the relationship between the people of the Sélune and their environment on the part of the public authorities has been demonstrated by several events. For example, the presence of *cabanons* along the shores of Vezins Lake was overlooked by elected officials and government departments. Initially they underestimated their number, and then, they considered them a minor problem, given that most of the structures were abandoned (Germaine et al., 2016). The public authorities limited their analysis to the public domain, which they must ultimately manage and develop, but this meant that they focused only on the pontoons, thus minimizing the scale of the buildings concerned. The *cabanons* were considered "black marks" on the landscape from an aesthetic point of view, and as infrastructures that posed safety problems (risk of collapse, liability issues). At no point was the presence of these sheds seen as evidence of a strong relationship with the environment. The salvage fishing organized during the lake drawdown is another example of the neglect of the relationship between the inhabitants and the river. The lakes were described by regulars as full of fish, and lake lovers were seen as spokespeople for a merely "ordinary" biodiversity. Guided by the need to restore salmon populations, the French government has also paid little attention to carnivorous fish and whitefish. These common species did not receive the attention of the public authorities when the Vezins reservoir was emptied. Anglers complained that they did not receive any response from the public authorities regarding the organization of a recovery fishery and the fate of the 15–20 tons of fish in the lakes (perch, pike, pikeperch and even catfish). The socio-environmental knowledge of the local population has therefore been neglected. Since the demolition of the structures, we have witnessed a tentative reappropriation of the valley by new actors, mainly hikers and kayakers who want to make this their new playground, and hunters who want to preserve the tranquility of the area and its hunting potential. It is the immersive and direct experience of the landscape that leads them, through landscape patterns, to appropriate and

16 The most recent plan is for in-river subsistence fishing to return to the Elwha in 2023.

project themselves onto this new space, independently of the plans of experts and decision-makers (Gonin et al., 2023). In the case of river ruins or small waterfalls created by former dams and fisheries, stakeholders and local residents have no official representative structure to turn to with their questions and interests regarding the fate of these heritage assets.

As we have demonstrated, the local population is therefore not indifferent to nature, but its relations, based on common or devalued species, common practices, or even debatable activities (hunting, agricultural seeding of the river,[17] introduction of fish), are poorly considered or even ignored by the public authorities (Gonin et al., 2023). They are also ignored by environmental NGOs, who find it difficult to approach them to support the decommissioning project. The situation is very different for Amerindian populations, whose cosmology has been adapted to the objectives of public policies. In Europe, the modern character of the WFD, which perpetuates the separation between nature and society, even while recognizing the need to integrate multiple stakeholders, does not value the relational nature of environmental projects. Local populations are still too often considered illegitimate and their relationship to their environment is underestimated. The Sélune restoration project is still part of a modern ecological restoration initiative that combines environmental expertise and democratic political power rooted in representative democracy; however, it does not really invest in the relationship between riparian societies and their environment, which would guarantee ownership of the ecological project by as many people as possible (Eden and Tunstall, 2006; Sneddon C. S. et al., 2017).

This discrepancy also applies to most elected officials, who view the valley's restoration in a relatively detached light, due to their physical distance from the environment, which they continue to view primarily as a resource to be developed, and the relative number of their directly affected voters. The proposals made by elected representatives in collaboration with the consulting firm reflect a tourism-oriented approach. This is far from the expectations of the local population, which is primarily concerned with the quality of the living environment and the ability to access it and develop activities there. Through its geographical proximity and daily use of the area, the local population's sensitivity for the river is undoubtedly strong. Local people's expectations are rooted in a phenomenological approach and an experience of a lived space that is not shared by elected officials and government services.

4.3.3 All is not lost: tribes as models?

Projects carried out in the United States can undoubtedly provide inspiration for taking this relational dimension into account. Indeed, without idealizing them, projects carried out in contexts where tribes have played a strong role can serve as lessons for a more general consideration of indigenous peoples and their relationships with the environment, as suggested by Linton and Pahl-Wostl (2023) and Gosselinge and Bartoli (2022) The relational ethics promoted by these peoples have the merit of reminding us that the environment is not just a living space, rather a set of relationships in which we are engaged. As Gosselinge and Bartoli (2022, p. 154) put it: "If the logic of interest is individual and rational, the relational logic is holistic and pathic: it brings into play bonds of attachment that cannot be translated into the order of calculation or compensation, because they involve the beings who inhabit and frequent the living environment in relationships of reciprocal obligations." The recognition of this dimension is not specific to indigenous populations, but it may characterize all local peoples who develop relationships with their living environment and its other inhabitants, human and non-human, and who can transmit this relational dimension from generation to generation. As the American Indian philosopher Burkhart (2019) points out, "the condition of being 'indigenous' refers less to belonging to an ethnic group than to belonging to a community whose practices and customs have taken shape in relation to an inhabited environment and the other-than-human inhabitants that make it up." Drawing inspiration from phenomenology and more-than-representational approaches, this involves paying attention to the everyday acts, habits, and affects in which the ordinary relationship to the environment is embedded (Thrift, 2007; Anderson and Harrison, 2010). This lesson, recalled by the Amerindians in their struggle for the environment, can be extended in the New World, as well as in Europe, to areas where indigenous populations have disappeared or where native populations do not have a specifically indigenous status.

However, the existence of this relationship is not automatic; it is not enough to reside somewhere to inhabit it. In this sense, it seems necessary to question the traditional categories of actors to recognize forms of legitimacy other than land ownership and take co-appropriation relations into account. It is not a question of highlighting the inhabitant, but rather the person who, through his or her practice, participates in a community and expresses an attachment to the living environment that he or she helps to produce. Recognizing these relationships requires us to move away from the binary nature/society approach rooted in Western modernity and spread by the colonial process. In our time, it is important to "stay with the trouble" (Haraway, 2016) and move beyond this binary vision of nature by developing relational approaches. We gladly follow in the footsteps of Milstein et al. (2023), p. 421), who promote a resolutely optimistic perspective according to which "the capacity of our species to collectively, even rapidly, adopt ecocentric systems of meaning that trigger massive change should be widely recognized and actively promoted." So as not to lose the thread of dwelling (Mathieu, 2016), including in Europe, and to make it one of the driving forces of people's attachment to a quality environment, we must include the history of the relationship between riparian populations and rivers within the environmental project. Ecological restoration must be carried out within a framework of cultural and socio-environmental continuity with regard to the local, indigenous community, which thereby slowly renews itself, its vocation being to stay and live in the area. For example, history

17 With selected forage species.

also underpins the legitimacy of local residents to express their views on the future of the valley in the name of a previously held property right. In all cases, the spaces are invested with tangible or intangible legacies, and the project revives ghosts, such as the meadows at the bottom of the valley and the old mills and fisheries on the Sélune, or the productive fisheries and sacred sites inundated by lakes on the Elwha. The ecological project cannot and must not erase the past.

At a time when Europe is witnessing a proliferation of demands for the recognition of the legal personality of rivers (Appel du Rhône, Parlement de Loire), it seems that other ways of promoting the recognition of multiple relationships with rivers might be more productive. Such projects could be inspired by bioregionalism, which promotes direct relationships with the land at the scale of a habitat, such as a valley or a watershed (Berg and Dasmann, 1977; Sale, 2000). By advocating for a community-based approach, bioregionalism pays close attention to local specificities to capture and integrate the interdependencies between biophysical environments and communities, while promoting an improvement in our relationship with other living beings.

5 Conclusion

The comparison of the dismantling of the Elwha and Sélune dams reveals, first and foremost, the importance of environmental projects on a global scale. In the context of an unprecedented biodiversity crisis, governments have taken up ecological issues; the removal of large dams is one of the most emblematic actions today, and undoubtedly one of the most successful from an ecological point of view. Nevertheless, a comparison of the two projects highlights the need to take geographical conditions into account in their implementation, whether these are biophysical conditions – which naturalists generally take care of – or socio-spatial dimensions, which have been identified as one of the main obstacles to the development of ecological restoration in Europe (Cortina-Segarra et al., 2021). The latter are still neglected or only partially addressed. Social dimensions often rely on indigenous populations in the Americas, with whom an alliance can be built around the return to better functioning rivers. However, the relationship with local native people has been neglected in the Sélune project. This international comparison is an opportunity to demonstrate that the long-term management of human/non-human relationships is a way to involve local populations in an ecological project. In this way, from the beginning of the project, advocates must take the territorial dimensions and the complexity of the spatial scales of reference into account as a prerequisite for the ecological project's complete success. The integration of relational dimensions is undoubtedly also crucial for sharing a river culture with all stakeholders and envisioning a more vital project that goes beyond the still dominant ecological and/or technical objectives. It seems to us that such an approach would enrich ecological projects and renew the relationship between the inhabitants of these ecologically degraded areas, the people in charge of the ecological project, and the environment itself (Higgs, 2003; Dicks, 2021). Under these conditions, the dismantling of large dams could then be an opportunity to outline more generally what a community could be, bringing together humans and non-humans around the river (Wantzen et al., 2016).

Data availability statement

The original contributions presented in the study are included in the article/supplementary material. Further inquiries can be directed to the corresponding author.

Author contributions

The authors contributed equally to this work and share first authorship. All authors contributed to the article and approved the submitted version.

Funding

The research presented in this paper was supported in part by The Seine-Normandy Water Agency which funds the research program called "Reconfiguration of collectives and territorial project" (convention 1085126-1) coordinated by M.A. Germaine (http://selune.hypotheses.org/). This is one of the topics of the scientific monitoring of the Sélune dams removal coordinated by the INRAE Rennes (https://programme-selune.com/en/).

Acknowledgments

We would like to thank all the people of the Sélune valley and from the Elwha dam removal project for the time they have given to our research. We thank Claudio Cambo who helped us translate this text. Finally, we thank Jeffrey Duda, Guest Associate Editor of this Research Topic, and the reviewers Peter Brewitt and Jeffrey John Opperman for the constructive and careful review.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

References

Albertson, Z. (2019). Constructing the klamath: nature, culture, and the management of a western river. *Soc. Natural Resour.* 32, 790–806. doi: 10.1080/08941920.2019.1590670

Allen, D. N. (2010). The klamath hydroelectric settlement agreement: federal law, local compromise, and the largest dam removal project in history. *Hastings West-Northwest J. Environ. Law Policy* 16, 427.

Anderson, B., and Harrison, P. (2010)The promise of non-representational theories. In: *Taking-place : non-representational theories and geography* (Ashgate: Farnham) (Accessed 1 December 2021).

Baglinière, J. L., and Porcher, J. P. (1980). Principales caractéristiques des adultes de saumon atlantique (Salmo salar L.) capturés par pêche à la ligne dans trois fleuves côtiers du Massif Armoricain : le Scorff, la Sée et la Sélune. *Bull. Français Pisciculture* 279), 65–75. doi: 10.1051/kmae:1980003

Barraud, R. (2011). *Rivières du futur, wild rivers ?, VertigO - la revue électronique en sciences de l'environnement, Hors-série*. doi: 10.4000/vertigo.11411

Barraud, R. (2017). Removing mill weirs in France: the structure and dynamics of an environmental controversy. *Water Alternatives* 10 (3), 796–818.

Barthélémy, C. (2013). *La Pêche amateur au fil du Rhône et de l'histoire. Usages, savoirs et gestions de la nature* (Paris: L'Harmattan).

Basilico, L., et al. (2021)Quand les rivières reprennent leur cours. In: *Béatrice gentil-salasc (OFB)*. Available at: https://hal.inrae.fr/hal-03198098 (Accessed 30 June 2023).

Bauman, J., and Kardouni, J. (2018). *Elwha River restoration: tribal voices matter in the restoration of natural resources', Reclamation Matters*. (Lexington, KY: American Society of Mining and Reclamation), 23–28.

Belletti, B., Garcia de Leaniz, C., Jones, J., Bizzi, S., Börger, L., Segura, G., et al. (2020). More than one million barriers fragment Europe's rivers. *Nature* 588 (7838), 436–441. doi: 10.1038/s41586-020-3005-2

Bellmore, R. J., Duda, J. J., Craig, L. S., Greene, S. L., Torgersen, C. E., Collins, M. J., et al. (2016). Status and trends of dam removal research in the United States. *Wiley Interdiscip. Reviews: Water* 4 (2), e1164. doi: 10.1002/wat2.1164

Benages-Albert, M., Di Masso, A., Porcel, S., Pol, E., and Vall-Casas, P. (2015). Revisiting the appropriation of space in metropolitan river corridors. *J. Environ. Psychol.* 42, 1–15. doi: 10.1016/j.jenvp.2015.01.002

Berg, P., and Dasmann, R. (1977). The ecologist'. *Ecologist* 7 (10), 399–401.

Blumm, M. C., and Erickson, A. B. (2012). Dam removal in the pacific northwest – lessons for the nation. *Environ. Law* 42, 1043. doi: 10.2139/ssrn.2101448

Boelens, R., Hoogesteger, J., Swyngedouw, E., Vos, J., and Wester, P.. (2016). Hydrosocial territories: a political ecology perspective. *Water Int.* 41, 1–14. doi: 10.1080/02508060.2016.1134898

Bouleau, G., and Gramaglia, C. (2015). "de la police de la pêche à celle de l'environnement : l'évolution d'une activité professionnelle dédiée à la surveillance des milieux aquatiques," in *Activités professionnelles à l'épreuve de l'environnement. Octarès*. Ed. I. Arpin, et al, 90. Available at: https://hal.archives-ouvertes.fr/hal-01166076.

Brenkman, S. J., Duda, J. J., Torgersen, C. E., Welty, E., Pess, G. R., Peters, R., et al. (2012). A riverscape perspective of Pacific salmonids and aquatic habitats prior to large-scale dam removal in the Elwha River, Washington, USA'. *Fisheries Manage. Ecol.* 19), 36–53. doi: 10.1111/j.1365-2400.2011.00815.x

Brewitt, P. (2019). *Same river twice: the politics of dam removal and river restoration* (Corvallis: Oregon State University Press).

Brown, R., Thomas, C. C., Cubley, E. S., Clausen, A. J., and Shafroth, P.B.. (2022). Does large dam removal restore downstream riparian vegetation diversity? Testing predictions on the Elwha River, Washington, USA. *Ecol. Appl.* 32 (6). doi: 10.1002/eap.2591

Burkhart, B. (2019). *Indigenizing philosophy through the land: A trickster methodology for decolonizing environmental ethics and Indigenous futures* (East Lansing, MI: MSU Press).

Busch, R. W. (2008). Tribal advocacy for Elwha River dams removal on Washington's Olympic Peninsula, 2. *Golden Gate U. Envtl. L.J.* 5, 5.

Chaffin, B., and Gosnell, H. (2017). Beyond mandatory fishways: federal hydropower relicensing as a window of opportunity for dam removal and adaptive governance of riverine landscapes in the United States'. *Water Alternatives* 10 (3).

Chan, K. M. A., Balvanera, P., Benessaiah, K., Chapman, M., Díaz, S., Gómez-Baggethun, E., et al. (2016). Opinion: Why protect nature? Rethinking values and the environment. *Proc Natl Acad Sci USA* 113 (6), 1462–1465. doi: 10.1073/pnas.1525002113

Chasan, D. J. (2000). *The Rusted Shield: government's failure to enforce—or obey—our system of environmental law threatens the recovery of Puget Sound's wild salmon, Report, Wild Fish Conservancy*. (Seattle: The Bullitt Foundation), 38.

Chenoweth, J., Bakker, J. D., and Acker, S. A. (2022). Planting, seeding, and sediment impact restoration success following dam removal. *Restor. Ecol.* 30, e13506. doi: 10.1111/rec.13506

Cortina-Segarra, J., García-Sánchez, I., Grace, M., Andrés, P., Baker, S., Bullock, C., et al. (2021). Barriers to ecological restoration in Europe: expert perspectives. *Restor. Ecol.* 29 (4), e13346. doi: 10.1111/rec.13346

Crane, J. (2009). "Setting the river free": The removal of the Edwards dam and the restoration of the Kennebec River. *Water History* 1 (2), 131–148. doi: 10.1007/s12685-009-0007-2

Crane, J. (2011) *Finding the river: an environmental history of the elwha* (Corvallis: OSU Press). Available at: https://muse.jhu.edu/pub/432/article/830644/summary (Accessed 26 June 2023).

Dicks, H. (2021). "Ethics of river restoration," in *River restoration* (Hoboken, NJ: John Wiley & Sons, Ltd), 49–65. doi: 10.1002/9781119410010.ch2

Diessner, N. L., Shcraft, C. M., Gardner, K. H., and Hamilton, L. C.. (2020). I'll be dammed! Public preferences regarding dam removal in New Hampshire. *Elementa: Sci. Anthropocene* 8 (1), 3. doi: 10.1525/elementa.003

Diver, S., Shcraft, C. M., Gardner, K. H., and Hamilton, L. C.. (2022). Indigenous nations at the confluence: water governance networks and system transformation in the Klamath Basin. *Ecol. Soc.* 27 (4). doi: 10.5751/ES-12942-270404

Doyle, M. W., Harbor, J. M., and Stanley, E. H. (2003). Toward policies and decision-making for dam removal. *Environ. Manage.* 31 (4), pp. doi: 10.1007/s00267-002-2819-z

Drapier, L., Germaine, M.-A., and Lespez, L. (2018). Politique environnementale et territoire : le démantèlement des ouvrages hydrauliques en France à l'épreuve du modèle nord-américain. *Annales geographie N° 722* (4), 339–368. doi: 10.3917/ag.722.0339

Drapier, L., Germaine, M.-A., and Lespez, L. (2023). The role of hydrosocial heritages produced by hydrosocial territories in understanding environmental conflicts: The case of Sélune dam removals (France). *Environ. Plann. E: Nat. Space*, 25148486231179292. doi: 10.1177/25148486231179293

Drenthen, M. (2009). Ecological restoration and place attachment: emplacing non-places? *Environ. Values* 18 (3), 285–312. doi: 10.3197/096327109X12474739376451

Duda, J. J., Beirne, M. M., Warrick, J. A., and Magirl, C. S. (2018). *Science partnership between US geological survey and the lower elwha klallam tribe—Understanding the elwha river dam removal project (No. 2018-3025)* (Seattle, W: U.S. Geolocical Survey Northwest Area, lieu de publication).

Duda, J. J., Torgersen, C. E., Brenkman, S. J., Peters, R. J., Sutton, K. T., Connor, H. A., et al. (2021). Reconnecting the elwha river: spatial patterns of fish response to dam removal. *Front. Ecol. Evol.* 9. doi: 10.3389/fevo.2021.765488Accessed: 30 June 2023

Duda, J. J., Freilich, J. E., and Schreiner, E. G. (2008). Baseline studies in the elwha river ecosystem prior to dam removal: introduction to the special issue. *Northwest Sci.* 82 (sp1), 1–12. doi: 10.3955/0029-344X-82.S.I.1

Duda, J. J., Warrick, J. A., and Magirl, C. S. (2011). Coastal and lower Elwha River, Washington, prior to dam removal—history, status, and defining characteristics, *Coastal habitats of the Elwha River, Washington—Biological and physical patterns and processes prior to dam removal. US Geological Survey Scientific Investigations Report* 5120, 1–26.

Dufour, S., and Piégay, H. (2009). From the myth of a lost paradise to targeted river restoration: forget natural references and focus on human benefits. *River Res. Appl.* 25 (5), 568–581. doi: 10.1002/rra.1239

East, A. E., Pess, G. R., Bountry, J. A., Magirl, C. S., Ritchie, A. C., and Logan, J. B.. (2015). Reprint of: Large-scale dam removal on the Elwha River, Washington, USA: River channel and floodplain geomorphic change. *Geomorphology* 246, 687–708. doi: 10.1016/j.geomorph.2015.04.027

East, A. E., Logan, J. B., Mastin, M. C., Ritchie, A. C., Bountry, J. A., and Magirl, C. S.. (2018). Geomorphic evolution of a gravel-bed river under sediment-starved versus sediment-rich conditions: river response to the world's largest dam removal. *J. Geophysical Research: Earth Surface* 123 (12), 3338–3369. doi: 10.1029/2018JF004703

Eden, S., and Tunstall, S. (2006). Ecological versus social restoration? How urban river restoration challenges but also fails to challenge the science policy nexus in the United Kingdom. *Environment and Planning C: Government and Policy* 24 (5), 661–680. doi: 10.1068/c0608j

Eden, S., Tunstall, S. M., and Tapsell, S. M. (2000). Translating nature: river restoration as nature-culture. *Environ. Plann. D: Soc. space* 18 (2), 258–273. doi: 10.1177/026377580001800101

Eitzel, M. V., et al. (2023) *Community and citizen science on the elwha river: past, present, and future*. Available at: https://escholarship.org/uc/item/1ck6z060 (Accessed 30 June 2023).

Eyster, H. N., Satterfield, T., and Chan, K. M. A. (2023). Empirical examples demonstrate how relational thinking might enrich science and practice. *People Nat.* 5 (2), 455–469. doi: 10.1002/pan3.10453

Foley, M. M., Bellmore, J. R., O'Connor, J. E., Duda, J. J., East, A. E., Grant, G. E., et al. (2017a). Dam removal: Listening in. *Water Resour. Res.* 53 (7), 5229–5246. doi: 10.1002/2017WR020457

Foley, M. M., Magilligan, F. J., Torgersen, C. E., Major, J. J., Anderson, C. W., Connolly, P. J., et al. (2017b). Landscape context and the biophysical response of rivers to dam removal in the United States. *PloS One* 12 (7), e0180107. doi: 10.1371/journal.pone.0180107

Forget, G., Bagliniere, J. L., Marchand, F., Richard, A., and Nevoux, M.. (2018). A new method to estimate habitat potential for Atlantic salmon (Salmo salar): predicting

the influence of dam removal on the Sélune River (France) as a case study. *ICES J. Mar. Sci.* 75, 2172–2181. doi: 10.1093/icesjms/fsy089

Fostvedt, M. P., Tullos, D. D., and Tilt, B. (2020). Institutional analysis of small dam removals: A comparison of non-federal dam removals in washington and oregon. *Water Alternatives* 13 (2), 24.

Fox, C. A., Reo, N. J., Fessell, B., and Dituri, F.. (2022). Native american tribes and dam removal: restoring the ottaway, penobscot and elwha rivers. *Water Alternatives* 15 (1).

Fox, C. A., Magilligan, F. J., and Sneddon, C. S. (2016). "You kill the dam, you are killing a part of me": Dam removal and the environmental politics of river restoration. *Geoforum* 70, 93–104. doi: 10.1016/j.geoforum.2016.02.013

Garibaldi, A., and Turner, N. (2004). Cultural keystone species: implications for ecological conservation and restoration. *Ecol. Soc.* 9 (3). doi: 10.5751/ES-00669-090301

Germaine, M.-A., and Barraud, R. (2013a). Les rivières de l'ouest de la France sont-elles seulement des infrastructures naturelles ? *Les modèles gestion à l'épreuve la directive-cadre sur l'eau Natures Sci. Sociétés* 21 (4), 373–384. doi: 10.1051/nss/2014003

Germaine, M.-A., and Barraud, R. (2013b). Restauration écologique et processus de patrimonialisation des rivières dans l'Ouest de la France, VertigO - la revue électronique en sciences de l'environnement. *[Preprint], (Hors-série 16)*. doi: 10.4000/vertigo.13583

Germaine, M. A., Drapier, L., Lespez, L., Menozzi, M. J., and Thomas, O. (2019). Entre désir de nature et peur de l'abandon : quelles attentes paysagères après l'arasement des barrages hydroélectriques de la Sélune? *Projets Paysage* 10 (2).

Germaine, M.-A., Drapier, L., and Lespez, L. (2021). "How to better involve stakeholders in river restoration projects," in *River restoration* (Hoboken, NJ: John Wiley & Sons, Ltd), 147–168. doi: 10.1002/9781119410010.ch7

Germaine, M.-A., and Lespez, L. (2014). Le démantèlement des barrages de la Sélune (Manche). Des réseaux d'acteurs au projet de territoire ? *Développement durable territoires. Économie géographie politique droit sociologie* Vol. 5, 3. doi: 10.4000/developpementdurable.10525

Germaine, M.-A., and Lespez, L. (2017). 'The failure of the largest project to dismantle hydroelectric dams in Europe? (Sélune River, France 2009-2017)'. *Water Alternatives* 10 (3), 655–676.

Germaine, M.-A., and Thomas, O. (2019). *Sur les bords (Left high and dry), video documentary, 39 min (English subtitles)*. Available at: https://geo-selune.wistia.com/medias/h32vo9mtwp.

Germaine, M.-A., and Thomas, O. (2023). *Filmer pour rendre compte des é motions suscitées par la transformation d'un paysage : l'exemple de l'arasement des barrages de la Sélune, Revue française des méthodes visuelles*. Available at: https://rfmv.u-bordeaux-montaigne.fr/numeros/7/articles/07-filmer-pour-rendre-compte-des-emotions–lexemple-de-larasement-des-barrages-de-la-selune/.

Germaine, M.-A., Viry, M., and Menozzi, M.-J. (2016). Construction des lieux et rapports à la nature. *Cabanons pêcheurs Des. lacs du Sud Manche Norois* 240, 77–100. doi: 10.4000/norois.5955

Gimblett, R., Scott, C. A., and Hammersley, M. (2017). Dam removal on the lower white salmon river rewilding, sacred spaces, and "Outstandingly remarkable values". *Int. J. Wilderness* 23 (2), 34–40.

Gonin, A., Germaine, M.-A., and Kiryenko, N. (2023). The production of territories seen from a materialist perspective: milieus in the politics of territorialization. *Territory Politics Governance* 0 (0), 1–20. doi: 10.1080/21622671.2023.2195438

Gosnell, H., and Kelly, E. C. (2010). Peace on the river? Social-ecological restoration and large dam removal in the klamath basin, USA. *Water Alternatives* 3 (2), 361–383.

Gosselinge, S., and Bartoli, D. (2022)La Condition terrestre. Habiter la Terre en communs. In: *Seuil. (Anthropocène)*. Available at: https://www.seuil.com/ouvrage/la-condition-terrestre-sophie-gosselin/9782021439335 (Accessed 26 June 2023).

Grabowski, Z. J., Denton, A., Rozance, M. A., Matsler, M., and Kidd, S.. (2017). Removing dams, constructing science: coproduction of undammed riverscapes by politics. *Finance Environment Soc. Technol.* 10 (3).

Guarino, J. (2013). Tribal advocacy and the art of dam removal: the Lower Elwha Klallam and the Elwha dams. *Am. Indian Law J.* 2, 114.

Habel, M., Mechkin, K., Podgorska, K., Saunes, M., Babiński, Z., and Chalov, S.. (2020). Dam and reservoir removal projects: a mix of social-ecological trends and cost-cutting attitudes. *Sci. Rep.* 10. doi: 10.1038/s41598-020-76158-3

Haraway, D. J. (2016). *Staying with the trouble: making kin in the chthulucene* (Durham, UK: Duke University Press).

Hayes, G. (2002). "Vive la Loire Sauvage! Serre de la Fare and the Political Opportunity Structure of Protest," in *Environmental protest and the state in France*. Ed. G. Hayes (London: Palgrave Macmillan UK: French Politics, Society and Culture Series), 132–154. doi: 10.1057/9780230554726_6

Hess, J. E., Paradis, R. L., Moser, M. L., Weitkamp, L. A., Delomas, T. A., and Narum, S. R.. (2021). Robust recolonization of Pacific lamprey following dam removals. *Trans. Am. Fisheries Soc.* 150 (1), 56–74. doi: 10.1002/tafs.10273

Higgs, E. (2003). *Nature by design: people, natural process, and ecological restoration* (Cambridge, UK: MIT Press).

Higgs, E. S. (2012) *Human dimensions of ecological restoration: integrating science, nature, and culture* (Island Press). Available at: https://scholar.google.com/citations?view_op=view_citation&hl=fr&user=Gz_N6W8AAAAJ&citation_for_view=Gz_N6W8AAAAJ:35N4QoGY0k4C (Accessed 30 November 2021).

Hilbert-Wolf, H. L., and Gerlak, A. K. (2022). The evolution of the modern dam conflict on the Snake River, USA. *Water Int.* 47 (8), 1349–1369. doi: 10.1080/02508060.2022.2090147

Hommes, L. (2022). The ageing of infrastructure and ideologies: contestations around dam removal in Spain. *Water Alternatives* 15 (3), 592–613.

Howard, A. J., Coulthard, T. J., and Knight, D. (2017). The potential impact of green agendas on historic river landscapes: Numerical modelling of multiple weir removal in the Derwent Valley Mills world heritage site, UK. *Geomorphology* 293, 37–52. doi: 10.1016/j.geomorph.2017.05.009

Ingold, T. (2002). "Culture and the perception of the environment," in *Bush base: forest farm, Culture, environment and development*. Eds. E. Croll and D. Parkin (London: Routledge), 38–56.

Johnson, K. (2013) *The elwha river restoration: landscape change, salmon, and sense of pl* (Central Washington University). Available at: https://digitalcommons.cwu.edu/etd/1421 (Accessed 30 June 2023).

Jørgensen, D. (2017). Competing ideas of "Natural" in a dam removal controversy. *Water Alternatives* 10 (3), 840–852.

Kareiva, P., and Carranza, V. (2017). "Fealty to symbolism is no way to save salmon," in *) effective conservation science: data not dogma*. Eds. P. Kareiva, M. Marvier and B. Silliman (Oxford, UK: Oxford University Press). doi: 10.1093/oso/9780198808978.003.0015

Latour, B. (1991). *Nous n'avons jamais été modernes: Essai d'anthropologie symétrique* (Paris, Fr: La Découverte).

Lefeuvre, J.-C., and Bouchard, V. (2002). From a civil engineering project to an ecological engineering project: An historical perspective from the Mont Saint Michel bay (France). *Ecol. Eng.* 18, 593–606. doi: 10.1016/S0925-8574(02)00022-8

Lejon, A. G. C., Renöfält, B. M., and Nilsson, C. (2009). Conflicts associated with dam removal in Sweden. *Ecol. Soc.* 14 (2). http://www.ecologyandsociety.org/vol14/iss2/art4/.

Le Lay, Y.-F., and Germaine, M.-A. (2017). Déconstruire ? L'exemple des barrages de la Sélune (Manche), Annales. *géographie* 715 (3), 259–286. doi: 10.3917/ag.715.0259

Lespez, L., and Dufour, S. (2021). Les hybrides, la géographie de la nature et de l'environnement. *Annales geographie* N737 (1), 58–85. doi: 10.3917/ag.737.0058

Lespez, L., Beauchamp, A., Drapier, L., Germaine, M.-A., and Thomas, O. (2023). La restauration écologique de la vallée de la Sélune au prisme de la géohistoire, in P. Valette, C. Micu, L. Carozza and A. Burens-Carozza (Dir.), *Géohistoire des zones humides d'ici et d'ailleurs. Regards croisés sur des trajectoires d'artificialisation et de conservation* Presses Universitaires du Midi, Toulouse, collection Paysage et Environnement.

Lespez, L., Viel, V., Rollet, A. J., and Delahaye, D.. (2015). The anthropogenic nature of present-day low energy rivers in western France and implications for current restoration projects. *Geomorphology* 251, 64–76. doi: 10.1016/j.geomorph.2015.05.015

Lespez, L., and Germaine, M.-A. (2016). La rivière désaménagée ? Les paysages fluviaux et l'effacement des seuils et des barrages en Europe de l'Ouest et en Amérique du Nord-Est. *Bull. la Société Géographique Liège* 67, 223–254. doi: 10.25518/0770-7576.4465

Linton, J., and Pahl-Wostl, C. (2023). "Drawing from Indigenous ontologies and practices to rethink European water policy," in *River research and applications*. doi: 10.1002/rra.4126

Lorimer, J. (2007). Nonhuman charisma. *Environ. Plann. D: Soc. Space* 25 (5), pp. doi: 10.1068/d71j

Lydiard, L. (1996). A remarkable grassroots effort: the work of the elwha citizens' Advisory committee*Olympic Park Associates Newsletter* 4, 1.

Mathieu, N. (2016). "Modes d'habiter «Modes d'habiter»,«cultures de la nature»: des concepts indissociables," in *Guide des Humanités environnementales*. Eds. A. Choné, I. Hajek and P. Hamman (Villeneuve d'Ascq: Presses universitaires du Septentrion), 567–581.

Mauer, K. W. (2020). Monopoly's winners and losers: Elwha River Dam construction as social closure. *J. Environ. Stud. Sci.* 10 (2), 137–147. doi: 10.1007/s13412-020-00586-w

Milstein, T., Thomas, M. O., Hoffmann, J., and Carr, J. (2023). "Even I am a part of nature": unraveling the human/nature binary to enable systems change. *Environ. Communication* 17 (4), 421–436. doi: 10.1080/17524032.2023.2199946

Morley, S., Foley, M. M., Duda, J. J., Beirne, M. M., Paradis, R. L., Johnson, R. C., et al. (2020). Shifting food web structure during dam removal—Disturbance and recovery during a major restoration action. *PloS One* 15 (9). doi: 10.1371/journal.pone.0239198

National Park Service. (2005). *Elwha river ecosystem restoration implementation, final supplement to the final, environmental impact statement*. (Port Angeles: Elwha National Park), 366.

Ohno, T. (2019). "Contextual factors affecting the modes of interaction in governance: the case of dam removal in Japan," in *Interactive approaches to water governance in asia*. Ed. K. Otsuka (Singapore: Springer), 55–76. doi: 10.1007/978-981-13-2399-7_3

Ombredane, D., Baglinière, J.-L., and Marchand, F. (1998). The effects of Passive Integrated Transponder tags on survival and growth of juvenile brown trout (Salmo trutta L.) and their use for studying movement in a small river. *Hydrobiologia* 371, 99–106. doi: 10.1023/A:1017022026937

Opperman, J. J., Royte, J., Banks, J., Day, L. R., and Apse, C.. (2011). The Penobscot River, Maine, USA: A basin-scale approach to balancing power generation and ecosystem restoration. *Ecol. Soc.* 16 (3). doi: 10.5751/ES-04117-160307

Perrier, C., Guyomard, R., Bagliniere, J. L., Nikolic, N., and Evanno, G.. (2013). Changes in the genetic structure of Atlantic salmon populations over four decades reveal substantial impacts of stocking and potential resiliency. *Ecol. Evol.* 3 (7), 2334–2349. doi: 10.1002/ece3.629

Pess, G. R., McHenry, M. L., Beechie, T. J., and Davies, J.. (2008). Biological impacts of the elwha river dams and potential salmonid responses to dam removal. *Northwest Sci.* 82 (sp1), 72–90. doi: 10.3955/0029-344X-82.S.I.72

Quinn, T. P., Pess, G. R., Sutherland, B. J., Brenkman, S. J., Withler, R. E., Flynn, K., et al. (2021). Resumption of anadromy or straying? Origins of sockeye salmon in the elwha river. *Trans. Am. Fisheries Soc.* 150 (4), 452–464. doi: 10.1002/tafs.10294

Ravot, C., Laslier, M., Hubert-Moy, L., Dufour, S., Le Coeur, D., and Bernez, I.. (2020). Large dam removal and early spontaneous riparian vegetation recruitment on alluvium in a former reservoir: Lessons learned from the pre-removal phase of the Sélune River project (France). *River Res. Appl.* 36 (6), 894–906. doi: 10.1002/rra.3535

Sadin, P., Vogel, D., and Miller, H. L. (2011). *An interpretive history of the elwha river valley and the legacy of hydropower on washington's olympic peninsula. Port angeles* (Washington, USA: National Park Service), 232.

Salanié, J., Le Goffe, P., and Surry, Y. (2004). 'Évaluation des bénéfices procurés par le démantèlement de barrages hydroélectriques : le cas de la pêche au saumon sur la Sélune'. *Ingénieries* 39), 65–78.

Sale, K. (2000). *Dwellers in the land: the bioregional vision* (Athens: University of Georgia Press).

Scannell, L., and Gifford, R. (2010). Defining place attachment: A tripartite organizing framework. *J. Environ. Psychol.* 30 (1), 1–10. doi: 10.1016/j.jenvp.2009.09.006

Sneddon, C., Barraud, R., and Germaine, M.-A. (2017). Dam removals and river restoration in international perspective. *Water Alternatives* 10 (3), 648–654.

Sneddon, C. S., Magilligan, F. J., and Fox, C. A. (2017). Science of the dammed: expertise and knowledge claims in contested dam removals. *Water Alternatives* 10 (3), 677–696.

Sweetser, A. (2019) *Socioecological and societal impacts of the elwha dam removal. Thesis.* Available at: https://digital.lib.washington.edu:443/researchworks/handle/1773/44847 (Accessed 26 June 2023).

Thomas, O., and Germaine, M.-A. (2018a). De l'enjeu de conservation au projet de territoire : Le saumon atlantique au coeur des débats. *VertigO - la Rev. électronique en Sci. l'environnement* 18 (2). doi: 10.4000/vertigo.22259

Thomas, O., and Germaine, M.-A. (2018b). La restauration de la continuité écologique des cours d'eau et la pêche de loisir : héritages, changements et enjeux. *Norois* 4 (4), 43–60. doi: 10.4000/norois.7159

Thrift, N. (2007). *Non-representational theory. Space, politics, affect* (Londres: Routledge). doi: 10.4324/9780203946565/non-representational-theory-nigel-thriftAccessed: 1 December 2021

Wantzen, K. M., Ballouche, A., Longuet, I., Bao, I., Bocoum, H., Cissé, L., et al. (2016). River Culture: an eco-social approach to mitigate the biological and cultural diversity crisis in riverscapes. *Ecohydrology Hydrobiology* 16 (1), 7–18. doi: 10.1016/j.ecohyd.2015.12.003

Warrick, J. A., Bountry, J. A., East, A. E., Magirl, C. S., Randle, T. J., and Gelfenbaum, G. (2015). Large-scale dam removal on the Elwha River, Washington, USA: Source-to-sink sediment budget and synthesis. *Geomorphology* 246, 729–750. doi: 10.1016/j.geomorph.2015.01.010

Yigit, A. (2021). *An assessment of the policy narrative strategies of the pro- and anti-dam removal groups, in the klamath river basin, over the 2001-2020 time frame* (Corvalis: Oregon State University).