“Water resilience and ecosystems”

How can we combine governance, innovative solutions and green solutions to protect ecosystems?

Workshop Highlights – Euro-INBO, Parma 2025

Introduction

The EURO-INBO International Conference 2025 in Parmaincluded on May 20th a workshop focused on "**Water resilience and ecosystems".** This workshop gathered 110 participants from various origins: Basin managers, Decision-makers, researchers with the main objective to to explore how **governance, technological and green solutions** can be combined to protect ecosystems and build water resilience, in line with the framework provided by the new **EU's Water Resilience Strategy**

Recognizing the interconnectedness of water security with climate change, biodiversity loss, and economic development, the workshop addressed the increasing pressures on aquatic ecosystems stemming from climate change and human activities and offered experience feedbacks and illustrations of potential solutions or good practices.

The workshop structure included an introduction setting the political context at different scales, followed by experience sharing through presentations and a significant participatory time dedicated to group work.

Two interconnected actions and complementary approaches were explored:

1. **Improved governance and collaboration**, leveraging the experience of the UNESCO Man and the Biosphere Programme (MAB UNESCO).
2. **Integration of innovative technological solutions** in synergy with nature-based solutions (NbS).

Introduction Session

The introductory segment included overviews of the workshop objectives and the political context, such as the EU Water Resilience Strategy and French perspectives on water resilience. The significant role of the UNESCO MAB Programme in water resilience was also highlighted.

Figure 1: Speakers for the introductory phase of the workshop

The speakers and topics covered during this introduction were as follows:

Eric Tardieu and Yannick Pochon from INBO presented the objectives and the flow of the workshop. The workshop sought to identify synergies and build a more resilient future for water resources.

Joachim D'Eugenio from the European Commission presented the "EU Water Resilience Strategy". This strategy is an essential framework for addressing water-related challenges holistically and ensuring a sustainable future for Europe. The general recommendations from the Commission include increasing the level of ambition to reduce the compliance gap by 2027, increasing investments and ensuring adequate financing, identifying and implementing supplementary and additional measures including nature-based solutions and restoration, addressing water scarcity through better climate adaptation in river basin management, establishing water balances, water reuse and efficiency, and improving transboundary cooperation and reducing knowledge and data

gaps. The approach is based on five pillars: **implementation, integration, international cooperation, investments, and innovation.**

Cyrille Barnérias from the French Office for Biodiversity (OFB) presented the French perspectives on water resilience. The OFB was created to meet the challenge of protecting and restoring water and biodiversity in France. Water resilience is defined as the capacity of water systems to adapt to future pressures stemming from climate change, biodiversity loss, and other threats, and recover from disruptions, and looks both at our capacity to guarantee access to water as a resource and our preparedness for risks. This involves improving water management, including reducing use and increasing efficiency, and promoting good governance, innovation, and Nature-based Solutions (NbS). The French Water Plan ("*Plan Eau*"), with its 53 measures, emphasizes the importance of Integrated Water Resource Management (IWRM), water efficiency, local governance, and NbS. The links between ecosystem resilience and water resilience are clear in terms of quantity and quality. It is highlighted that **there is no water security without ecological security** and that technology alone or nature alone cannot solve the current problems; **a combination of both is necessary**.

Stefania Aucelli (UNESCO Expert, Italian Ministry of the Environment and Energy Security) presented the role of UNESCO MAB Programme Biosphere Reserves in water resilience. The MAB Programme, created in 1971, is an intergovernmental program that promotes a balanced relationship between humans and nature. Biosphere Reserves (BRs) are considered "open-air laboratories" where innovative approaches are experimented for a **harmonized coexistence between humans and nature**. Resilience is a core concept for Biosphere Reserves, which act as privileged sites for research, training, and environmental education, as well as experimentation hubs for targeted development and territorial planning policies. They constitute models of advanced governance involving collaboration between institutions, local communities, the private sector, and the scientific world, and promote integrated resource management and ecosystem protection. The Italian network of Biosphere Reserves aims to build a system of synergistic and coordinated actions. The MAB program is currently focusing on creating a specific network on rivers and wetlands, emphasizing the importance of water resource management within Biosphere Reserves.

Samuel Partey (Head of the UNESCO Regional Bureau for Science and Culture in Europe) presented the UNESCO MAB Programme too. The MAB Programme supports and enhances territories where communities pursue, through study and research, innovative approaches to economic development that are socially appropriate and environmentally sustainable. It is forward-looking, acting concretely in the present. The program was born with the mission **to promote and exchange information, experiences, and best practices**.

The introductory phase also included online polls to gather participants' expectations for the workshop, and the most important factor for enhancing water resilience in ecosystems.

Figure 2: Participants' opinion on the most important factor to enhancing water resilience in ecosystems

This introduction set the political and conceptual framework for the workshop, connecting European initiatives and framework (Water Resilience Strategy, Water Framework Directive) with national approaches ("Plan Eau" in France) and international programs focused on balancing humans and nature (UNESCO MAB Programme and its Biosphere Reserves), emphasizing the importance of governance, technological innovation, and nature-based solutions. It laid the groundwork for the deeper exploration of case studies and group discussions planned thereafter.

Following the introductions, case studies were presented.

Figure 3: Speakers presenting experience sharing

Experiences sharing

Erik Aschenbrand, Eberswalde University for Sustainable Development, UNESCO

How UNESCO biosphere reserves act as change agents was presented. Biosphere Reserves (BR) are part of an intergovernmental programme working towards sustainable development since 1971. They are viewed as "open-air laboratories" for experimenting with innovative techniques for harmonized co-existence between humans and nature. BRs play an increasing role in strategic planning, considering stakeholders, sustainable resource management, safety,

biodiversity, quality of life, and economic development. They provide local solutions to global challenges, acting as spaces for change and promoting sustainable transformation locally and globally. Examples of state-funded, NGO-led floodplain restoration projects within the Elbe River Landscape Biosphere Reserve demonstrated actions like creating near-natural floodplain landscapes, connecting floodplains and rivers, increasing water retention, restoring natural riverbanks, changing channel morphology, and enlarging floodplains by relocating dams. Biosphere Reserves can be helpful for implementing conservation functions but experience governance fragmentation, particularly in development zones. Resources and alignment of actors' core objectives are needed for successful action. Visibility and participatory design are important for BRs.

Ludovica Ramella - Head of the Technical Secretariat of the Po Grande UNESCO MAB Reserve, at ADBPO

Approaches to activate synergies between District Authorities and Biosphere Reserves were discussed, using the example of the **Po Grande UNESCO MAB Reserve**. An agreement was signed in April 2024 between five UNESCO MAB Reserves along the Po River (Monviso, Collina Po, Ticino Val Grande Verbano, Po Grande, and Delta Po). Biosphere Reserves represent a useful common working table to create dialogue between local actors and higher authorities on shared issues like resource management. They enhance the understanding of the BRs' important role, especially concerning stakeholder involvement. BRs have hosted training activities and shared projects to implement local management plans, facilitating consultation between water management bodies and stakeholders. This allows River Basin District Authorities to use BRs as effective communication and consultation tools, particularly for plan revisions. There is a focus within the MAB Programme on creating a network on rivers and wetlands, emphasizing water resource management within BRs. Key lessons learned include the territory's call for coordination, BRs providing a working table, the potential for proper project implementation leading to stability, and the importance of **including local stakeholders in planning**. Challenges include political boundaries, funding, and logistics. A **multidisciplinary approach** and using different languages for various stakeholders are necessary for water resource management.

Clara Eugenia Estrela Segrelles - Jefa de Servicio en Dirección Técnica Júcar Hydrographic Confederation, Spain

Innovative technologies supporting ecosystem resilience were illustrated with the example of **increasing flood resilience in the Jucar River Basin District** in Spain. The district faces challenges from intense rainfall, flash floods, high flow velocities, and impacts from urbanization and infrastructure. Reducing flood risk involves addressing exposure, vulnerability, and hazard. Vulnerability reduction includes reviewing flood hazard and risk mapping (adding sediments, vehicles) and increasing knowledge and preparedness via real-time hydro-meteorological and **hydraulic data systems** like the Automatic Hydrological Information System (SAIH). Hazard reduction involves, among others, **implementing Nature-based Solutions** (NbS). Examples of NbS include hydrological restoration and reforestation, "making room for the river," and creating controlled floodplain areas. Implementing NbS requires compensation mechanisms for affected landowners. **Raising risk awareness among citizens** is also essential. It was noted that zero risk does not exist.

PhD Gaia Vaglio Laurin - IRET, National Research Council, Italy.

Proximal and remote sensing techniques for ecosystem monitoring were presented as innovative technologies. These techniques acquire information on objects or physical phenomena without direct contact, using platforms like satellites, airplanes, and drones equipped with sensors. They allow **data collection over large areas and over time**, useful for generalizing local information and monitoring changes. Passive sensors record energy from the sun, while active sensors emit energy and record the return signal. Light is electromagnetic energy, and sensors record returning energy in different bands, stored as multidimensional matrices. Visualizing these bands highlights features, and the amount of returned energy provides information. These techniques support monitoring aquatic ecosystems (inland, transitional, coastal surface waters, groundwaters), including vegetation, single species, water quality, and changes due to human activities and climate issues. Each surface has a specific spectral behaviour allowing distinction between communities, species, health status, sediments, and alien species. Remote and proximal sensing are powerful tools for monitoring aquatic ecosystems and their changes. Multiple sensors and data types are available, requiring expertise for selection. They are important for **monitoring Nature-based solutions, climate change impacts, biodiversity loss** (especially high in aquatic ecosystems), **and anthropogenic pressure.**

Reeda Iismaa, Ministry of Climate of Estonia

Nature-Based Solutions (NbS) as a key to strengthen Water Resilience was highlighted, including examples from Estonia. **Traditional infrastructure is often inadequate** against modern water challenges like climate instability and nutrient pollution. NbS integrate natural processes with infrastructure to enhance water quality through natural filtration, build resilience against extreme weather, deliver multiple ecological and community benefits, and provide cost-effective alternatives. **Floating islands** are miniature ecosystems enhancing water purification; plant roots provide surfaces for beneficial microorganisms, absorb excess nutrients, and stabilize water bodies against sudden increases in pollutants. Additional benefits include habitat creation and aesthetic improvement. A case study in the Soolikaoja creek showed 11 floating islands installed in 2021 with specific construction materials and planted species. Water analysis showed floating islands were somewhat successful in nitrogen removal, with up to 70% removal observed in the Supeluse park area which had the greatest retention time. No major decreases were observed for phosphorus and suspended solids, with increases related to summer algae blooms. An in-stream woodchip bioreactor was also installed to reduce nitrate concentrations. Preliminary results showed an average nitrate removal efficiency of 43.6%. However, performance depended strongly on dissolved oxygen concentration and was limited by photosynthesis and eutrophication, posing a risk of anoxia in-stream. Other Estonian projects mentioned include LIFE UrbanStorm (stormwater systems, flood prevention), LIFE LATESTadapt (NbS, smart solutions, sensing techniques for monitoring NbS), Interreg MUSTBE (stormwater treatment for Baltic Sea, combining NbS and digital solutions), and LIFE Mires Estonia (conservation/restoration of mires for water purification, storage, and regulation).

Participatory Discussion (Group Work)

A key component of the workshop was the dedicated participatory time where attendees discussed key questions in small groups. This facilitated exchanges and aimed to identify synergies and build a more resilient future.

The main questions addressed during these group sessions were:

- **Technological solutions and ecosystem protection strategies: a win-win approach?** This question explored the potential benefits and

challenges of integrating technological advancements with strategies for protecting ecosystems.

- **Nature-Based Solutions: a key to combining technological innovation and ecosystem protection for Water Resilience?** This focused on how NbS can bridge the gap between technological development and ecological health, thereby enhancing water resilience.
- **How can improved governance structures and collaboration address new challenges for sustainable water resource management?** This question delved into the institutional and cooperative aspects necessary to manage water resources effectively in the face of current and future pressures.

Figure 4 : Round tables with participants

These discussions allowed participants from different backgrounds and regions to share perspectives, challenges, and potential solutions related to combining governance, technology, and nature for water resilience. The insights gained from these group works were intended to be synthesized for a common conclusion.

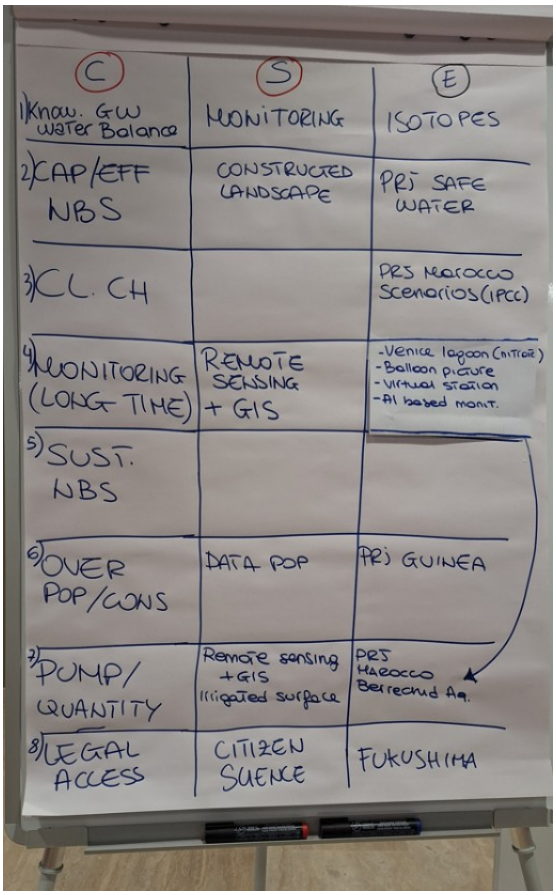

Figure 5: Results of the work of certain groups on the issue 'Technological solutions and ecosystem protection strategies: a win-win approach?' (Challenges, Solutions, Experience Sharing)

<u>Some examples of outcomes from the working groups:</u>

1) How can improved governance and collaboration address new challenges for sustainable water resource management?
Participants highlighted that communication between stakeholders is often a key obstacle to effective collaboration. Some conflicts of interest may also be at play. To overcome this, several ideas were proposed: strengthening dialogue among stakeholders, enhancing education on water-related issues, and promoting experience sharing.

2) Technological solutions and ecosystem protection: a win-win approach?
A major challenge identified was ensuring the environmental, economic, and social sustainability of the actions taken. Moreover, strong discrepancies are often observed between the planned actions (action plans) and the concrete measures actually implemented in the basins. Technology can play a crucial role by improving resource monitoring (real-time tracking, management of extreme events, etc.), increasing water use efficiency, and reducing certain types of pollution. Experience sharing was also highlighted among participants (Finland, Morocco, France, Italy, etc.).

3) Nature-Based Solutions (NBS): a key to combining technological innovation and ecosystem protection for water resilience?
Discussions highlighted the strong potential of NBS to support water resilience. However, several challenges remain, particularly the need to ensure their effectiveness and long-term viability, especially in a context where climate change is having a significant impact on water and aquatic ecosystems. To achieve this, it is essential to develop tools to improve monitoring and measure the effectiveness of NbS (for example, through the use of remote sensing). It is also important to build on and draw inspiration from ongoing projects that are already working on these issues.

Conclusion

The EURO-INBO workshop in Parma successfully brought together European actors involved in integrated water resource management to discuss the critical issue of water resilience.

By highlighting the roles of **improved governance** (drawing on the MAB UNESCO Programme), **innovative technologies** (such as remote sensing and real-time monitoring), and **Nature-based Solutions** (demonstrated by case studies like floating islands and mire restoration), the workshop emphasized that a multifaceted, integrated approach is necessary to address current water challenges. The participatory group sessions allowed for dynamic exchanges on how to effectively combine these elements and address the complex interdependencies between water, ecosystems, and human well-being. The discussions reinforced the understanding that neither technology nor nature alone can solve today's problems; combining them with innovative governance is essential for greater resilience. Furthermore, the importance of **stakeholder involvement and cross-sectoral collaboration** was a recurring theme, recognized as vital for effective planning and implementation of water management strategies. Biosphere Reserves, through their network and role as 'open-air laboratories,' offer valuable models and spaces for testing and demonstrating such integrated approaches.

Effective governance is considered crucial for the responsible deployment of both **technological and nature-based approaches**, while innovation in both areas supports sustainable ecosystem management.

The workshop aimed to foster discussion and collaboration to identify synergies and contribute to a more resilient future for water resources. The exchanges, experiences feedback and group sessions outcomes will contribute to pursue Water Framework Directive's goals of sustainable water management and ecosystem protection and to the new EU's Water Resilience Strategy implementation.

For further information on this workshop:

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The workshop presentations are available on the RIOB website: https://www.inbo-news.org/documents/euro-inbo-parma-2025-introduction-and-french-perspectives/EURO INBO 2025 - INBO

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