

Good practice in NbS policy integration in Europe: Po River Basin management plan (2022-2027) and river restoration project (PNRR Po)

Short description

Po River Restoration Project (PNRR Po) - implementing nature-based solutions in the river basin water management and flood risk management plan (2022-2027)

Key messages

- The Po River Restoration Project implements the nature-based solutions prioritised in the river basin management plan. It is a unique opportunity to implement, along the entire main course of the Po River, a large-scale ecological restoration process and an integrated management approach, with a budget of over €350 million.
- River restoration must overcome conflicts with intensive land uses along the river, but with tailored and concerted solutions the river basin authority works together with land users toward an integrated approach to water management, which restores river connectivity and the natural functions of the river ecosystem to increase water quality, create a more resilient river, reduce flood risk, and increase ecosystem services.
- Achieving NbS for water management requires more awareness of how river systems work and respond to different actions, engaging all stakeholders through appropriate educational processes and allowing time to assimilate the knowledge, concepts and ideas behind this new approach to river management - ultimately fostering societal acceptance to redefine the space shared by our communities. Scientific knowledge on geomorphic and eco processes must underpin water management and restoration strategies at the basin scale.

Description of policy and initiative

WHAT

There are several policy documents that work together to inform the river basin management. First, the third iteration of the **Po River Basin Management Plan (RBMP, in Italian Piano di Gestione Acque - PdGPO)** for the period 2021 – 2027 [1] describes the challenges that threaten the water environment and how these challenges can be managed. Second, the **Po Flood Risk Management Plan (FRMP, in Italian Piano di Gestione Rischio Alluvioni - PGRA)** for the period 2021-2027 [2] outlines how to manage flood risks in the identified areas of highest flood risk within the basin, aiming to reduce flood damage and protect communities and the environment. The PdGPO and PGRA together with two other sectoral plans (hydrogeological structure, and water balance) form the Po District Basin Plan, hereinafter referred to as the **Basin Plan**.

The **Action Plan of the Po River Restoration (PdA-PNRRPo)** approved in 2022 by ADBPO is the strategic document that identifies priority intervention areas for the period 2022 to 2026 [3]. It defines the guidelines on how and where to intervene, what the objectives are, the expected results and the governance. The **Po River Basin Restoration Project document (PNRR Po)** details the hydraulic, morphological, ecological, and forest-related measures to be implemented, specifying their design, construction plan, worksites, and economic plan.

WHO

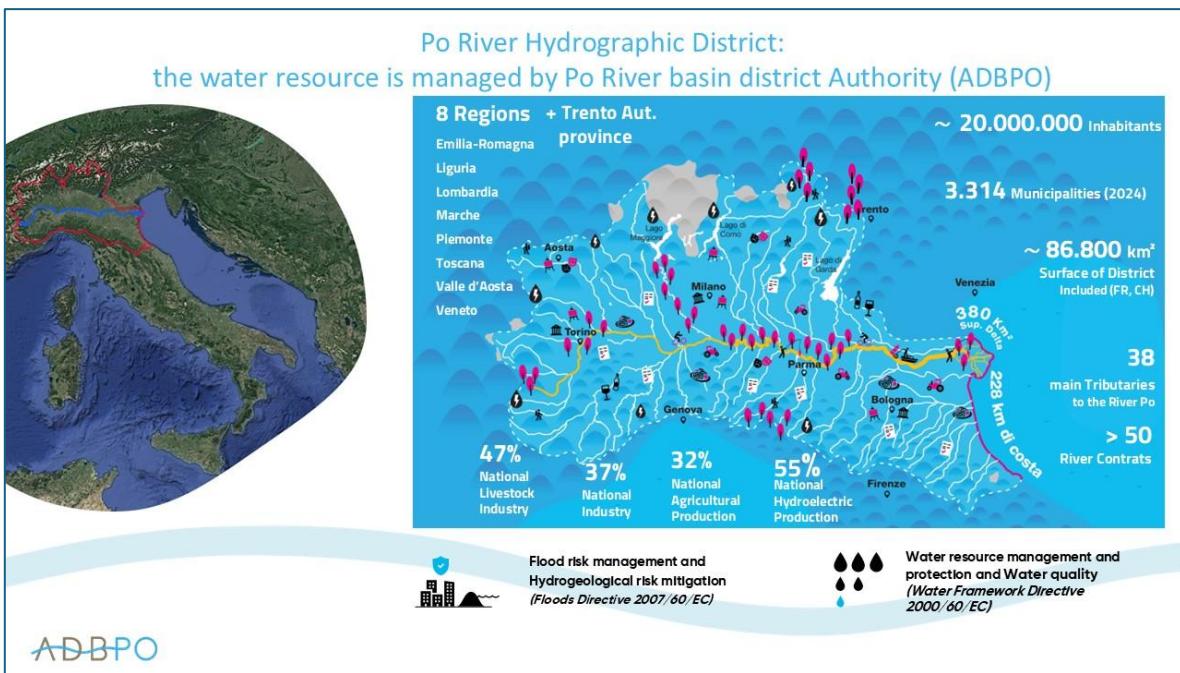
The **Po River Basin District Authority (ADBPO)** is the public body of national relevance, controlled by the Ministry of Ecological Transition, responsible for planning and programming interventions for soil protection, and for the safeguarding and management of water resources in the Po River district. The Permanent Institutional Conference of the ADBPO is the governing, coordination and planning body and brings together the eight Regions and one Autonomous Province within the basin. Four of them are tasked with implementing the restoration actions across 56 designated sites along the Po River.

The **Interregional agency for the river Po (AIPO)**, is a public body established by four regions of the Po Basin (Piedmont, Emilia-Romagna, Veneto, and Lombardy). It provides engineering and environmental services for flood protection and flood damage reduction in the Po Basin/along the Po River

HOW

The **Po River Restoration Project (PNRR Po)** [4] funds the morphological and ecological restoration of 56 intervention areas identified in the Action Plan. It was launched in 2022 and is scheduled for completion by March 2026. The interventions are for restoration of the river morphology and nature [5]: reduction of the artificial sectors of the riverbed (adjustment of navigation groins which have become too high over the years, following the lowering of the river bed, decommissioning/modification of defence works); reactivation and reopening of oxbow lakes and abandoned branches and opening of new river branches; nature restoration of oxbow lakes and abandoned branches; natural reforestation to consolidate and expand the present forests; and control of invasive alien vegetation species. The project has set targets to reduce the artificiality of the riverbed on at least 13 km by June 2024 and on at least 37 km by March 2026. The first target was achieved in 2024 with the publication of calls for tenders for the procurement of works for the 5 interventions on 5.9 hectares of abandoned banks and branches and approximately 400 hectares of close to nature reforestation. for a total of €43.5 million [6].

Images

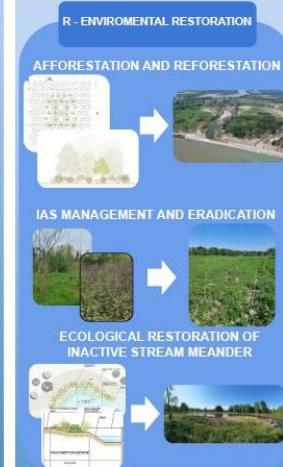


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PNRR Po - The restoration of river ecosystems to improve the ecological status and reduce hydraulic risk



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Type of policy instrument(s)	Scale and location
PLANNING INSTRUMENTS – combined regional river basin and flood risk management plan (basin plan) with action plan (programme of measures) ECONOMIC INSTRUMENT – action plan funded by the Italian Recovery & Resilience fund (2022-2026)	<p>Po river hydrographic district Italy - covers an area of about 86,800 km² that includes almost all northern Italy with around 6,750 km of major rivers (652 km of the Po itself plus the major tributaries). Covering the basin is divided in one main watersheds (Po river basin) and other small river basins.</p> <p>Geography of the Po river hydrographic district:</p> <p>The grey area is the Po river basin and the 4 coloured areas are the others smaller river basins. The entire area (Po river basin + 4 small basin) are the Po river Hydrographic district. The PNRR Po project refers only to the Po river basin</p> <p>The hydrographic district covers nine regional authorities (Emilia-Romagna, Liguria, Lombardia, Marche, Piemonte, Toscana, Valle d'Aosta, Veneto, and the Autonomous Province of Trento) [7] with 3 314 municipalities. It includes 687 Natura 2000 sites designated under the Habitats Directive (SAC, SCI or pSCI) and eight UNESCO biosphere reserves. In short, The PNRR Po project addresses a vast area including 56 intervention areas in four regions with 106</p>

	municipalities [8]. Including Natura 2000 protected areas and UNESCO biosphere reserves, particularly the Po Grande biosphere reserve.
NetworkNature theme(s)	NbS Types
<ul style="list-style-type: none"> • Climate adaptation, mitigation and resilience • Biodiversity enhancement and ecosystem restoration <ul style="list-style-type: none"> • Restore / create: Solutions that involve ecosystem restoration or creating new ecosystems, provided they preserve biodiversity and deliver various ecosystem services. • Sustainably use and manage: Solutions based on developing sustainable management protocols and procedures for managed or restored ecosystem 	
Policy Good Practice Criteria	
NbS mainstreamed in policy text and/or NbS are a central component of policy response	<p>The Action Plan specifies nature-based solutions as a priority action to conserve and restore fluvial and peri-fluvial ecosystems, through the recovery of the river bed and the lateral connection with the flood plain [3]. Restoration actions that align with NbS approach are: river restoration, recreation of flood meadows, water retention areas</p> <ul style="list-style-type: none"> - green infrastructure to increase water retention - wetland restoration - floodplain restoration - afforestation and reforestation - land use conversion - management of invasive alien species <p>It is unclear whether NbS are selected over traditional 'grey' solutions. The PNRR project explicitly puts nature first and promotes the improvement of the floodplain, forests, wetlands and biodiversity across the whole landscape. Importantly, these measures have formed a central part of the wider policy response aligning with a broad number of sustainable development goals [8].</p>
Societal challenges are addressed, and human wellbeing outcomes are defined	<p>The Po River restoration project contributes to the achievement of these multiple objectives:</p> <ul style="list-style-type: none"> - improves water quality through the restoration of the ecosystem functionality of watercourses; - reduces hydrogeological risk through the reactivation and reopening of oxbow lakes and abandoned branches; - enhances biodiversity through naturalistic reforestation and control of invasive alien plant species. <p>It therefore addresses the societal challenges of:</p> <ul style="list-style-type: none"> • Climate resilience • Natural and climate hazards • Water management • Soil, land and sea management and planning • Biodiversity enhancement • Knowledge and social capacity building for sustainable transformation <p>The actions are expected to have a great impact on the safety and quality of life of those who live in the areas and tourists. Specifically, to [5]:</p> <ul style="list-style-type: none"> • contribute to the reduction of the coastal populations' vulnerability to flooding and other climate-related natural disasters (SDG 13.1) • climate change mitigation through the forestation, and adaptation by creating a more resilient river (SDG 13.1) <p>increase ecosystem services providing multiple benefits to community well-being (SDG 6.3, 6.6, 13.1, 15.1, 15.2, 15.5)</p> <p>increase awareness and territorial responsibility (Landcare) for the active protection of the MAB Po Grande biosphere reserve, educate on river heritage and the sustainable use of ecosystems (SDG 15.1, 13.1)</p>

Dedicated budget or funding stream	<p>The PNRR Po project is financed with over €350 million from Italy's Recovery and Resilience Plan (NRRP) under the Next Generation EU initiative [8; 10]. The funding must be spent by March 2026. Upon the completion of the project experts are seeking solutions to continue funding the actions after the end of the project are being explore, experts are seeking solutions to continue funding the actions after the end of the project.</p> <p>By way of example, the AIPO can leverage is abundance of staged outputs, resources and stakeholder connections to secure potential LIFE or Horizon grants.</p>
Indicators of impact and evaluation framework	<p>Two different kinds of indicators are used to demonstrate, on the one hand, the effectiveness of restoration from an ecological and hydrological point of view, and on the other hand, the project's contribution to the EU Restoration Target of 25,000 km of free-flowing rivers set by the Biodiversity Strategy.</p> <p>State indicators, namely the environmental components that demonstrate the effectiveness of the intervention in terms of environmental benefits and improvement of the river system, are distinguished from the result and performance indicators, which address the need to demonstrate the project's contribution to the EU objective of achieving 25,000 km of "free-flowing rivers".</p> <p>The "State indicators" were established with the "Guidelines for Monitoring the Interventions of the PNRR Project "Renaturalisation of the Po Area". It is a paper drafted in June 2023 by ADBPO, with the support of the Scientific Committee established within the project's governance. It serves as a reference document for the methodological framework of intervention monitoring, aimed at assessing their effectiveness in terms of ecosystem functionality.</p> <p>On the basis of these guidelines, ADBPO has established a collaboration with five Universities and the National Centre of Research to develop a reference baseline for monitoring the environmental response of the restored ecosystems and monitoring for the two years of implementation in the project. The monitoring plan combines traditional monitoring approaches with innovative techniques such as remote sensing and environmental DNA. The monitoring activity is still ongoing and will continue throughout 2026. It has been funded with ADBPO's own budget resources. ADBPO is currently seeking additional funding to continue the monitoring beyond 2026, in order to obtain further results concerning the post-implementation phase.</p> <p>The "result and performance indicators" were established through a methodology developed by AIPO that measure in kilometers, the length of reconnected oxbow lakes, and the size of restored and reforested areas.</p>
Inclusivity and stakeholder engagement	<p>The basin plan was developed with a public consultation and stakeholder engagement process during 2019 as required by the EU Water Framework Directive and Floods Directive. During 2023 an informational and participatory process has been undertaken to share the project's objectives and the contents of the Action Program of Po river restoration, as well as to engage local stakeholders and gather suggestions and insights useful for the design and implementation phases of the interventions.</p> <p>ADBPO is encouraging private-public partnership for biodiversity conservation actions and stakeholder involvement through participation and negotiation processes. This engagement is taking place through multiple channels:</p> <ul style="list-style-type: none"> • The five UNESCO MAB (Biosphere) reserves along the Po River are key partners as they signed an agreement in 2024 [9] to coordinate and work with the River Po District Basin Authority on agreed joint actions. ADBPO works on Youth participation and gender equality [16][9]. • The Nature Positive Network is a network of companies committed to the implementation of actions for the protection and enhancement of nature in the Po River Basin. • Voluntary river stewardship contracts (Contratto di Fiume)
Consistency within policy mix	<p>The Action Plan ensures consistency with the district's spatial and environmental planning frameworks. The Action Plan of the Po river restoration project implements the measures envisaged by the Flood Risk Management Plan and by the Water Management Plan of the Po River Hydrographic District.</p>

	<p>The project has started a process of revision of the legal framework for the planned renaturation interventions, to define new procedures for issuing state-owned land concessions for the restored areas.</p> <p>The interventions contribute to the implementation of the Po River Sediment Management Plan adopted in 2008.</p> <p>National adaptation strategy and plan The Po Basin Plan and Action Plan are designed to support the achievement of the Italian National Strategy for Adaptation to Climate Change (SNACC) adopted in 2015 and its National Adaptation Plan (adopted in 2023). The strategy emphasizes nature-based solutions and blue-green infrastructures as key actions for climate change adaptation.</p> <p>Implementing EU policy objectives for water, flood risk and nature The plans implement the Water Framework Directive (2000/60/EC) and the Floods Directive (2007/60/EC), and support the objectives set by the Birds Directive (2009/147/EC), the Habitats Directive (92/43/EEC), and the EU Biodiversity Strategy for 2030 (COM(2020) 380 final). They are aligned with the recently adopted Nature Restoration Regulation (Regulation (EU) 2024/1991).</p>
Knowledge development and transmission	<p>Research, knowledge & data: ADBPO collaborates with five universities and the National Centre of Research to develop a reference baseline for monitoring the environmental response of the restored ecosystems and monitoring for the two years of implementation in the project. The ecosystem quality of the Po River and its floodplain will be assessed by monitoring key environmental components that effectively respond at scales consistent with the expected impacts of the river restoration interventions: Habitats, physico-chemical quality of water and sediments, ecosystem functioning, riparian forests, and bird fauna. The collaboration foresees the organization of study days (workshops) with the aim of transferring the acquired know-how, primarily addressed to the authorities responsible for monitoring (Regional Environmental Protection Agencies), in order to provide guidance for the design and implementation of future post-operam monitoring activities.</p> <p>Learning and education: The collaboration with the UNESCO Biosphere reserves in the Po River Basin [9] focuses on education and data and information collection with “antenna points” along the river basin for the sharing of data.</p>
Success factors / uptake / impact	
<p>Integrated approach to planning: The Po River Basin District Authority (ADBPO) has developed an integrated approach to water management, which considers the recovery of river connectivity and the restoration of the natural functions of rivers a cross-cutting issue to reach the goals of the EU legislation for water, flood risk, and nature. The ADBPO has developed an integrated planning strategy aimed at ensuring synergy between the actions and measures they contain, for the conservation, protection, and enhancement of the soil, as well as the proper safeguarding and use of water resources and river restoration. The measures are carried out through an integrated management approach that seeks to balance ecological and operational dimensions, while ensuring continuous engagement with local territories and the various stakeholders and users of the resource.</p>	
<p>Partnerships for long-term continuity: The private-public partnerships and stakeholder involvement through the UNESCO biosphere reserves, the business network, and other engagements, are seeking concerted solutions to ensure continuity after the project finishes.</p>	
<p>Biodiversity and ecosystem restoration: The project is achieving ecosystem restoration at an unprecedented scale for Italy, including restoration in 42 Natura 2000 protected areas and five UNESCO biosphere reserves.</p>	
Main barriers and challenges	

Complexity and conflicting objectives: The project is very challenging both for the numbers of interventions on 56 sites and for the difficulties of reconciling conflicting objectives among the different stakeholders. The main challenge is obtaining social acceptance and resolving divergences related to the current land use affected by the interventions—particularly the poplar-growing industry and agriculture. The resistance stems from conflicts between renaturation goals and the long-established agricultural and poplar-oriented use of the floodplain lands. To address issues related to conflicts between renaturation objectives and land use, meetings were initiated with the various institutional actors involved in the governance of the investment, as well as with agricultural associations.

Land acquisition for the implementation of the interventions: expropriation or revocation of state-owned concessions. Difficulties related to the agricultural sector and the owners of the affected land. Difficulty reaching an agreement with landowners, who are concerned about the loss of their crops.

Pressure of short time period set by project funding: The main challenge is the need to design and implement the interventions and involve stakeholders within four years, as the project must spend the Next generation EU funds by March 2026. This is even though these actions are of unprecedented scale—both in terms of budget and area—in the Italian context, and within the hydraulically dynamic environment of the Po River corridor, which is intensively used for agricultural purposes. We addressed these challenges by sharing a list of priority criteria for the implementation of intervention plans with the stakeholder working group.

Potential for replication / upscaling

Replication in Italy and in other countries:

The Po River basin covers a quarter of the Italian territory and population and 40% of its gross domestic product. The PNRR Po project addresses 56 intervention areas in the basin and is absorbing 18% of the Italian allocation of the EU recovery and resilience funding. The ecosystem restoration project is therefore at an unprecedented scale for Italy and already serves as an example of large-scale river restoration. For example, the project was the focus of a conference in November 2024 on implementation of the EU Nature Restoration Regulation in Italy [10]. The scientific and management approach can be transferred to other river courses with morphological characteristics similar to the Po river.

Ensuring continuity in the Po River Basin:

The ADPO is now carrying out a series of other projects to strengthen integrated water management and climate adaptation in the Po river basin, including:

- LIFE funded project (CLIMAX PO – 2023-2032) [11] to set up an integrated governance approach (a multi-level governance deal) for the whole Po River Basin with the mission of leading the implementation of the Italian National Adaptation Strategy. It has set up demonstrative adaptation projects, designed to address significant and urgent climate-related risks and impacts foreseen by the national adaptation strategy, including the promotion of nature-based solutions for riparian restoration.
- LIFE funded project (NatConnect2030 – 2024-2032) [17]
- Horizon Rewet [18]. The Italian open lab of this Horizon project is a restored area along the Po River and it has been considered as a pilot NbS project. REWET added value is quantifying GHG, carbon sequestration and ecosystem services. The natural and environmental requalification of the ox-bow lake will the pilot project to pursue the aims of the Biodiversity Strategy 2020, with consequent benefits for the whole UNESCO Biosphere Reserve community.

However, there is a shortage of national funding for climate adaptation and ecosystem restoration. The Italian climate adaptation plan has no dedicated funding and relies mainly on EU funding sources.

Sources and further information

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