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Restoring Free flowing rivers for humans and biodiversity: synergies with the Water Framework Directive

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Inviting authorities:

ADBPO Autorità di bacino distrettuale del fiume Po

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Thematic context:

The importance of free-flowing rivers that allow free movement of water, sediment, fish and other organisms is increasingly recognised by European environmental policy, in particular the Water Framework Directive (WFD) and the Biodiversity Strategy for 2030, adopted under the European Green Deal. The European Union Biodiversity Strategy for 2030 calls for greater efforts to restore freshwater ecosystems and the natural functions of rivers by setting a target to restore by 2030 at least 25 000 km of rivers into free-flowing rivers through the removal of primarily obsolete barriers and the restoration of floodplains and wetlands.

A "free-flowing river" is not impaired by anthropogenic barriers and is not disconnected from its floodplain. It supports connectivity of water, sediments, nutrients, matter and organisms with the river system and with surrounding landscapes in all of the following four dimensions:

- Longitudinal: connectivity between upstream and downstream;
- Lateral: connectivity to floodplain and riparian areas;
- Vertical: connectivity to groundwater and atmosphere.
- Temporal: connectivity based on seasonality of fluxes.

Currently, 34% of surface water bodies in Europe are affected by hydromorphological pressures (alterations to the channel, bed and riparian zone, presence of barriers, etc...). The implementation of the Biodiversity strategy means removing or modifying obstacles that have become obsolete, no longer fulfill their original function or are no longer needed. The restoration of buffers, wetlands and riparian zones is also essential to improve the quality of the habitats and aquatic ecosystems and to manage the presence and spread of invasive alien species.

However, the implementation of this strategy is facing several major challenges:

- Identifying obstacles and areas in need of restoration
- Taking account of social and economic targets: landscape heritage, recreational areas, flood risk issues, etc.
- Management in high population density area
- Preservation of certain natural barriers that facilitate bed overflow and sediments/nutrients input to lateral zones.
- Importance of infrastructure for navigation, energy production, and flood risk management.
- Need for closer cooperation between stakeholders such as locals, regionals, nationals, European, private companies, researchers and the general public.
- Development of technical and social tools, supported by the European Commission, to connect the main river sections to the most important tributaries and habitats.

The restoration of aquatic habitats to support biodiversity contributes to the achievement of the WFD objectives, as well as measures to reach the WFD objectives contribute to the objectives of the Nature Restoration Regulation. Moreover, the WFD establishes monitoring and reporting obligations regarding the ecological status of waters, while the Nature Restoration Regulation requires measurements and monitoring to assess progress in the restoration of

habitats and species ; both tools require relevant data collection and analysis, which could be integrated to get a complete picture of the effectiveness of protection and recovery policies.

This session provides an overview of tools, methodologies and best practices for meeting these challenges and restoring river continuity as well as an overview of the synergies between the Nature Restoration Law and the WFD.

Visual representation respects panelist preferences

Session Report

Despite the widely acknowledged benefits of river restoration for both nature and society, significant challenges persist, leading to relatively low or slow investment in this area.

One of the primary problems is the **physical fragmentation** of rivers caused by man-made barriers. It is estimated that more than one million barriers fragment Europe's rivers. These barriers, often related to damming, hydropower, flood protection, agriculture, and forestry, have modified watercourses throughout history. In Finland, hydromorphological alterations are considered significant pressures in 983 waterbodies.

Beyond physical barriers, rivers and their associated ecosystems face pressures from **urban development** and agricultural activities. These activities have historically occupied natural floodplains along rivers, reducing the space available for natural river dynamics and flood water expansion.

Another significant ecological challenge is the **proliferation of alien invasive plant species**. Dense colonies, such as those of the common cane (Arundo donax), can prevent the natural free flow of water, especially during floods. The control of invasive species is explicitly identified as a difficult challenge in restoration projects, such as the Rinaturazione area del Po project in Italy.

Implementing restoration projects is also hampered by **complex socio-political**

factors:

- Reconciling divergent societal goals takes time and effort. Different river users often have different perceptions of what a river should look like or how it should function.
- There is often a lack of public support and understanding regarding the importance and necessity of restoring free-flowing rivers.
- Implementation can suffer from a lack of references and previous experiences, leading to uncertainty among project managers and stakeholders.
- Restoring free-flowing rivers requires a concerted effort involving many stakeholders, but a lack of stakeholder trust and interaction can present obstacles to scaling up efforts. Projects face unique and place-specific challenges that require broad expertise and stakeholder mobilization.
- For large, complex systems like the Ganga basin in India, complex water governance and diverse hydrological, geological, and socio-economic features necessitate moving towards integrated approaches, indicating the challenges of fragmented management.
- In heavily used river systems like the Rhine, despite decades of effort, there are still significant deficits related to hydromorphology, making restoration difficult.

The session highlighted various approaches and measures being implemented to **overcome these challenges and accelerate the restoration** of free-flowing rivers, emphasizing the synergy with existing legal frameworks like the WFD.

A key opportunity is presented by the **Water Framework Directive** (WFD), which has laid the basis for planning and implementing river restoration, and the new **Nature Restoration Regulation** (NRR). The NRR provides a strong impulse, including a target to restore at least 25,000 km of free-flowing rivers in Europe by 2030. It is seen as a great opportunity to boost WFD river restoration actions and integrate NRR measures within the WFD planning process, particularly within River Basin Management Plans (RBMPs).

Various **technical solutions** are being implemented:

- Removing migration barriers and decommissioning small hydropower plants. Examples from Finland demonstrate successful projects, including the abolition of hydropower plants and dam removal or alteration, freeing up significant river kilometers. The Hiitolanjoki project in Finland involved abolishing 3 hydropower plants to restore rapids and spawning areas.
- Building fish passages and structures for downstream migration. Fish passes are planned for almost 400 waterbodies in Finland as part of their WFD PoMs.
- Restoring stream channels and implementing flow regulation measures.
- Restoring rivers and streams and building artificial reproduction areas.
- Restoring longitudinal, lateral, and vertical connectivity. This involves reconnecting main channels with floodplains and tributaries.
- Floodplain protection and aquifer recharge. In the Po River basin, efforts include maintaining and restoring alluvial plains for flood expansion and ecosystem conservation.
- Scientific afforestation and biodiversity conservation. Reforestation using native species is a key component of restoration projects, often integrated with other measures.
- Controlling alien invasive plant species. Solutions involve eradication followed by planting

native species to prevent their return and increase habitat complexity.
- Tailored solutions are developed for different contexts, such as urban and rural areas. In Spain, solutions have included creating river parks, replacing houses near the river with parkland, making farmlands resilient to floods, and improving river vegetation for better flow.

Beyond technical measures, successful restoration relies on **strategic and collaborative approaches**:

- National policies and strategies are crucial. Finland has a National Fish Passage Strategy (updated 2026), National Salmon and Sea Trout Strategy, and National Migratory Fish Programme NOUSU. France is developing a National Nature Restoration Plan. The Rhine basin has the "Rhine 2040" programme and a Masterplan Migratory Fish.
- Implementing an integrated river basin management approach is key. The Ganga basin in India has shifted towards this, inspired by the EU WFD but customized for the local context. This involves planning at different levels, from hydrological sub-basins (like the Ramganga) to administrative districts (District Ganga Plans).
- Combining voluntary and regulatory measures is highlighted as a feasible way to reconcile divergent societal goals. Finland's NOUSU program emphasizes partnership and cooperation, allocating state funds to projects with high stakeholder commitment.
- Broad cooperation and partnerships between administration, local levels, NGOs, corporations, and other actors are essential. The Hiitolanjoki project in Finland involved funding from the state, local authorities, WWF, private donors, and companies. The French Biodiversity Agency (OFB) mobilizes a wide range of stakeholders in a "whole of society approach".
- Diversifying funding sources is critical, such as multiplying state aid with fundraising from various actors. EU financial support mechanisms like MFF contributions to biodiversity, LIFE Strategic Nature Projects (SNaPs), and advisory initiatives like Green Assist are available, along with technical assistance like TAIEX-EIR Peer2Peer. Restoration investments are seen as potentially outweighing costs.
- Using River Basin Management Planning based on the EU WFD approach is being adapted and implemented in other contexts like the Ganga basin in India. This includes detailed characterization, risk assessment, setting objectives, and stakeholder consultation.

Based on the challenges and experiences shared, several **key recommendations** emerge for effectively restoring free-flowing rivers:

- Mobilise **society** and build broad support: River restoration needs to be a concerted effort involving many stakeholders, including public and political support. Building a support base both nationally and locally is crucial. Outreach, public participation, clear communication, and stakeholder consultation are essential to overcome the lack of understanding and reconcile different perceptions.
- Emphasize the **diagnostic phase**: An in-depth diagnostic phase is paramount. A good diagnosis helps anticipate and avoid problems downstream, reduces uncertainty, builds trust between stakeholders, and strengthens project outcomes.
- Foster **cooperation** and share **knowledge**: Working together with a broad set of actors is vital. There is a strong need for better interaction and frequent knowledge sharing between

actors facing similar issues. Establishing platforms, networks, or centres for sharing expertise, methodologies, good practices, and lessons learned can help reduce uncertainty and grow the evidence base.

- Leverage **legal frameworks**: The WFD has provided a foundation for planning, and the NRR offers a significant opportunity to boost river restoration measures within RBMPs. RBMPs and River Basin Authorities (RBAs) are seen as key to making restoration a normal practice. It is important to ensure that WFD and RBMPs are complied with and integrated into all policies related to rivers.
- Adopt a **combination of approaches**: Combining voluntary and regulatory measures is effective. Updating fisheries obligations in legal permits is one example of a regulatory measure. Fostering high commitment from stakeholders through partnerships is key for voluntary action.
- **Diversify funding and demonstrate value**: Multiply state aid with fundraising. The availability of EU financial and technical support should be utilized. It should be communicated that investments in restoration outweigh costs.
- Learn from **successes**: Local successes can serve as inspiration nationally. Sharing case studies and results helps build an evidence base.
- Integrate **scientific knowledge**: Scientific knowledge on geomorphic and ecological processes should underpin water management and restoration strategies at the basin scale. Using tools like habitat modelling for E-flows assessment is an example of applying science.
- Embrace **integrated basin management**: Shifting towards an integrated river basin management approach is considered a key evolution.

In essence, restoring free-flowing rivers is a complex but essential undertaking that requires technical interventions, robust legal frameworks like the WFD and NRR, innovative funding models, strong scientific understanding, and, critically, a concerted effort involving broad societal support and intense cooperation and knowledge sharing among all actors. RBMPs and RBAs play a central role in driving this transition.