Fluvial and ecosystem restoration of the Arga-Aragon Rivers, Spain

Year of issue

2025

Summary

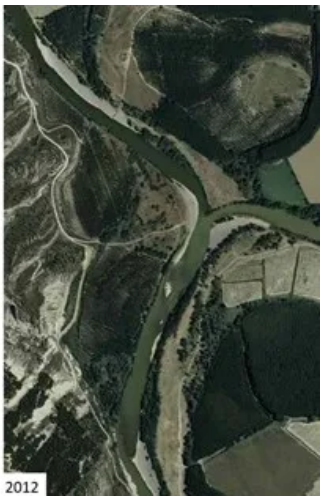
The fluvial and ecosystem restoration of the Arga and Aragón River systems combines multiple measures to reconnect rivers with their floodplains and improve habitat quality. Initially developed under the LIFE+ Territorio Visón project, the intervention focused on the lower Arga and lower-to-middle Aragón Rivers, key tributaries of the Ebro River in Navarra (NE Spain). Actions included removing dykes, restoring meanders and oxbows, rewetting floodplains, replanting native riparian vegetation, and promoting habitat heterogeneity.

Between 2016 and 2021, two implementation phases were completed, with over €7 million invested. Monitoring reports documented positive impacts on flood mitigation, biodiversity, and hydromorphological processes. A third phase is planned under Spain’s 2022–2030 National River Restoration Strategy, with an additional €3 million allocated.

The project is recognised as a model for large-scale river reconnection in agricultural landscapes. Follow-up studies assess vegetation recovery (active vs passive restoration), aquatic fauna return, and groundwater recharge. Coordination involves the Government of Navarra, Confederación Hidrográfica del Ebro, Fundación Biodiversidad, and WWF Spain.

Photo Gallery





Location

42.3322, -1.6919

Project

NWRM

National ID

Spain_01

Sector

Hydromorphology

Installation Date

2006

Implementation status

Ongoing

Contact

Fernanda Milans (IMDEA Water) in close cooperation with Fernando Magdaleno Mas (CEDEX) whose valuable contribution is acknowledged and very much appreciated.

Overview

Location of the project

The project comprises the lower reaches of Arga River (from the mouth of Salado River until the confluence of Arga and Aragón Rivers) and the middle-lower reaches of Aragón River (from Carcastillo until the union of the Aragón and Ebro Rivers).

Country

Spain

NUTS2 Code

Comunidad Foral de Navarra

Sponge measures implemented in the case study

Re-meandering

Reconnection of oxbow lakes and similar features

Elimination of Grey River Bank Protection

Floodplain restoration and management

Removal of dams and other longitudinal barriers

Stream bed re-naturalisation

Forest riparian buffers

Wetland restoration and management

Natural bank stabilisation

Objectives

Restore hydrological connectivity between the Arga River and its floodplain :
100 ha of restored floodplain
7 km of river restored or reconnected
4 oxbow lakes and several side channels re-created
12 municipalities involved in land negotiations
Improve riparian and aquatic habitats
Enhance biodiversity, with a focus on endangered species, especially the European mink (Mustela lutreola), a flagship species of the LIFE+ project.
Control the spread of the invasive American mink
Contribute to natural flood risk reduction
Revert land use in the floodplain : Convert intensive agricultural or poplar plantation areas into semi-natural riparian habitats, Promote sustainable land use compatible with periodic flooding
Raise awareness and engage local stakeholders

Involved partners

Authority type	Authority name	Authority role	Comments	Authority responsibility
Regional / sub-national water authority	Regional Government of Navarre	Monitoring	Government of Navarre with authority for environmental matters. Provided technical oversight, institutional support, and co-financing. Led land-use negotiations with municipalities (often owners of the restoration zones).	Supporting
Other	TRAGSA (public company of the Spanish State)	Monitoring	Spanish public company.	Supporting
National water authority	Ministry of Agriculture, Food and the Environment (Spain)	Monitoring	Agriculture, Food and Environment - National authority	Supporting
Regional / sub-national water authority	Ebro Basin Authority (CHE)	Monitoring	Participated in technical studies, including a 2014 feasibility report for habitat and hydrological restoration. Supported implementation coordination and monitoring. Provided funding and legal authorisations for works in the public hydraulic domain.	Supporting
Other	GAVRN	Other	Public company dependent on the Environment Department of the Navarre Regional Government. Its mandate includes environmental protection, conservation management and environmental education. Responsible for the technical administration and management of the LIFE+ project at stake in this case study, and also for project co-ordination.	Responsible

Authority type	Authority name	Authority role	Comments	Authority responsibility
Other	CRANA	Implementation	The Navarran Environmental Resource Centre is a nonprofit foundation established on the initiative of the Government of Navarra and some public companies. Promotes public participation in issues of environmental and social inters.	Supporting
Research institute / University	CETA (CEDEX)	Determination of design details of the measure	The Applied Techniques Research Centre (CETA) depends on CEDEX (Centre for Research and Experimentation of Public Works) and focuses its activities on studying the natural and human induced conditions and risks on the environment.	Supporting
NGO	WWF Spain	Monitoring	Assisted in biodiversity monitoring, especially concerning riparian fauna and species of interest (e.g. European mink). Promoted public awareness and visibility of the restoration project. Contributed technical and strategic advice on ecological restoration. Supported the removal of barriers to river connectivity.	Supporting

Site Information

Climate Zone

Warm temperate dry

Temperature (°C)

14.00 °C

Runoff

187.00 mm

Elevation range

334

Slope range

sloping (5-10%)

Soil type

Cambisols

Vegetation class

Native riparian forest (bosque de ribera autóctono), primarily composed of:

Populus nigra (black poplar)
Salix spp. (willows)
Ulmus minor (field elm)
Fraxinus angustifolia (narrow-leafed ash)
Alnus glutinosa (alder)

Wetland and floodplain herbaceous vegetation, particularly in reconnected oxbows and meanders.

WFD Ecological status

Moderate

WFD Chemical status

Good

Water quality status

The river section between the mouth of the Arga River and the Ebro River shows the worst water quality and the greater existence of organic pollution regarding the physical and chemical indicators.

Design and Implementation

Project scale

Large

Project scale specifications

The real scale of the project involves the sub-catchments of the Rivers Arga and Aragón (Ebro River Basin District).

Project area

300

Project area specifications

The project proposes to:
Set back a total of 2,620 linear metres of earth embankments which will allow water to spread naturally during flood events and to recover the natural habitats over 29 hectares of floodplain.
Remove a total of 660 linear metres of earth embankments, which will allow recuperation of 3.9 ha.
Recover and restore the fluvial space of the meander “el Platnío” of River Arga of 24 ha.
Construct at least three wetlands, suitable for use by the European mink and with a total surface area of 7.6 ha. -
Restore habitats in at least 17 action areas, accounting for a total of 230 hectares of restored natural habitats

Area subject to Land use change or Management/Practice change (ha)

30.00 ha

Principles

Contributing to naturalizing the river flow and to diversify the geomorphological environments.
Conserving functions, interactions, dynamics, continuity and connectivity of fluvial ecosystems.
Contributing to reducing peak flood flows, minimizing flooding levels, which benefits the population centres downstream.
Solving spatial development challenges in flooding areas, thus contributing to reducing exposure to risk, which means in the short term potentially major savings in defences and compensations.
Improving and consolidating the fluvial landscape, and returning to a more natural state.
Building the essential basis, both functional and territorial, for the conservation of fluvial spaces and restoration.
Fostering public interest and awareness.
Progressively integrating cost-benefit analysis in the decision-making process about the river system management.

Factor constraints

With regards to the management of the habitat, the project entails the restoration of the natural floodplains, which are currently covered by agriculture and tree plantations. To do so, it was necessary to acquire private plots of land and to lease out the right to use public plots of land, to compensate for the loss of profits derived from giving up the activities developed in the floodplains to be restored.
Some projects required a topographical survey and water modelling to provide information on the land floodability.
Work started removing the ripraps and restoring the habitat. Particular care was taken to use native plant species and varieties.
Involvement of CRANA (Navarre’s Environmental Resource Centre) as an administrative unit capable of achieving public participation and stakeholder engagement in the whole process.
Farmers’ commitment since they are the primarily affected agents by flooding events.

Favourable preconditions

- The low population density (60 inhabitants/km2 on average), the small and compact urban centres and the fact that buildings are fairly concentrated facilitate the needed intervention works. (Source: Anuario Estadístico, Instituto de Estadística de Navarra, (2012))
- Natural and physical conditions allow N5, N4 and N8 to be carried out in the months of August and September, taking advantage of the low river flow during those months. Also N2, N3 and F1 can be easily carried out during those months when there is no plant growth (from November to February), in order to guarantee the plantation success.
- The fact that most of the compromised lands are publicly owned facilitates the negotiation with landowners to acquire the plots and make possible the restoration activities.
- Since the selected case-study site comprise not very productive lands (most of them poplar plantations) make cheaper the compensation required for the loss of profits derived from giving up the activities developed in the floodplains to be restored.
- The relatively high GDP per capita (29,071 in euros) of the area inhabitants and the fact that The Navarre Regional Government has its own financing capacity influence positively in the development of the planned intervention activities. (Source: Anuario Estadístico, Instituto de Estadística de Navarra, (2012))
- The existence of a large riverside dimension and the large floodplains allows and facilitate the recovery of the river natural space.

Financing

Total cost

13680000.00 €

Total cost information

Phase II : (2016-2021) : 7,210,000 €
Phase I : 6.023.406 + 257.412,07 + 138.840,25 € : the project Life+ Mink territory + total cost phase I and II for the project INTERREG IIIa GIRE-IMER restoring the "El Plantío"meander + total cost for the Life project GERVE restoration of the "Barranco Vallacuera"

Costs land acquisition

466466.00

Costs land acquisition information

Acquisition of privately owned land

Costs operational

2601689.00 €

Costs operational information

Setting back or removal of earth embankments + re-meandering + recovery of habitats specific to the European mink + restoration of other river habitats + eradication of nonnative and invasive species.

Costs other

1423804.00 €

Costs other information

Preparatory actions + Public awareness campaigns and dissemination of results + Project management and monitoring

Information on Economic costs additional

Identified plots of land, in addition to being included in the Natura 2000 Network and having a high potential for restoring habitats of interest for conservation purposes, are also subject to frequent flooding, leading to a low crop yield and considerable investment by the administrations in the maintenance of flood defences and irrigation infrastructures. The estimated damage caused by the flooding events in Navarre in 2003 and 2007 in agricultural and urban infrastructure of public ownership reached nearly 6 millions euros and more the 8 millions euros respectively. Therefore it could have some effects on agricultural and forestry income losses in the areas adjacent to the restored reaches, even though the economic information related to the specific area is not available, is considered to be low.

Financing authorities

Authority name	Type of funding	Comments	Financing share
European Union	EU-funds: LIFE+	3,877,164 €	61 % of phase 1
Ministry of Agriculture, Food and the Environment (Spain)	National funds	—	—
Regional Government of Navarre	Sub-national funds	—	—
Ebro River Basin Authority.	Local funds	—	—

Compensations

Oui

Compensations total

1531445.00 €

Compensations annual information

Compensations to landowners for loss of income in situations where the projects include several hectares of cropland that either have to be acquired or require compensation payments for several years following the restoration.
Agreements with local councils (or other local authorities) for the lease of the rights to use this common-property land, which had already been identified as potentially suitable for the restoration of habitats. The agreements put forward consist of paying the council for the loss of income derived from felling the poplar plantations located on land intended for restoring natural copses or wetlands for the mink. It was also proposed to pay the councils for the loss of income derived from carrying out restoration schemes on farming land that has the potentiality for conversion into copses.

Policy and Governance

Policy description

The lower reaches of the Aragón and Arga rivers form one of the Sites of Community Importance (SCI) included in the Natura 2000 network. The area´s importance is mainly due to the presence of Mediterranean river forest habitats (Mediterranean poplar and willow forests) and species such as the European mink, otter (Lutra lutra), European pond turtle (Emys orbicularis) and night heron (Nycticorax nycticorax). In the past, dikes and breakwater defences were built to defend agricultural and forestry plantations along the rivers´ floodplains, and the Arga River was canalised to protect downstream towns from floods. These defence infrastructures have diminished the dynamics of these two rivers, resulting in a decrease in natural habitats, a reduction in biodiversity, losses of ecohydrological connectivity, deterioration of the role of the natural habitats as traps for water and sediments and decrease the functionality of the flow regime to contribute to good status of rivers and floodplains. The project comprises the lower reaches of the Arga River (from the mouth of the Salado River until the confluence of the Arga and Aragón Rivers) and the middle-lower reaches of Aragón River (from Carcastillo Village until the confluence of the Aragón and Ebro River).
Stability does not exist in these sections, major flooding events occured in February 2003 (Arga Q=930.2 m3/s T=15), in April 2007 (Arga Q=910 m3/s T= 10 Aragón Q= 1394 m3/s T=25) and in January 2010 (Aragón, Q= 806 m3/s Arga, Q= 730 m3/s T= 3-4).
The restoration of the floodplains and the natural habitats, will permit the coordinated application of the three European river management related Directives: the Habitats Directive (1992/43); the Water Framework Directive(2000/60); and the Flood Prevention Directive (2007/60). This also goes in line with the EU Biodiversity Strategy to 2020 (COM (2011) 244) seeking to address the protection and restoration of biodiversity and associated ecosystem services.

Land ownership

Most of the land involved in the restoration is publicly owned, including municipal property.

Policy targets

Peak-flow reduction

Improved Biodiversity

Increase Water Storage

Oher Societal Benefits

Target remarks

Achieving habitat management goals and restoring the natural river ecosystem, in order to enhance local biodiversity levels.
Flood control and risk mitigation by restoring floodplains, so that they can perform its main function, driving away the energy of floodwaters by storing them during the flood process.

Policy pressure

Directive	Relevant pressure
WFD identified pressure	4.1.1 Physical alteration of channel/bed/riparian area/shore of water body for flood protection
WFD identified pressure	4.1.2 Physical alteration of channel/bed/riparian area/shore of water body for agriculture
Floods Directive identified pressure	Defence or Infrastructural Failure
Other EU	Habitats Directive (1992/43): Modification of hydrographic functioning, general (J02.05) and flooding modification (J02.04)

Pressure remarks

Regarding the Habitats Directive, other pressures have affected the long-term feasibility of on siteconservation efforts of different species and their habitats, as in the case of agricultural practices (A01) and the Invasion of non-native species (I02).

Policy impact

Directive	Relevant impact
WFD identified pressure	Altered habitats due to hydrological changes
WFD identified pressure	Altered habitats due to morphological changes
Floods Directive identified pressure	Protected areas
Other EU	Habitats Directive (1992/43) Inundation (natural processes) (L08)

Impact remarks

Other adverse environmental impacts are also addressed in connection to the FD objectives and related biodiversity, flora and fauna targets.
Additionally, in the case of the Habitats Directive the impact of the measures directly seeks to enhance the habitat conservation status, which is also in line with the EU Biodiversity Strategy to 2020 (COM (2011) 244) seeking to address the protection and restoration of biodiversity and associated ecosystem services.

Requirement directive

Requirement directive
WFD-achievement of good ecological status
Floods Directive-mitigating Flood Risk
The Birds and Habitat Directives

Requirement directive remarks

In the case of the WFD the conservation of functions, interactions, dynamics, continuity and connectivity of fluvial ecosystems is a key factor when aiming at the good ecological status (GES).
According to the FD, flood risk management plans should focus on giving rivers more space and should consider the maintenance and/or restoration of floodplains, since they contribute to reducing peak flows by flooding, and minimizing flooding levels which significant benefits in urban areas downstream.
The comprised area is one of the Sites of Community Importance (SCI) included in the Natura 2000 network. The area’s importance is mainly due to the presence of Mediterranean river forest habitats (Mediterranean poplar and willow forests) and species such as European mink (Mustela lutreola), otter (Lutra lutra), European turtle (Emys orbicularis) and night heron
(Nycticorax nycticorax).
Additionally, some requirements from the EU Biodiversity Strategy to 2020 (maintaining and restoring ecosystems and their services and enhancing efforts to protect species and habitats) are also addressed by these measures.

Policy challenges requirements

The implemented measures go in line with the Ministry Agriculture, Food and the Environment policy goals, that aim at improving the management of rivers and their conservation status, and that has undertaken plans and lines of action concerning water quality, as well as the protection and conservation of the Water Public Domain (Programme of Conservation and Enhancement of the Water Public Domain). In addition, a great deal of effort is going into water planning for the next WFD planning cycles, which introduces the challenge of producing new river basin management plans (aligned with the National Strategy for River Restoration) and propose a set of measures to improve the management of rivers and their ecological status.

Part of a wider plan

Oui

Wider plan

Wider plan type	Wider plan focus	Name
Catchment-based	Environment & Biodiversity	Natura 2000 Network - SIC: ES2200035 / lower reaches of the Arga and Aragón rivers
Catchment-based	Water	National Plan of Rivers restauration / Hydrological connection of the lower reaches of the Arga and Aragón Rivers
Project based	Water	INTERREG IIIa - GIRE "Integrated Management of European Rivers"
Project based	Environment & Biodiversity	Life project "GERVE - Ecosystemic Management of Rivers with European Mink"

Public consultation

Non

Has contractual arrangements

Non

Impacts and Monitoring

Monitoring System

Monitoring requirements

A structured monitoring programme was implemented to evaluate ecological and hydrological outcomes over several years after project execution.

Monitoring parameters

During and after the two main implementation phases (2016–2021), the project partners conducted systematic monitoring focusing on riparian vegetation recovery, groundwater levels, hydromorphological changes, and biodiversity indicators. Vegetation monitoring compared the outcomes of active planting versus passive natural regeneration, assessing species composition and cover. Groundwater monitoring was used to evaluate the reconnection between the river and floodplain. Hydrological indicators such as flow patterns and sediment dynamics in restored meanders and oxbows were tracked. Additionally, fauna surveys targeted species like amphibians, fish, aquatic invertebrates, and mammals, including the European mink (Mustela lutreola) and the invasive American mink (Neovison vison). These activities were carried out by project partners such as the Government of Navarra, Confederación Hidrográfica del Ebro, and LIFE+ Territorio Visón technical teams.

Maintenance

Maintenance requirements

Basic maintenance has included control of invasive species, protection of planted vegetation, and occasional removal of debris in restored channels.

Impact Assessment Methodology

Performance impact assessment method

Edge of Field/Plot

Performance impact estimation information

An external team made by independent assesos is in charge of the assessment. The assessors willl prepare a report which serve as a source to determine the degree of compliance with the objectives. The final outcome is the strict and meticulous monitoring of the project based on the reports required to assess the evolution of the measurable indicators defined in each of the actions.

Socio-economic Impacts

Direct benefits information

Flood risk reduction (Increasing water storage capacity)
Habitat and biodiversity conservation (recovering and increasing the European mink population)
Clear water (achieving the good ecological status (GES) according to the WFD).

Ancillary benefits information

Flood risk reductions avoid future economic losses arising from down stream flooding events.
Data from the 2003 flooding in Navarra indicate that the economic losses, including production losses and infrastructure damages, where estimated in more than 9 millions euros. In the case of the flooding event in 2007 the total amount of damages in public and private infrastructure and agricultural production losses were quantified in more than 8 millons euros. (Source: Gobierno de Navarra (2010)).
Local socio- economic benefits when developing the measures in terms of employment and local consumption
The provision of clear water in turn yields social benefits as recreational services and amenity (increased demand for recreation or increased number of visitors) and clean drinking water
Habitat and biodiversity conservation perform numerous ecosystem functions that provide multiple co-benefits as in the case of storing and fixing carbon, serving as wildlife habitats and ecological corridors, stabilizing stream banks, providing shade, organic matter, retaining sediments and filtering chemicals applied on agricultural sites on upslope regions.

Biophysical impacts: Hydrology

Information on increased water storage

The measures enhance the water storage capacity since they can act as buffers. As in the case of wetlands and floodplains, both having the capacity to temporarily store flood waters, during high runoff events.

Information on runoff reduction

Wetlands and floodplain as the vegetation on the riparian area have the capacity to intercept and reduce the runoff. Also there is a reduce runoff from agricultural land since they should be reallocated.

Information on peak flow reduction

The setting back and the removal of earth embankments to revitalize the flowing water increase the water travel time to prevent the flash flows in downstream area.

Information on soil moisture

The biological removal of stumps avoids loss of quality of riparian soils and helps infiltration.

Information on Restoring hydraulic connection

The hydrological reconnection of the meanders during flooding make it possible to remove the fine sediment from the former river bed whilst the target habitats will be flooded, thereby ensuring their natural conservation and regeneration.

Information on reducing flood risks quantity

The crops and poplar groves were protected from flooding by building earth embankments, which prevented the natural development of the river and caused flooding problems in downstream areas. Actions directed at eliminating or setting back the earth embankments (flood defences) in order to extend the River Territory minimize flood risks and some associated costs.

Reducing flood risks quantity change

After the removal of riverbank protections and reconnection of the floodplain, recent floods (e.g. winter 2017, spring 2018) caused less damage in the town of Funes, demonstrating improved flood mitigation capacity.

Biophysical impacts: Biodiversity

Improved biodiversity

Oui

Information on improved biodiversity

The measures seek to improve the overall river ecosystem, leading to the recovery and increase of forest habitats (Mediterranean poplar and willow forests), species such as the European mink, otter (Lutra lutra), European pond turtle (Emys orbicularis) and night heron (Nycticorax nycticorax) and its habitats in the area, together with a decrease in the main threats to this species.
The afforestation of riparian areas and the restoration of the wetlands are also of strategic importance to other species and also for aquatic birds present in the area.

Biophysical impacts: Water & Soil Quality

Water quality overall improvements

Positive impact-WQ improvement

Information on water quality overall

The floodplain and wetlands contribute to nutrient retention, sedimentation and de-nitrification (retention of nitrogen and phosphorous) improving the water quality. Sediment removal from old meander beds eliminated polluted mud deposits, enhancing water quality and habitat conditions in newly restored side channels.

Soil quality overall improvements

Positive impact-SQ improvement

Information on soil quality overall improvements

The plants that grow in wetlands and riparian areas are especially adapted for the high water levels, and high water flow energies. These plants have strong roots that helps to hold the soil in place, their leaves and stems help to protect the soil surface during high flow events. Then, they seek to conserve soils and its quality by reducing accelerated erosion.

Biophysical impacts: Others

Ecosystem impact climate regulation

Impact on GHGs (net emissions and storage) including soil carbon

Information on ecosystem impact climate regulation

Climate control is another hydrologic function of wetlands and floodplains, by storing and capturing carbon. Also wetlands return in average, over two-thirds of their annual water inputs to the atmosphere through evapotranspiration (Richardson and McCarthy 1994). Wetlands also act to moderate temperature extremes in adjacent uplands (Brinson 1993).

Lessons Learned

Key lessons

1. Large-scale river-floodplain reconnection is possible within agricultural landscapes
Despite land-use pressures, over 100 hectares of disconnected floodplain were restored.
Success required strong collaboration with 12 municipalities and compensation or reclassification of land use (e.g. replacing poplar plantations).
2. Public land ownership facilitates restoration
The majority of the land was publicly owned, enabling easier access, implementation, and long-term commitment to ecological restoration.
3. Combining active and passive restoration can be effective
Areas were either actively replanted with native species or left to regenerate naturally.
Monitoring showed both strategies contributed to biodiversity and habitat recovery.
4. Hydrological restoration reduces flood risks and improves water retention
After project implementation, real flood events demonstrated lower damage in adjacent urban areas (e.g. Funes), validating the hydraulic benefits of natural retention.
5. Targeting biodiversity (e.g. European mink) can increase ecological ambition
Using an endangered flagship species helped mobilise political and public support and ensured high ecological standards across interventions.
6. Strong institutional coordination is key
Success depended on collaboration between local (Navarra Government), basin-wide (Confederación Hidrográfica del Ebro), national (MITECO), and European (LIFE+) actors.
7. Restoration fits within broader adaptation and climate strategies
The project is now cited as an example in Spain’s National River Restoration Strategy (ENRR 2022–2030) and climate adaptation tools like AdapteCCa, highlighting its value beyond biodiversity.

Barriers

Barrier type	Barrier role	Comments
Lacking coordination between authorities	Main barrier	Differences in timings when developing the actions along the rivers
Other	Secondary barrier	Lack of knowledge of the actual functioning of the river system
Limited staff and consultant knowledge	Secondary barrier	Lack of knowledge of specific preferences of flora and fauna, and interactions between habitats and species
Other	Secondary barrier	Lack of information about extreme hydrologic events
Other	Secondary barrier	Lack of post-project hydrogeomorphological behaviour

Drivers

Driver type	Driver role	Comments
Balancing different objectives	Main driver	The lower reaches of the Aragón and Arga rivers forms one of the Sites of Community Importance (SCI) included in the Natura 2000 network. The project area hosts a fifth of the species population in Navarra and two-thirds of the Iberian population; hence the importance of restoring the river ecosystems of the lower reaches of these two rivers for the global strategy of the species conservation.
Past flooding events	Main driver	Give solution to the endemic flood challenges of the river system - shift from traditional paradigms

Success factors

Success factor type	Success factor role	Comments
Public participation	Main factor	The low population density (60 inhabitants/km2 on average), the small and compact urban centres and the fact that buildings are fairly concentrated paved the way for the required interventions.
—	Main factor	The fact that most of the compromised lands were publicly owned facilitated the bargaining process with landowners to acquire the plots and make the restoration activities possible.
Financing possibilities	Secondary factor	Since the selected case-study site comprises not very productive lands (most of them poplar plantations) this made less costly the compensation required for the loss of profits derived from giving up the activities developed in the floodplains to be restored.
Financing possibilities	Main factor	The availability of different funding mechanisms and match-funding schemes; LIFE+, LIFE-GERVE, INTERREG IIIAa GIRE-IMER
Legal obligations	Secondary factor	Since the area is considered of high ecological value (included in the SCI) this made easier the active engagement of stakeholders and the funding availability for the development of restoration interventions.
Financing possibilities	Secondary factor	The relatively high GDP per capita (29,071 in euros) of the area and the fact that the Navarre Regional Government has its own financing facilities positively influenced in the development of the planned intervention activities.
Other	Main factor	The existence of a large riparian area and the large floodplains allowed and facilitated the recovery of the river’s natural space.

Flexibility / Adaptability

The implemented measures are quite flexible to be implemented in other areas of similar characteristics, even though some baseline site conditions should be taken into account for a cost-effective project. Some of them are listed below. - Climate conditions for the selection of plant species and the planting time. - The existence of large riverside areas that allows the recovery of the river’s natural space.
Population density and the existing on site.
The compensation scheme to offset landowners’ income losses and land productivity; in case that land productivity or the financial compensation is too high it may yield very large costs

Transferability

This measure is highly transferable to other lowland rivers with former floodplains, especially where land is publicly owned or low-value. Success depends on strong institutional coordination, hydrological feasibility, and local stakeholder support. Attention must be paid to land tenure, flood risk tolerance, and invasive species control to ensure long-term effectiveness and acceptance.

Basin characteristics influence

The large riverside dimension allows for the recovery of the river natural space. Mediterranean weather conditions in terms of rainfall and temperature gradient, allowed the implementation of the measures to be carried during the low-flow summer months.

Sources

Sources

LIFE+ Project Mink Territory

Natural water retention for combined outcomes - the Arga-Aragon case study (Spain)

TERRITORIO VISÓN - Recuperacion ambiental del Territorio Fluvial; espacio vital del vison europeo (Mustela lutreola) - LIFE09 NAT/ES/000531

El agua en navarra

ES2200035 Tramos Bajos del Aragon y del Arga

Tramos Bajos del Aragon y del Arga

Publicaciones sobre restauración fluvial

Directirces y recomendaciones técnicas para la conservacion del vison Europeo y sus hábitats

Plan Nacional de Restauracion de Ríos

Foro del Agua de Navarra. Documento Técnico para la Participacion Publica en la Cuenca del Arga. Documentacion previa para su análisis. Pamplona, marzo 2007

Foro del Agua de Navarra. Documento Técnico para la Participacion Publica en la Cuenca del Aragon. Documentacion previa para su análisis. Pamplona, marzo 2007

Lugares de importancia comunitaria: Tramos Bajos del Aragon y del Arga

ES2200035 -Tramos Bajos del Aragon y del Arga

Effect of land development and forest management on hydrologic response in southeastern coastal wetlands: a review

Changes in the functioning of wetlands along environmental gradients

Conexión hidrológica y mejora de hábitats en los meandros del tramo bajo del río Arga

Informe de viabilidad. Conexión hidrológica y mejora de hábitats en los meandros del tramo bajo del río Arga

Estrategia Nacional de Restauración de Ríos 2022–2030

Resultados del proyecto LIFE+ Territorio Visón

Ríos navarros, libres de algunos obstáculos