MERLIN

Deba barrier removal ES

Unchoke rivers, improve nature and society

www.project-merlin.eu

MERLiN

Imprint

The MERLIN project (https://project-merlin.eu) has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101036337.

Contributors: Miriam Colls (University of Basque Country), Arturo Elosegi (University of Basque Country) and Iñaki Bañares (Gipuzkoa Provincial Council)

To be cited as:

Colls M., Elosegi, A. & Bañares I. 2024. Unchoke rivers, improve nature and society. Deba Barrier Removal ES Regional Scalability Plan (RSP). 18 pp.

Due date of deliverable: 30 September 2024

Actual submission date: 30 September 2024

Content

1. For the reader

Unchoke rivers, improve nature and society

In the Basque Country and beyond, rivers and streams are choked by countless weirs and dams[1]. Some of these fluvial barriers have a specific use, such as water supply, irrigation, or hydroelectric power generation. However, most of them are obsolete barriers, reminders of the industries that once operated there and now abandoned in the middle of our streams and rivers. In addition to the aesthetic impact of these barriers, both currently used and obsolete barriers, block fish movements, destroy river habitats, block sediment transport and nutrient dynamics, increase greenhouse gas emissions (GHG) and flood risk, between others. Additionally, future scenarios predict a decline in the ecological status of fluvial ecosystems as a result of climate change impacts, leading to the greatest degradation of our streams and rivers. Fluvial ecosystems have been and continue to be essential for the development of human societies, but if we want them to continue to be so, it is essential to renaturalise and protect them. After the implementation of wastewater treatment plants and sanitation systems, the removal of obsolete barriers is the next renaturation strategy that needs to be taken to protect both nature and societies.

The aim of this Regional Scalability Plan (RSP) is to provide a framework to guide the improvement of the longitudinal connectivity of fluvial ecosystems to face climate change in accordance with the European Green Deal, Sustainable Development Objectives and the Nature Restoration Law. In this document, the improvement of the longitudinal connectivity is mainly focused on the demolition of weirs (total or partial demolition), but the examples and ideas developed in this document are also applicable to other barriers that, at some point, cause a longitudinal disruption in the fluvial ecosystem[2]. Due to the large number of stakeholders involved in this type of renaturation actions and their diverse, sometimes conflicting, interests, a secondary goal of this RSP is to provide some examples of how to manage these potential conflicts that may arise during its implementation. It is primarily aimed at river managers of the Basque Country, including the Basque Water Agency and the Provincial Councils, but may also be of interest to other stakeholders such as river managers beyond the Basque Country, municipalities, the insurance, or hydropower sectors.

This document has been prepared by the Group of Stream Ecology at the University of the Basque Country, based on the experience of working with the Sustainability Department of the Gipuzkoa Provincial Council on the MERLIN project. However, this RSP is also the result of the multiple inputs from other departments of the administration, as well as from stakeholders such as the insurance, hydropower sector or nature conservation NGOs. Overall, this RSP has been written with the intention of providing the reader with an overview of the benefits and trade-offs of barrier removal, as well as some examples and recommendations to building a roadmap for barrier removal as part of the adaptation to reduce the risks of climate change and hand down the oncoming generations a more sustainable environment.

2. Focus of the RSP

2.1. Regional characteristics

The Basque Country is a small territory (ca. 7,300 km^2) located in the north of the Iberian Peninsula, and divided into three historical territories: Alava, Bizkaia and Gipuzkoa (Figure 1). It borders Navarre and the French department of the Atlantic Pyrenees to the east, La Rioja to the south, and Burgos and Cantabria to the west. The land is mainly covered by tree plantations, native forests, pastures and scattered dairy farms. The population of the region is currently around 2,20 million people, highly concentrated in small- and medium-sized towns in the bottom of the valleys. The population density is high (308 inhabitants km^2), and the main economic sectors are the industry and the tertiary sector.

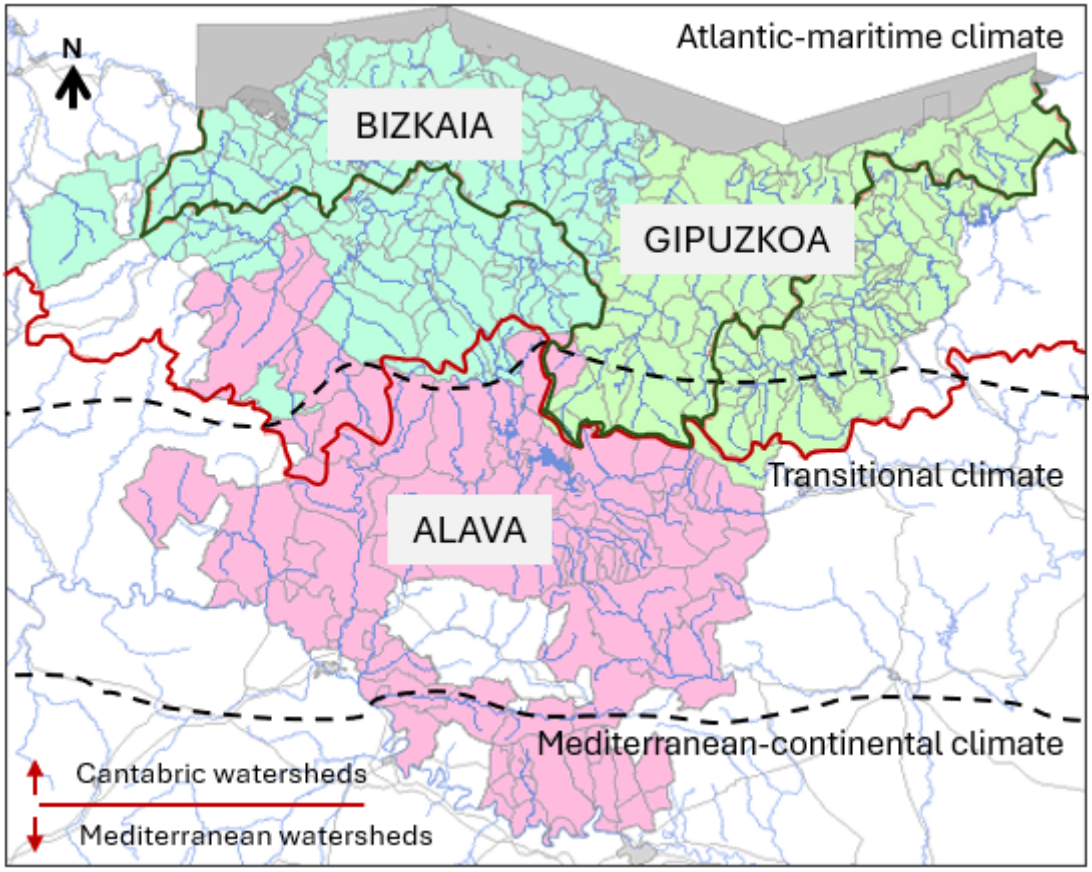

Figure 1. Basque Country map. Shaded areas indicate historical territories (blue: Bizkaia, green: Gipuzkoa, pink: Alava). Dashed lines indicate the climatic regions, red line the limit of Cantabric and Mediterranean watersheds, and green line the internal watersheds of the Basque Country.

The Basque Country is a rugged and mountainous landscape shaped by the Basque Mountains, which link the Pyrenees to the east and the Peaks of Europe at the west. The highest Basque mountains reach 1,500m above sea level. The small area of the region and the proximity of the mountains to the coast result in short, steep, and narrow valleys. Despite its small area, the above-mentioned topographical characteristics result give rise to three climatic regions: Atlantic-maritime, Mediterranean-continental, and Transitional (Fig. 1). The Atlantic-maritime climate dominates in Bizkaia and Gipuzkoa. This climate is humid and rainy all the year (mean annual rainfall: 1200-2000 mm). The influence of the sea causes a slight thermal oscillation: the average temperature in summer is around 20 °C, in winter 8 °C, and the annual average is 13 °C. The mediterranean-continental climate corresponds to the southern part of the territory. This area has well-defined seasons and a significant difference between daytime and nighttime temperatures, especially in summer. Summer is mainly dry and warm, whereas the winter is dry and cold. Spring is the wettest season. Between these two climatic regions is the Transitional climate, an intermediate climate between the two.

The hydrographic network of the Basque Country is divided among the streams that flow into the Cantabric Sea, and those that flow into the Ebro River, which drains to the Mediterranean Sea. Due to the topographical and climatic characteristics of the area, the Cantabric basins are smaller but carry more water than those that end in the Ebro River. From a management point of view, those streams whose drainage basins lay entirely in the Basque Autonomous Region (i.e., Barbadun, Butron, Oka, Lea, Artibai, Deba, Urola, and Oiartzun), called the internal Basque River Basins, belong to the Oriental Cantabric River District and are

managed by the Basque Water Agency. The other rivers flowing to the Cantabric Sea (i.e., Karrantza, Agüera, Kadagua, Ibaizabal, Nervión, Oria, Urumea and Bidasoa) are managed by the Cantabric Hydrographic Confederation (CH). The Bidasoa is a transboundary river that forms the border between Spain and France. Finally the rivers draining to the Mediterranean (i.e., Ebro, Omecillo, Baias, Zadorra, Inglares, Araia, Ega and Errioxa) are managed by the Ebro River Hydrographic Confederation (CHE), The proposals presented address primarily rivers flowing into the Cantabric Sea.

Most of the streams of the Basque Country were extremely polluted as a result of industrial and urban effluents, but the situation has improved considerably in recent decades thanks to major investments in sanitation and wastewater treatment plants, as well as the restructuring of the industrial sector. Now that fish have returned to all the streams, other environmental problems are becoming evident, notably the degradation of the physical habitat of the streams as a consequence of channelling and the presence of hundreds of barriers. These barriers consist mainly of old weirs (small structures that raise the water level but do not regulate the flow), most of which are useless and obsolete, but which fragment the river continuum. Weirs, whether are active or not, alter or completely block the movement of fish and the transport of sediment and nutrients, destroy the river habitats, emit GHG, and increase the risk of flooding by raising the water level. Climate change, with increasing temperatures and decreasing precipitation but more intense rainfalls in the region (i.e., more torrential), will exacerbate the impact of weirs on both the ecosystem and on the human society, promoting GHG emissions, the proliferation of invasive species, pathogenic microorganisms, and enhancing flood risks. In this context, the removal of obsolete weirs stands out as a strategy to renaturalise fluvial ecosystems and face climate change scenarios.

The Basque Water Agency has made an inventory of all the impacts on the territory and has concluded that river barriers are the most common impact in the Basque Country's river basins barriers[3]. Based on this information, the Basque Water Agency is preparing a master plan to prioritise the removal of these barriers in the coming years. Based on our previous experience, the present RSP claims to present some examples of strategies and actions to ensure that the process of removing barriers is more sustainable, comprehensive and inclusive, in line with the Nature Restoration Law and Green Deal goals established by the European Union. Overall, the main environmental issues and risks of the region to be addressed by the present RSP are related to flood risk resilience, zero pollution, biodiversity net gain, climate regulation, green growth and health and well-being. All in a context of inclusiveness.

2.2. Justification for the region

We have chosen the Basque Country as the main region to implement the RSP of the Case Study 2 (CS2) - Deba barrier removal ES - of the MERLIN project mainly because the Basque Water Agency is currently preparing a master plan to prioritise the removal of barriers for the region. This is thus an opportunity to increase the impact of the RSP, as it might seed ideas to the Basque Water Agency.

2.3. Linkages and synergies with other initiatives

The removal of barriers is an increasingly important renaturation measure in the Basque Country. In the 1980s and 1990s, following the disastrous floods of August 1983, some weirs were removed to reduce the risk of flooding. Later, in the early 2000s, weir removal was carried out mainly as a measure to restore Atlantic salmon populations and improve river habitats in Natura 2000 sites. These early works were carried out with fundings from the European Union, in collaboration between the Gipuzkoa Provincial Council, the Basque Water Agency and the Government of Navarre, and became part of the Gipuzkoa Provincial Council's Barriers Removal Programme. This document focuses on the identification and prioritisation, from a technical point of view, of the barriers to be removed. While the Barriers Demolition Programme of the Gipuzkoa Provincial Council focus mainly on the environmental effects of barriers barrier removal, the present RSP, in the framework of the MERLIN project, also includes the social dimension.

The interest in removing barriers as a means of restoring fluvial ecosystems is growing among scientists and water authorities. However, as this type of restoration becomes more widespread, so too does the social opposition and misinformation surrounding these actions barrier. To deal with this situation is becoming increasingly challenging. Based on the experience gained in the MERLIN project, we present here a set of indicators to objectively assess the impact of river obstruction removal on fluvial ecosystems, but also on the society. The use of these indicators would provide objective data that would help to gather evidence on the pros and cons of barrier removal. We therefore wish to make it clear that this document is not intended to put an end to conflict situations, but to present different tools for learning how to carry out this type of restoration in the most objective and fair way possible.

3. Stakeholders of the RSP

Based on the lessons learned from the implementation of the CS2 restoration actions, two main groups of stakeholders have been identified: local and strategic stakeholders. The first refers to organisations or citizens from the municipalities where each specific restoration action is implemented. Their level of involvement is generally low and limited to information, disseminated through websites, local newspapers, etc., or consultation. The second group includes local authorities or associations of local authorities, as well as authorities or groups at catchment or even regional level. This second group is actively involved, ranging from collaboration to empowerment. Within this second group, the Department of Culture of the Basque Government, water agencies, and the Biodiversity and Sustainability Departments of the Provincial Councils and the Basque Government stand out.

The classification of the stakeholders in these two groups, as well as the level of involvement of each stakeholder group, can change over time and depends mainly on the interest of the groups to the restoration actions. For example, representatives of local groups with a particular interest in the development of the restoration actions may become very active, pro or against barrier removal, and be invited to the meetings of the strategic stakeholders. In our experience, this depend on the social interest in the barrier to be removed. Demolition barriers located within urban areas, which are part of people's daily lives, tend to generate more debate, and it is in these cases that local stakeholders need to be actively involved in the process.

Overall, stakeholder mapping was divided into two categories:

i) Strategic stakeholders: Key players in the implementation of restoration actions (e.g., municipalities or water agencies).

ii) Local stakeholders: Local organizations at the municipal scale that may be interested in the restoration actions but do not play a key role in their implementation and do not have a specific working area within a particular municipality.

The following details the strategic stakeholders who must be included from the beginning of the project. Local stakeholders will depend on each locality and may change over time, as associations or social groups may show interest in the restoration actions at different times or places. This list should be developed in conjunction with the strategic stakeholders, especially those with extensive knowledge of the environment, such as town councils. Additionally, awareness campaigns and talks may bring forth other interested groups that were not initially included.

Table 1: Overview of RSP stakeholders

Name of stakeholder	Acronym	Sector	Involvement status	Scale	Ownership	Description	WebLink
Gipuzkoa Provincial Council	DFG	Cross Sector	Already involved	Regional	Public	The Gipuzkoa Provincial Council, governing Gipuzkoa (Basque Country), manages environmental and waterworks projects, including environmental monitoring and obstacles removal	www.gipuzkoa.eus/es/diputacion/medio-ambiente-y-obras-hidraulicas
Basque Water Agency	URA	Cross Sector	Already involved	Sub-national	Public	URA aims to implement water policy in the Basque Country, collaborating with the DFG on developing flood maps and managing obstacle removal administratively and technically.	www.uragentzia.euskadi.eus/u81-0002/es/
Society for the Economic Development of Deba Basin	DEBEGESA	Other	Already involved	Catchment	Private	DEBEGESA, comprising eight municipalities, aims to promote sustainable growth in the Debabarrena region by addressing regional needs to benefit citizens, companies, and municipalities, and actively engage the local population due to its extensive basin-scale network.	www.debegesa.eus
Deba Bassin Rural Development Association	DEBEMEN	Agriculture	Already involved	Catchment	Community group	DEBEMEN, comprising representatives from six municipalities, trade unions, cooperatives, and farmer associations, aims to enhance rural quality of life.	www.debemen.eus/es
Eibar's Living Forests		Environment, climate and disaster	Already involved	Catchment	NGO	A naturalist association active in the Deba river basin will contribute to understanding the perspective of local environmental group and promoting restoration actions.	
Environmental Technician		Cross Sector	Already involved	Municipal	Public	All of them are working in local town councils where restoration actions will occur, facilitating access to local meeting spaces, promoting restoration dissemination, and collaborating with the Gipuzkoa Provincial Council and Basque Water Agency on administrative tasks for MERLIN.	
Alderman		Cross Sector	Already involved	Municipal	Public		
Civil Works Technician		Cross Sector	Already involved	Municipal	Public		

Name of stakeholder	Acronym	Sector	Involvement status	Scale	Ownership	Description	WebLink
Agricultural Technician		Cross Sector	Already involved	Municipal	Public	All of them are working in local town councils where restoration actions will occur, facilitating access to local meeting spaces, promoting restoration dissemination, and collaborating with the Gipuzkoa Provincial Council and Basque Water Agency on administrative tasks for MERLIN.	
Mayor		Cross Sector	Already involved	Municipal	Public		
Sustainable Development Tech.		Cross Sector	Already involved	Municipal	Public		
Hydroelectric power plant association		Hydropower	Already involved	Catchment	Private	Involving the owner of local hydroelectric power plants will provides insights into his concerns regarding the planned restoration actions.	
Commonwealth of the Upper Deba	MAD	Cross Sector	Already involved	Catchment	Public	The Commonwealth of the Upper Deba, comprising Oñati, Arrasate, and Bergara, manages regional services including waste and environmental management, and is crucial for involving key community groups due to its extensive basin-scale network.	https://www.debagoiena.eus/es/mancomunidad

4. Green deal goals

Improving the longitudinal connectivity of fluvial ecosystems is mainly associated with seven green deal goals (see Table 2). The presence of an barrier in the middle of a streambed generally increases the water level under baseflow conditions. Under high flow conditions, this situation increases the risk of flooding. When the barrier is part of the urban landscape, this highest flood risk barrier represents a major risk to the citizens, endangering their health and well-being. Removing river barriers will therefore improve flood risk resilience, but also human health and well-being. Barrier removal is also a mechanism to improve territorial cohesion (i.e. inclusiveness) by reducing the vulnerability and exposure of citizens of these areas to climate change and environmental degradation. They also block the movement of fish such as salmon, trout, and eels along the river, reducing their biodiversity and threatening their survival. They also trap sediments rich in organic matter, which decompose in impounded areas, causing foul odours, and releasing significant amounts of greenhouse gases into the atmosphere. Downstream, this retention of organic matter affects the dynamics of nutrients and the capacity of the ecosystem to retain them, i.e., affect the self-purification capacity of fluvial ecosystems. Finally, the impounded areas also promote the proliferation of mosquitoes, which also affect human health and well-being

Criterion	Indicator(s)
Biodiversity net gain	Conservation status and trends of species and habitat of community interest (Habitats Directive) and/or WFD ecological status
Climate regulation	IPCC emission reporting guidelines on net CO_2 equivalent reductions or storage
Flood resilience	Flood hazard reduction for people (number) in vulnerable communities or volume (m^3) of additional storage capacity created
Drought resilience	Drought risk reduction for vulnerable communities in (number) of people affected
Health & Well-being	Increased access to nature-centred recreation and eco-tourism for people (number)
Zero pollution Goals	Reduce nitrate and chemical run-off from agricultural land (% of change)
Farm to Fork - Sustainable Food Systems	Sustainable agriculture and aquaculture (ha increase)
Sustainable energy	Energy savings of using NbS and any increase in renewable energy generation capacity in restored area (kWh)
Sustainable transport	Measures taken to improve active and public transport (increases in numbers) or renewable energy use (kWh)
Inclusivity (Leaving no one behind)	Change in access to blue-green space - a) overall, b) for disadvantaged communities, i.e. low employment/high deprivation (% change)
Circular economy	Business models adapted according to principles of a circular economy (number); Reduced consumption of water and other relevant resources (%)
Financing the transition	New economic activity (number) company registrations in relevant standard industry classification codes in the region
Green Growth	Employment (% changes) in relevant standard industry classification codes in the region

Table 2: Overview of Green Deal Goals

4.1. SMART Green Deal goals relevant for the region: primary goals

Climate related goals. Weirs, and other types of barriers that regulate water flow, create water impoundments areas upstream of them. In these areas, river hydrology is significantly altered; water velocity and turbulence are reduced, organic matter (OM) deposition increases, and oxygen saturation is reduced. As a result, the decomposition of accumulated OM occurs under conditions that tend to be anoxic, which favours methane (CH4)

production in these zones. Removal of barriers lead to the elimination of these impounded areas and therefore promotes the reduction of these emissions.

Biodiversity related goals. Weirs in stream act as a barrier to the movement of organisms and sediment, which negatively affect community and nutrient dynamics. Firstly, the removal of these barriers facilitate the longitudinal movement of species along the river courses. Additionally, the elimination of impounded areas as a result of weir removal restores natural heterogeneity to the fluvial habitat and consequently its functioning. This favours the improvement of the ecological status of the fluvial ecosystem and consequently the net improvement of biodiversity.

Inclusivity goals/ Goals for local community/public participation. The lack of investment and services in rural areas or small and medium-size towns, compared with investment in large cities leads to social inequalities and is a major challenge for territorial cohesion. Among other things, this model crates inequalities in the exposure and vulnerability of societies to climate change and environmental degradation. Indeed, the European Commission expects the costs of climate change to be higher in these areas than in large cities. Removing obsolete barriers that endanger citizens in these areas (see section 4) increase inclusiveness and territorial cohesion.

Flood risk related goals. The hydromorphological modifications resulting from the presence of weirs in fluvial ecosystems cause an increase of the water level upstream of the barrier. This, together with the fact that weirs slow down but do not regulate the water flow (i.e., the water overflows over them), increases the risk of flooding in nearby areas. Their elimination, therefore, result in a direct and immediate reduction of flood risk.

4.2. SMART Green Deal goals relevant for the region: secondary goals

Green growth goals. The maintenance and enhancement of natural ecosystems promotes more natural and sustainable tourism, while making local communities aware of the importance of natural heritage. The demolition of weirs and other types of barriers are a direct action in favour of fluvial ecosystems.

Health and wellbeing goals. Impounded waters, such as those resulting from the presence of barriers in fluvial ecosystems, favour the presence of mosquitoes as well as bad odours, which are directly detrimental to human well-being. Indirectly, the replacement of these areas by naturalized river courses encourages people to go for walks in these areas and, therefore, improves their quality of life.

Knowledge goals. One of the major challenges of the 21st century is disinformation, which is derived from fake news. One of the consequences of this disinformation is an increase in social opposition to certain measures, such as the demolition of weirs. It is therefore important to create models that serve as examples to learn from, but also as evidence of the benefits that certain actions have on ecosystems and people's lives. The implementation of the restoration measures described here, and their monitoring using both ecological and social indicators, help to build this model and provide objective evidence of the benefits of removing barriers.

Zero-pollution goals. In-stream barriers represent a barrier to the movement of sediment, which negatively affect nutrient dynamics. The elimination of impounded areas return to the river its natural habitat heterogeneity and consequently its functioning, which improve the self-purification capacity of fluvial ecosystems.

5. From general goals to actions

Translating these sustainable development goals into concrete actions to help achieve them is not easy. Below are several actions that can help. However, we must stress that the concrete actions presented here are just a few examples, limited to our experiences and case study.

Climate Goal

- Develop a Barriers Permeabilization Plan.
- Execute the barrier permeabilization.
- Habitat heterogeneity improvement to improve self-purification of the fluvial ecosystem.
- Analyse greenhouse gas emissions (GHG) resulting from the presence of barriers in fluvial ecosystems to provide other prioritisation criteria for their removal.

Biodiversity Goal

- Continuous monitoring of the stream water quality to provide data to help prioritisation decisions and, at long term, data to demonstrate barrier removal benefits.
- Periodic physicochemical monitoring to provide data to help prioritisation decisions and, at long term, data to demonstrate barrier removal benefits.
- Assessment of the health of the waterbody through which macroinvertebrates are present and in what number.
- Fish monitoring to provide data to help prioritisation decisions and, at long-term, data to demonstrate barrier removal benefits.
- Macroinvertebrate monitoring to provide data to help prioritisation decisions and, at long term, data to demonstrate barrier removal benefits.
- Use of eel (Anguilla anguilla) as a flagship species to promote weir removal movement.

Inclusivity goal

- Establish regular meetings with mayors to discuss progress or potential problems that may arise.
- Illustrate the benefits of barrier removal through examples from previous case studies, initially. As the project progresses, show the specific results. Organize workshops periodically.
- Create a communication channel through which citizens can contact the experts in charge of the project and ask them any questions or doubts they may have.
- Regardless of whether or not permeabilization actions are planned, develop awareness campaigns through social media.
- Constant updating of the official website of the water agencies. Chart of the renaturalisation actions, so that citizens can easily access information related to the elimination of barriers.

Flood risk

- Develop a Barriers Permeabilization Plan.
- Execute the barrier permeabilization.
- Regardless of whether or not permeabilization actions are planned, develop awareness campaigns of flood-associated risks caused by weirs through social media
- To quantify the damages associated with floods corresponding to return periods of 10, 50, 100, 500 years as a data to include in the awareness campaigns but also as a prioritization criterion.

Green Growth

- Develop a Barriers Permeabilization Plan.
- Execute the barriers permeabilization.
- Waste Water Treatment Plant improvement to reduce the loads of OM to the fluvial ecosystem
- Identification of discharges that increase the load of MO and pollutants

Zero pollution

- Develop a Barriers Permeabilization Plan.
- Execute the barriers permeabilization.
- Habitat heterogeneity improvement to improve self-purification of the stream ecosystem.

Health & well-being

- Develop a Barriers Permeabilization Plan.
- Execute the barriers permeabilization.
- Develop awareness campaigns of flood risks associated with the presence of weirs through social media.

5.1. Responsible stakeholders and their roles

In this type of renaturalisation action, there are different actors who share responsibilities and play significant roles. Nevertheless, the coordinator of the restoration actions must be the water authority, in this case the Basque Water Agency.

In a first stage, the water authority is responsible for drawing up a barrier removal plan with a clear prioritisation strategy. To this end, it may be interesting to examine the different prioritisation strategies that can be applied2. In addition, the Basque Water Agency can contact experts such as scientists and provincial councils, organise sampling campaigns, and gather additional information to base decisions.

In a second state, the water authorities, in this case the Basque Water Agency but also the provincial councils, are responsible for obtaining the budget (see section 7) and executing the restoration actions. They must also liaise with scientists to facilitate the collection of relevant data to generate new knowledge. To preserve the historical significance, it is important to consult with archaeologists and perform the demolition work under their supervision. If necessary, install informative panels or organize talks to explain the cultural value of the barriers. However, it is also crucial to highlight the following points:

1. The proposed actions aim to balance social and environmental protection by removing the barrier while acknowledging its historical value.
2. Protection is meaningless without active maintenance. Therefore, it is imperative to remove barriers that are not being maintained.

Finally, it is important to share the acquired knowledge with the public and experts. All the aforementioned stakeholders are responsible for this dissemination.

6. Timeline

Actions	Period (2 years interval)				Period (5 years interval)			
	2025 - 2006	2027 - 2028	2029 - 2030	2031 - 2032	2033 - 2034	2035 - 2039	2040 - 2044	2045 - 2050
Obstacle Removal Plan creation								
Obstacle Removal Plan Implementation								
Collecting prior data								
Awareness campaigns								
Workshops and meetings								
Collecting data to analyse the impact of the actions								

7. Budget

The budget for removing the barriers may come from public taxes as well as from European funding through projects or other financing opportunities.

8. Uncertainties and assumptions/ boundary conditions

The main weaknesses of the restoration efforts are linked to the presence of other anthropogenic impacts in the area, which may limit the expected improvements. These multiple stressors include a diverse array of pollutants from wastewater treatment plant (WWTP) effluents, point-source pollution from leaking or unconnected sewers, illegal yet ongoing releases of industrial pollutants, high loads of suspended solids from erosion in intensive tree plantations, and morphological alterations beyond barriers fragmenting longitudinal connectivity.

Through workshops and social inclusion initiatives, there is an opportunity to enhance social awareness and ecological knowledge among the local population. This increased awareness can drive demand for and promote improvements in all other aspects of the Green Deal. Furthermore, improving the biodiversity and ecological status of the rivers in the Basque Country can elevate their conservation status and degree of protection.

Barrier removal is just one aspect of the restoration process, as the territory faces multiple stressors. These include erosion from forestry, the presence of exotic species, lack of lateral connectivity, and high pollution levels from current and historical industrial activities. These stressors pose significant threats to achieving restoration objectives. However, removing barriers can highlight these other stressors and encourage the involvement of local and strategic stakeholders in their management. This RSP, derived from the Deba River restoration experience, is valuable for demonstrating how to approach restoration in such complex situations and presents an opportunity to generate new knowledge.

References

[1]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. https://doi.org/10.1038/s41586-020-3005-2

[2]Garcia de Leaniz, C., & O'Hanley, J. R. (2022). Operational methods for prioritizing the removal of river barriers: Synthesis and guidance. Science of The Total Environment, 848, 157471. https://doi.org/10.1016/j.scitotenv.2022.157471

[3]https://www.uragentzia.euskadi.eus/libro/tomo-4-y-5-humedales/webura00-contents/es/