

Upper Biebrza, Podlaskie Voivodeship, Poland

NbS for ecological and hydrological resilience in Upper Biebrza wetlands

The Upper Biebrza



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The Upper Biebrza

The Upper Biebrza Case Study, located within the Biebrza National Park in northeastern Poland, is a critical wetland ecosystem known for its transitional mires, alkaline fens and bog woodlands. These wetlands play an essential role in regulating the water cycle, storing carbon and maintaining biodiversity. The Nature-based Solutions (NbS) implemented here aim to ensure ecological and hydrological resilience in the face of climate change.

The Upper Biebrza CS is one of the most valuable wetland ecosystems in Europe, which plays a crucial role in water retention, biodiversity conservation and carbon sequestration. These wetlands act as natural sponges, absorbing water during periods of heavy rainfall and releasing it slowly during dry spells, thus stabilizing the water table and mitigating the risk of drought.

This area is a part of the **Natura 2000 network**, specifically designated as a Special Protection Area (PLB200006) and a Special Area of Conservation (PLH200008), underscoring its international importance. The protected habitats include alkaline fens (*7230) and transitional mires (*7140), as well as bog woodlands (*91D0), which are recognized as priority habitats under the EU Habitats Directive. The conservation of these habitats is critical for preserving the region's ecological integrity and the species that depend on it. The region's hydrology has been historically shaped by natural processes such as slow water infiltration through the peat soils. However, human activities, particularly agricultural drainage, have disrupted these processes, leading to a significant degradation of the wetland ecosystem. Lowered groundwater levels, drying peatlands, and the spread of expansive plant species have contributed to a decline in biodiversity and increased carbon emissions.

Despite the degradation of the ecosystem, the Upper Biebrza region retains immense ecological value. It remains a habitat for many rare and endangered species, including birds like the aquatic warbler (*Acrocephalus paludicola*), black grouse (*Tetrao tetrix*), lesser spotted eagle (*Clanga pomarina*), as well as plants such as the fen orchid (*Liparis loeselii*) and marsh saxifrage (*Saxifraga hirculus*), which depend on specific hydrological conditions.

In response to the ongoing threats, several restoration interventions have been implemented in the past to protect this unique ecosystem including rewetting the peatlands, blocking drainage ditches and restoring natural water flows.

These measures aimed to reestablish the region's hydrological balance and enhance its capacity to function as a natural buffer against climate impacts. However, sustained efforts are essential for the long-term preservation

of this unique landscape, which requires continuous management improvements to prevent peatland degradation, secondary succession and strengthen the involvement of local communities to harmonize conservation needs with theirs.

One such initiative is the **SpongeScapes project "Evidence and Solutions for Improving SPONGE Functioning at Landscape Scale in European Catchments for Increased Resilience of Communities against Hydrometeorological Extreme Events"**.

Among other things, it focuses on large-scale peatland restoration to enhance the sponge function of Upper Biebrza wetland area. This NbS is aimed at increasing the landscape's capacity to retain water, which is vital in this region for mitigating the impacts of extreme hydrometeorological events like droughts.

NbS in depth

Key NbS Techniques Applied:

• **Peatland restoration** to enhance water retention capacity, stabilize groundwater levels, and support wetland biodiversity.

• **Improved water and land use management** using 'Sponge Measures' to promote long-term ecosystem stability.

• **Hydrological monitoring** implementation to assess the effectiveness of the sponge functions and ensure adaptive water management strategies.

This approach will not only strengthen the adaptive capacity of the area in face of climate change, but also restore the natural ecosystem services of the wetland, support sustainable agriculture and biodiversity conservation.



The Upper Biebrza project focuses on enhancing the natural sponge-like functions of the peatland ecosystem through targeted Nature-based Solutions (NbS).

Key NbS actions include:

- **Re-establishing waterlogged conditions** by improving water management, which prevents peat decomposition and enhances the landscape's ability to sequester carbon, contributing to climate change mitigation.
- **Development of better ecosystem-based management adaptation strategies** that are focused on restoring the interactions between groundwater and surface water. These actions aim to improve the natural hydrological processes that support water retention and sustain wetland ecosystems.

<Groundwater measurements

- **Conducting continuous hydrological monitoring** and data collection through the SpongeScapes initiative to conduct detailed hydrological studies and observe the effects of NbS on groundwater levels, soil moisture, and water flow. This data is critical for developing effective conservation strategies for groundwater-dependent wetlands across Europe.
- **Transferring knowledge by serving as a model for other European regions**, facilitating the exchange of best practices and demonstrating how NbS can be successfully applied to enhance climate resilience of a region through wetlands.

Hydrometric measurements>



Environmental benefits

•Water retention:

In the Upper Biebrza catchment, the restoration of peatlands and/or improving their condition will enhance the natural water retention capacity by improving groundwater recharge and reduce drought risk.

• **Carbon sequestration and climate mitigation:**

Peatlands are among the most effective natural carbon sinks, storing more carbon per hectare than forests. Re-establishing waterlogged conditions in Upper Biebrza's peatlands will prevent further peat decomposition, turning the region into a significant carbon sink. This action plays an important role in mitigating climate change by trapping carbon that would otherwise be released into the atmosphere as greenhouse gases.

• **Biodiversity conservation:** The Upper Biebrza area hosts several threatened species that rely on the specific wetland habitats within the alkaline fens, transitional mires and bog woodlands, including species of birds, amphibians, and invertebrates. The restoration of water levels and natural flows helps sustain these fragile ecosystems, making it a critical site for biodiversity preservation in Europe.



Economic benefits

•Sustainable agriculture:

By improving water retention and stabilizing groundwater levels, the NbS actions in Upper Biebrza benefit local agriculture. Farmers will experience improved soil conditions and more reliable water supplies during dry periods, supporting more sustainable and productive farming practices.

•Cost-effective ecosystem services:

Restoring the wetland ecosystem and improving land use management will provide a natural alternative to costly infrastructure for water retention management, offering a more sustainable and cost-efficient solution to climate-related risks. Investing in NbS like this reduces long-term economic impacts by minimizing future environmental degradation.



Social benefits

•Community engagement:

The SpongeScapes project actively involves local communities and stakeholders in the planning and implementation of Nature-based Solutions (NbS). Through workshops and stakeholder engagement, local knowledge and priorities will be integrated into the restoration efforts, fostering a sense of ownership and stewardship among local residents.

•Recreational and educational opportunities:

The restoration of the Upper Biebrza wetlands also enhances opportunities for eco-tourism, environmental education, and nature-based recreation. The area is already a significant destination for birdwatchers and nature enthusiasts. The project further highlights the value of preserving natural landscapes, fostering environmental awareness and engagement with local communities.



Credits:

Lead Organization: Warsaw University of Life Sciences
Case Study Collaborators: Biebrza National Park, Polish Academy of Sciences, Local Stakeholders
Project Partners: Stichting Deltares (Coordinator), UK Centre for Ecology & Hydrology, (CEH), International Office for Water (OIeau), Ruhr University Bochum (RUB), University of Padova (UniPD), University of Ljubljana (UL), Slovenian Environment Agency (ARSO), WWF Greece and Etifor.

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Selected case studies



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