AQUA-WISE cluster overview and vision

Water4All Thematic Annual Programming (TAP) Action 2024 - 2026

Co-funded by
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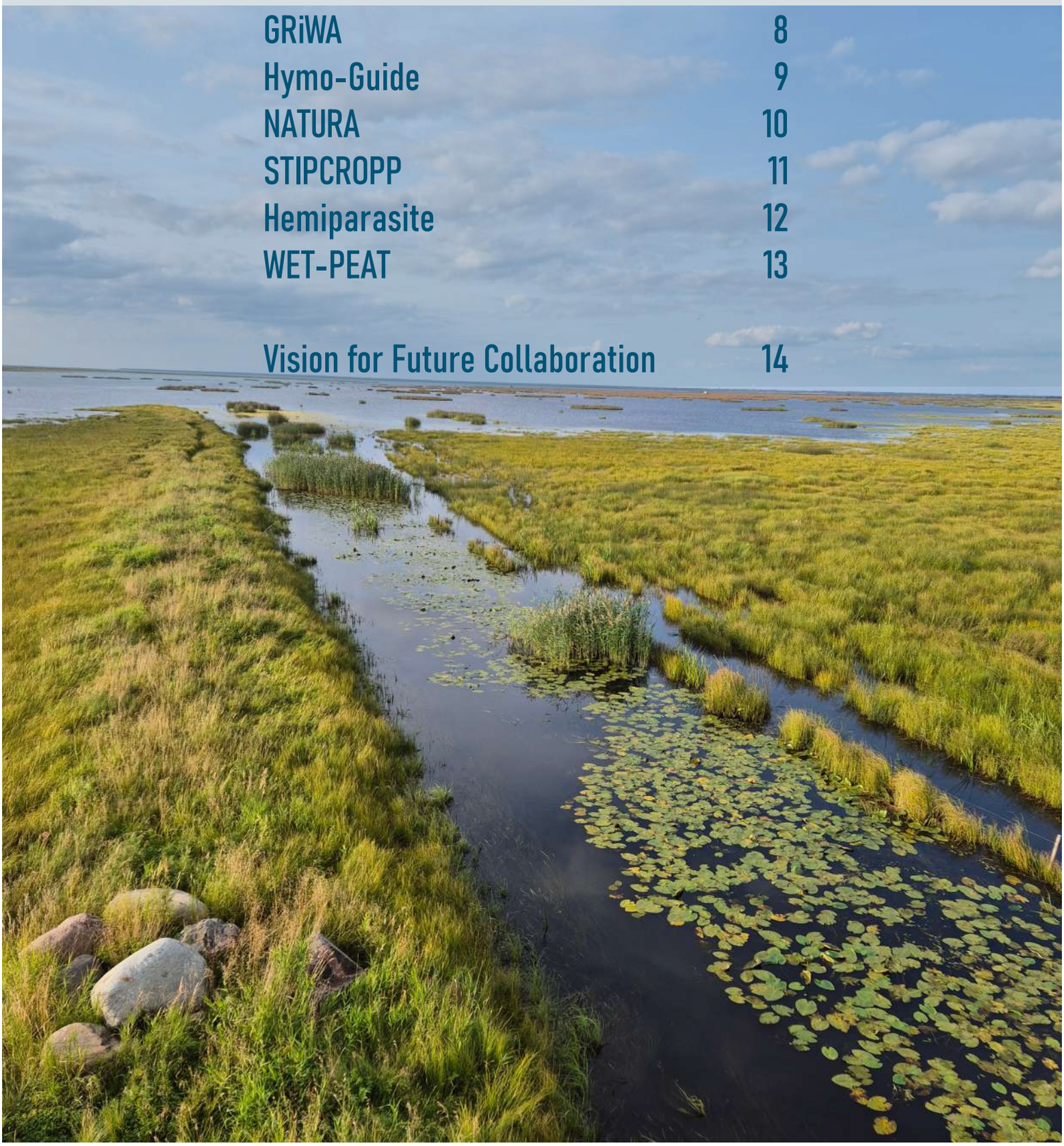
CONTENT



INTRODUCTION

Water and Biodiversity: Building Knowledge and Collaboration Across Europe

The AQUA-WISE Cluster represents a unique network of excellence established under the Water4All Thematic Annual Programming (TAP) Action. This Europe-wide initiative connects national research projects that share one vision: to strengthen our collective ability to secure, restore, and manage water ecosystems and biodiversity. By uniting scientific expertise, innovation, and collaboration, the Cluster provides the foundation for evidence-based action addressing one of today's most urgent environmental challenges—sustainable water management for people and nature.

Rooted in the Water4All SRIA Theme II – Water for Ecosystems and Biodiversity, the TAP Action brings together projects that explore the intricate relationships between water, ecosystems, and society. The AQUA-WISE Cluster has striven to harmonize these efforts, combining a diverse range of expertise to create a critical mass of knowledge, methods, and innovation that advances ecological restoration, improves monitoring tools, and supports the protection of aquatic habitats across Europe. Through joint work, the Cluster promotes cross-disciplinary cooperation—bridging ecology, hydrology, social sciences, and policy— leading to integrated, actionable outcomes.

The Cluster currently unites pioneering projects from Finland, Ireland, Spain, and the Czech Republic, each contributing unique expertise and approaches to shared environmental goals:

WETZONE (Charles University, Czech Republic): Studies how overgrowth and vegetation succession affect wetland biodiversity in human-managed fishponds, developing methods for active habitat restoration and management.

BIO-JUST (University of La Laguna, Spain): Analyzes the measures and policies implemented to protect and restore groundwater and springs on the island of La Palma (Canary Islands) through the lens of environmental justice and political ecology, with a particular focus on nature-based solutions.

GRiWA (Finnish Environment Institute, Finland): Investigates how the spread of non-native pink salmon and added nutrient inputs impact Arctic river ecosystems, biodiversity, and water quality under climate change.

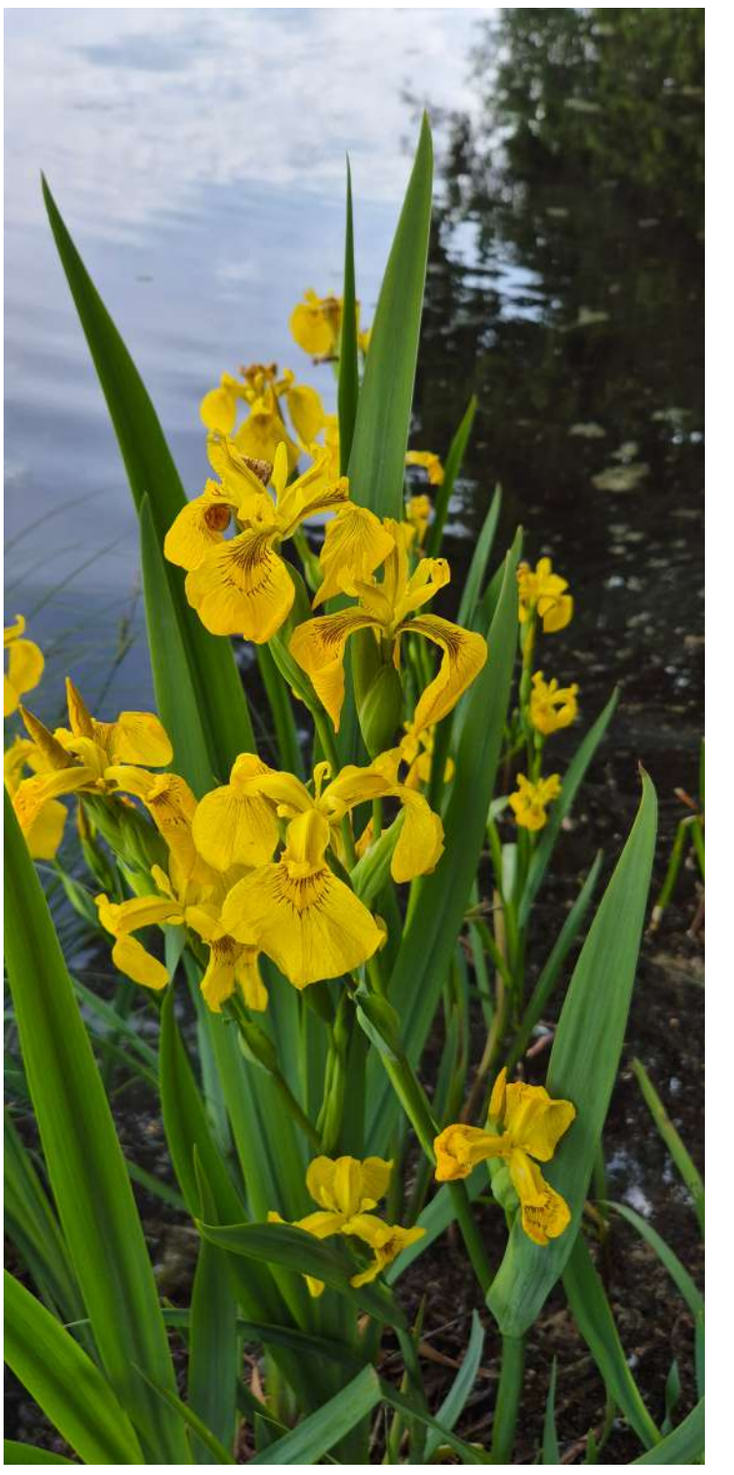
HymoGuide (University College Dublin, Ireland): Develops scientific guidance for the development of regulatory standards for hydromorphology across Irish surface waters, strengthening implementation of the EU Water Framework Directive.

NATURA (IMDEA Water Institute, Spain): Designs economic and regulatory tools to scale up nature-based solutions that enhance resilience to water scarcity and hydroclimatic extremes.

STRIPCROPP (Brno University of Technology, Czech Republic): Tests strip cropping as an adaptation measure to optimize landscape-water management and reduce erosion in agricultural settings.

Wetland Hemiparasite (Masaryk University, Czech Republic): Integrates hemiparasitic plants into wetland restoration as an ecological engineering tool to naturally regulate invasive species, foster biodiversity recovery, and complement other habitat management measures across lowland wetlands.

WET-PEAT (University of Galway, Ireland): Supports large-scale peatland re-wetting and restoration through advanced hydrological and water quality modelling and monitoring to improve water quality and carbon storage.



INTRODUCTION

Together, these initiatives reflect Europe's diversity of landscapes, methods, and expertise, ranging from cold Arctic rivers to Mediterranean aquifers, Central European wetlands, and volcanic Atlantic islands. However, they all share one mission that is to **safeguard water as the foundation of life and biodiversity.**

For researchers, the Cluster offers a platform to exchange knowledge and harmonize methodologies; for policymakers, it provides scientifically grounded tools to guide decision-making; and for the public, it demonstrates how collaborative science directly supports healthier environments and more resilient communities, while fostering awareness that environmental conservation also depends on their active participation.

During the two-year establishment period of the Cluster, we have been actively seeking common ground among our thematically diverse projects. This process unfolded through online and in-person meetings, within the full Cluster as well as in smaller, focused sub-clusters. These exchanges have been inspiring—revealing the remarkable thematic potential we collectively represent—and at the same time challenging. Nevertheless, this formative stage has led to the creation of two promising sub-clusters with strong potential for future collaborative research. More importantly, it has fostered a deep mutual understanding of our members' expertise, laying the groundwork for developing larger, integrated projects on water and biodiversity management and conservation.

This brochure reflects not only the diversity of our scientific expertise, but also the collaborative spirit and research capacity that define the AQUA-WISE Cluster. It serves as both a showcase and an invitation—for external partners, policymakers, and researchers—to join in future collaborations. As we move beyond the initial two-year phase, the Cluster will continue to grow as a vibrant platform, driving forward joint initiatives across Europe and transforming water and biodiversity research into real-world impact, thereby connecting knowledge to action, empowering innovation, and building a sustainable future where water and biodiversity thrive together.

David Hořák & Kamila Kinštová

WETZONE

Biological diversity of overgrowing transition zones at fish ponds in Třeboňsko PLA: State evaluation and solutions

Water4All
Water security for the planet

Abstract

Třeboňsko Protected Landscape Area (PLA) is dominated by fishponds that today face a new nature protection challenge. Over the last decades, protection of the PLA has led to decreasing intensity or absence of management in wetlands, apart from the ponds themselves. However, in large-scale protected areas such as PLAs, there is a need to actively manage valuable habitats that, despite representing the core values of the area, are under threat due to changes in land management. This is the case for vegetation succession in wetland habitats that are affected by fishing management. The crucial parts of wetlands are transitional zones of ponds, which create a moisture gradient that supports diverse communities of wetland plants and animals. However, in their current state, these zones have become interrupted or completely covered by the early successional stages of woody species, especially Salix sp. (willow). This situation requires a new and active approach to nature and landscape protection in the Třeboňsko PLA, for which there is a lack of an adequate expert knowledge and baseline data. The WETZONE project thus seeks to expand the knowledge base on wetland biodiversity and contribute to the improvement of natural environments.

Overall, we have established 27 study areas in 19 broader locations of the Třeboň region. Microclimatic conditions are monitored using Minikin dataloggers. Supporting GIS analysis is based on processing available map data, and quantifying and visualizing the types of wetland vegetation studied. Biodiversity is assessed using the following groups of organisms: birds; selected insect groups; spiders; zooplankton; and selected plant groups. The selection of focal taxa takes into account (i) their significance/representativeness for wetland biodiversity, (ii) the visual aspects of the environment, which are strongly related to human interest in the natural environment, (iii) the functioning (food chain) of the wetland ecosystem, and (iv) and also the ability to assess biodiversity adequately within the given timeframe.

Additionally, experimental management intervention has been initiated in order to assess the rate of change in biodiversity after the removal of encroaching woody species at the experimental Farský Pond site. During the two-year establishment period of the Cluster, we have been actively seeking common ground among our thematically diverse projects. This process unfolded through online and in-person meetings, within the full Cluster as well as in smaller, focused sub-clusters. These exchanges have been inspiring—revealing the remarkable thematic potential we collectively represent—and at the same time challenging.

Aims

- To assess temporal changes and the impact of the overgrowth of fishpond transition zones in Třeboňsko PLA by woody plants on the structure of ecological communities in selected taxa of animals and plant community types.
- To compare the currently most represented wetland zone types, namely (i) low wetland vegetation, (ii) reed beds, (iii) willow growths; which also represent different phases of succession and parts of the ecological gradient.
- To evaluate spatial patterns at the landscape scale.
- To establish an experimental site to evaluate the effects of woody plants elimination on temporal changes in community structure and describe microclimatic conditions in the studied biotopes.
- To provide the state administration and the professional community with up-to-date information on the diversity of changing wetland habitats in the Třeboň region and, through evaluating practical management interventions, identify solutions that support the biological value of Třeboňsko wetlands.

Keywords

Biotic communities, Ecosystem services, Experimental approaches, Invasive species, Temporal change, Water quality

Project Coordinator

David Hořák, Charles University

Project Members

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Funding Institution

Technology agency of the Czech Republic

Duration

3 years

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BIO-JUST
BIOdiversity and ecosystem protection driven by Environmental JUSTice

Water4All
Water security for the planet

Abstract

BIO-JUST is an international research project that explores the factors and conditions influencing whether nature-based solutions (NbS) can advance both environmental sustainability and social justice. The project is Coordinated by the German Institute of Development and Sustainability (IDOS) bringing together institutions from Europe and Latin America, including Wageningen University & Research (The Netherlands), Universidade Federal do ABC (Brazil), Bureau de Recherches Géologiques et Minières (France), Universidade de Lisboa (Portugal), Associação Natureza Portugal–WWF (Portugal), and Société Anonyme des Eaux Minérales d'Évian, Danone Group (France), and the Universidad de La Laguna (Spain).

The project's overall goal is to analyze how water-related NbS (such as wetland restoration or aquifer recharge) can contribute to biodiversity protection and climate resilience, while ensuring fair distribution of benefits and inclusive participation in decision-making. Drawing on concepts from environmental justice and political ecology, BIO-JUST examines the social, economic, governance, and other dimensions that determine when NbS can truly deliver "win–win" outcomes for people and nature.

In Spain, the research is carried out by a team of social scientists (social anthropologists) from the Instituto Universitario de Investigación Social y Turismo (ISTUR) de la Universidad de La Laguna, focusing on the island of La Palma (Canary Islands). Their study analyses the hydraulic closures of the island's water galleries, a type of underground dam technology. These closures reproduce La Palma's volcanic hydrogeological structure to control groundwater flow and recharge aquifers, aiming to balance water use with ecosystem restoration, while generating ecological, social, and economic benefits.

Through interviews, policy analysis, and community engagement, the ULL team investigates the social, political, economic, and environmental implications of this technology: how decisions are made, who benefits, and what challenges emerge. In a context of climate change and growing tourism pressure, this research seeks to identify pathways for equitable and sustainable groundwater management, contributing to BIO-JUST's broader mission of linking biodiversity protection with environmental justice.

Aims

This study aims to investigate the current use and management of groundwater resources on the island of La Palma, with a special focus on its springs and their environmental, social, and economic benefits. This work is undertaken through analyses of the measures for environmental protection and hydraulic planning that have been established to conserve and restore these water sources. In addition, the research team is examining and evaluating the implementation, outcomes, and potential impacts of such measures on the springs and, more broadly, on the island's groundwater systems.

Keywords

Nature-based solutions, Groundwater conservation, Protection of springs, La Palma, Canary Islands, Spain

Project Coordinator

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Funding Institution

Agencia Estatal de Investigación (AEI) – Spain. PCI2022-135044-2 funded by MCIN/AEI/10.13039/501100011033 and by the European Union NextGenerationEU/PRTR

Duration

3.5 years

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GRiWA

Greener rivers in the warming Arctic? Anticipating the short- and long-term effects of additional nutrient inputs.

Water4All
Water security for the planet

Abstract

Invasive pink salmon (Oncorhynchus gorbuscha), introduced originally to Kola Peninsula by Russians, has in recent years had mass occurrences in the northernmost European rivers. Pink salmon differs from the native fish species by having an anadromous and semelparous life cycle: all returning adults die after spawning, with large numbers of carcasses remaining in rivers and on riverbanks. In its native distribution area, the north Pacific Ocean and adjacent regions of the Bering Sea and Arctic Ocean, pink salmon and the marine-derived nutrients released from their carcasses are key resources for rivers and their terrestrial surroundings. Thus, pink salmon carcasses and nutrients released from them could be an important additional resource also for inherently oligotrophic European Arctic ecosystems. Similarly, nutrient status in Arctic areas is likely to change in response to multiple other ongoing climate change related drivers such as intensifying land use, altered precipitation patterns and permafrost thaw. These additional resources have potential to boost northern river ecosystems giving them an opportunity to become more productive, but that will likely happen at the cost of changes in the native community of producers and consumers and, in the end, at the cost of native biodiversity. Consequently, adding to the long list of threats to Arctic freshwater biodiversity, climate change related nutrient inputs may challenge the sustainability of ecosystem services with significant likelihood for societal effects.

The GRiWA project focuses on the dichotomy of threats versus opportunities related to climate change related additional resources using pink salmon as an example, aiming to reveal its direct and indirect food web effects in the inherently poor arctic nature. For this purpose we use a combination of correlative field data and experimental approaches. Experimental approaches include both controlled mesocosm and manipulative field experiments. Using state-of-the-art field and laboratory protocols we collect and analyze data, for example, on riverine benthic communities (algae, bacteria, invertebrates), ecosystem functions (primary production, decomposition, metabolism) and related environmental variables (nutrient availability, habitat structure, climate). Our field research sites are located in northernmost Finland and Norway. Mesocosm experiments are run in Paltamo, Finland. Potential effects are studied at different temporal scales from immediate to short- and long-term.

Aims

- To explore the potential of additional climate-change related resource inputs to alter the rates of ecosystem functions and change community structure of the native biota, and to identify the winners and losers of potential community change.
- To study the potential cascading effects of additional resources across riverine food webs and aquatic-terrestrial ecosystem boundaries.
- To advance the understanding of potential effects of additional resources at different temporal scales from weeks to decades.
- To provide scientific data to evaluate the severity of the ecological, and consequent societal impacts of pink salmon invasion to evaluate the need for preventing and mitigating measures.

Keywords

Biotic communities, Ecosystem services, Experimental approaches, Invasive species, Temporal change, Water quality

Project Coordinator

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Project Members

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Funding Institution

Research Council of Finland

Duration

4 years

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HymoGuide
Developing guidelines for regulatory standards in hydromorphology

Water4All
Water security for the planet

Abstract

The HymoGuide project, which is funded by the Irish Environmental Protection Agency (EPA), aims to provide recommendations for the setting up of guidelines and standards for hydromorphology, to support the development of regulations in Ireland. This work is being conducted through an integrated research design employing critical review and synthesis of existing knowledge, data analyses involving the testing of methods, tools and datasets, and stakeholder participation and engagement.
The term 'hydromorphology' which has gained momentum in scientific and policy circles since the inception of the Water Framework Directive (WFD, 2000/60/EC) in 2000, describes the hydrological and geomorphological character and function of surface waterbodies, namely rivers, lakes, and transitional and coastal (TraC) waters. Fundamentally, hydromorphological states are dynamic, reflecting complex process-response interactions that operate across a range of spatial and temporal scales. The HymoGuide project is therefore predicated on an understanding that a process-oriented approach must be at the core of hydromorphological assessment methods and tools, including the evaluation of the effectiveness of mitigation measures.

HymoGuide is set within the context of the 3rd Water Framework Directive Cycle (2022-27), which has identified the pressing need to address hydromorphological degradation, initiate its remediation and support nature-based solutions (NbS) in future interactions with aquatic resources. Pressures on hydromorphology have been identified as one of the principal threats to surface water quality in Ireland, second only to agriculture in terms of the number of water bodies affected. Alongside critical review and empirical evaluation of methods and tools, an integral part of the HymoGuide study is the bringing together of stakeholders across all sectors in Ireland, to capture the needs and experience of practitioners, and to investigate the level of current stakeholder interactions and data sharing, in hydromorphology-related activities.

The results from HymoGuide will support activities related to the assessment of hydromorphological pressures, build on current understandings of the linkages between hydromorphology, ecology and specific biological quality elements (BQEs), and provide an evidence-base for the implementation of mitigation measures.

Aims

- The overall aim of the HymoGuide project is to provide recommendations that will inform the development of guidelines and standards for the regulation of activities in Ireland that require assessment of hydromorphological impact and the benefits of measures.
- The specific objectives are to:
- Review and assess the state of knowledge, methods and tools, including linkages between hydromorphology and ecology, and identify knowledge gaps.
- Test and assess methods and tools for hydromorphology assessment in an Irish context.
- Produce an evidence base for the development of guidelines and standards for hydromorphology in Ireland across all surface waterbodies, integrating stakeholder requirements and experiences.

Project Coordinator

Jonathan Turner, University College Dublin

Project Members

John O'Sullivan, University College Dublin; **Mary Kelly-Quinn,** University College Dublin; **Zoe Rosenblum,** University College Dublin; **Juan Quintero,** University College Dublin; **Mattie O'Hare,** cbec eco-engineering, UK; **Colm Casserly,** cbec eco-engineering, UK; **Willliam Roche,** Inland Fisheries Ireland

Funding Institution

Environmental Protection Agency (Ireland)

Duration

3 years

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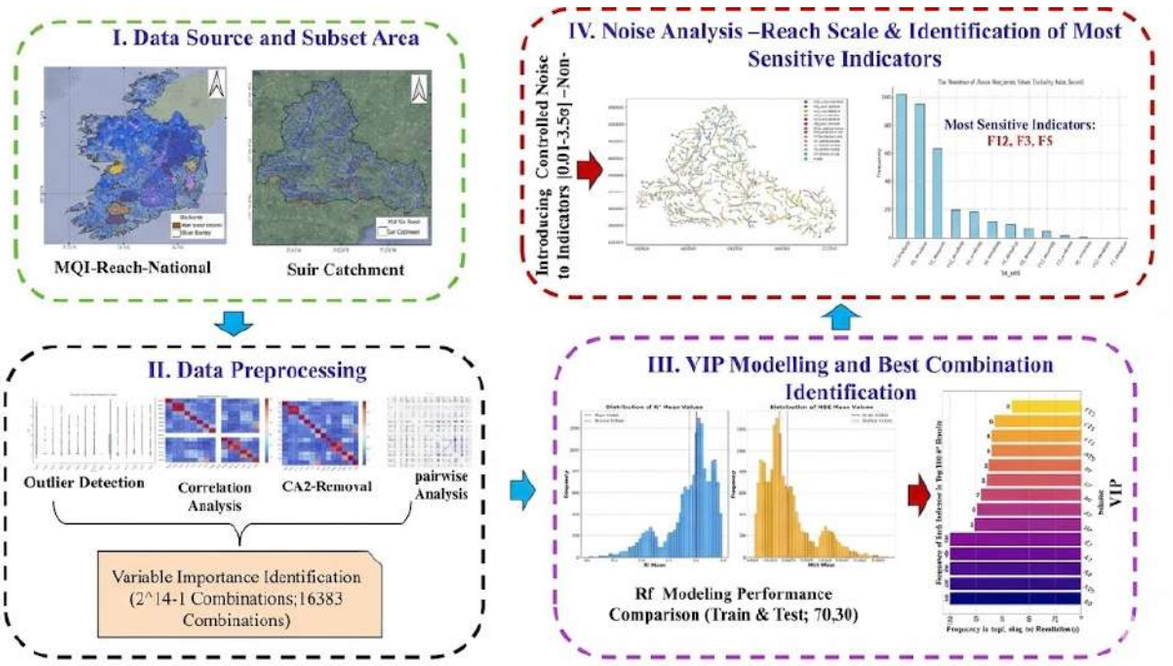
Keywords

Hydromorphology
Surface Water Bodies
Methods and Tools
Guidelines and Standards
Water Framework Directive
Stakeholders



NATURA
Nature-based Solutions for Resilient Adaptation to Water Scarcity and Hydroclimatic Extremes

Water4All
Water security for the planet

Abstract

Water scarcity and hydroclimatic extremes—intensified by climate change—pose an existential threat to societies and ecosystems, depressing regional GDP growth, causing extensive human losses, and inflicting trillions in damages. The European Green Deal and national adaptation plan increasingly promote Nature-based Solutions (NbS) as resilient pathways to cope with droughts and floods while generating multiple co-benefits. However, adoption remains limited due to socioeconomic barriers: uncertainty about performance under extremes and climate change; lack of supportive financial and regulatory instruments; inadequate valuation of co-benefits; and limited integration into decision-making tools used by stakeholders.

NATURA addresses these barriers by developing economic, regulatory, and disaster risk financing instruments and by operationalizing an ecosystem of innovation that combines: (1) knowledge networks for inclusive stakeholder engagement and capability building; (2) an actionable socio-ecological ensemble modeling suite integrated with stakeholders' Decision Support Systems (DSS); and (3) three living labs to co-design, co-develop, co-evaluate, and co-implement NbS in distinct European river basins: Douro (Spain), Reno (Italy), and Nitra (Slovakia). The modeling suite links climate, hydrologic, agronomic, micro- and macroeconomic models via a modular multi-system, multi-model, multi-scenario approach, explicitly assessing uncertainty and two-way feedbacks between human and natural systems. Integration with AQUATOOL, TOPKAPI, and MIKE, and with actuarial models used by insurers, will enable robust assessment of NbS performance and risk-reduction potential.

Through iterative scenathons and Talanoa-inspired dialogues, NATURA's knowledge networks will catalyze co-creation across public authorities, insurers, investors, NGOs, and water users, aligning governance, finance, and technical design. The project targets: deployment of a NATURA-enabled DSS in each lab; design and testing of 10+ synergistic adaptation strategies per lab (combining NbS with economic, regulatory, and risk financing instruments) with at least one adopted; establishment of 5+ "inspiration labs" for replication; and mainstreaming of results into national and EU strategies (e.g., Green Deal, climate adaptation, green infrastructure). Over 24 months, NATURA will deliver actionable science and unlock pathways for resilient NbS adoption—upscaling their contribution to water security, climate adaptation, disaster risk reduction, and sustainable development in the EU.

Aims

- Develop and integrate a modular socio-ecological ensemble modeling suite with stakeholders' DSS to generate actionable, uncertainty-aware evidence on NbS performance under water scarcity and extremes.
- Co-design, test, and inform adoption of NbS coupled with economic, regulatory, and disaster risk financing instruments, including insurance-linked mechanisms.
- Demonstrate feasibility, performance, and co-benefits of NbS through iterative co-creation in three living labs (Douro, Reno, Nitra).
- Build multi-sector knowledge networks to enhance capability, advocacy, and market acceptance, and to operationalize novel financing for sustained NbS investment and updating.
- Replicate and upscale by establishing 5+ "inspiration labs" and synthesizing results to inform national and EU strategies on water management, green infrastructure, climate adaptation, and disaster risk reduction.

Project Coordinator

Carlos Dionisio Pérez Blanco, IMDEA Water Institute

Project Members

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Collaborating stakeholders in the three living labs:
Douro River Basin (Spain): River basin authority and water users
Reno River Basin (Italy): Regional authorities and technical partners
Nitra River Basin (Slovakia): Water agencies and local stakeholders

Funding Institution

Agencia Estatal de Investigación (AEI), Ministerio de Ciencia e Innovación, Spain, co-funded by the European Union (NextGenerationEU) under the Plan de Recuperación, Transformación y Resiliencia.

Duration

2 years

Contact

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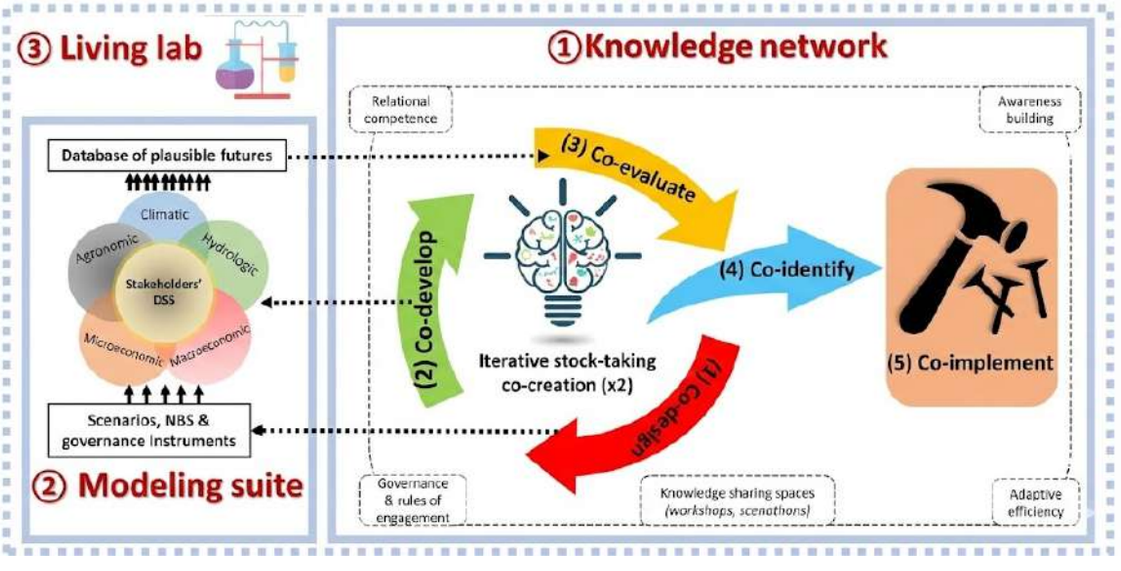
Keywords

Nature-based Solutions (NbS)
Socio-ecological modelling
Ensemble uncertainty
Disaster risk financing
Water scarcity and floods
Co-creation living labs



STRIPCROPP
Strip cropping management as an adaptation measure to optimize landscape water management

Water4All
Water security for the planet

Abstract

Intense torrential rain causes soil erosion, which removes valuable topsoil in the form of sediment, which can end up in aquatic ecosystems - watercourses, ditches, reservoirs and wetlands. The damage this can cause is not only ecological, but also economic. Soil retained in reservoirs, watercourses, wetlands must then be removed (e.g. through dredging), which creates additional costs.

The solution is provided by the STRIPCROPP project and the technology of strip crop management. It can limit water erosion, prevent overheating of the soil and retain water in the landscape. Strip crop rotation, which utilizes the protective effect of vegetation cover, involves the regular rotation of strips of crops with low erosion control effects (root crops, corn, sunflowers, etc.) and strips of crops with a high erosion control effect (grassland, perennial forage crops, densely sown cereals, legumes, etc.) established in the direction of the contour lines or in a direction close to the contour. Strips of crops with different erosion control effects must be alternated so that when precipitation falls, the water flowing from the protected strip and falling on it directly is retained on the protective strip and infiltrates into the soil.

Strip cropping as a soil conservation measure offers significant benefits for aquatic ecosystems. It reduces erosion and runoff in watersheds, thereby reducing the transport of sediments into aquatic ecosystems, and sediments-borne nutrients, herbicides, and pesticides that can cause eutrophication and have a very detrimental impact on aquatic life. This is the crucial contribution of strip cropping and the fundamental link between strip cropping and other activities. These strip farming systems reduce soil erosion and sediment transport, thereby also having a positive effect on reducing flood risk in built-up areas.

In addition to soil protection, strip cropping farming also promotes increased soil retention capacity, enhances biodiversity and landscape diversity, thereby improving crop productivity and climate. It also significantly increases the diversity of the soil edaphon – the number of bacteria, fungi, and algae that increase soil retention capacity. Strip crop rotation also contributes to wildlife protection. On large fields, animals are eliminated by agricultural machinery. However, if the field is divided into strips and agricultural machinery only moves in one strip, the animal has a chance to move to the side strip, which provides it with protection.

Aims

- The aim of the project STRIPCROPP is to provide a comprehensive view of strip crop management as an adaptation measure to optimize water management in the landscape, and its effectiveness on erosion and runoff conditions.
- One of the aims is also to verify the positive effect of strip crop management on the physical, chemical and biological properties of soils.
- Another aim is reduction of soil erosion and sediment transport during rainfall-runoff events will also reduce the volume of sediment and associated nutrients and agrochemicals into water ecosystems.
- The strip crop management also supports the enhancement of biodiversity.
- The implementation of protected and buffer strips and grasslands on stabilization and manipulation areas lead to the storage of more carbon in the soil and support a greater number of plant and animal species.

Keywords

Strip cropping management, Erosion and runoff conditions, Soil and water conservation, Water and wind erosion, Hydropedology, Biodiversity

Project Coordinator

Miroslav Dumbrovský, Brno University of Technology

Project Members

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Funding Institution

Technology agency of the Czech Republic

Duration

3 years

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Wetland Hemiparasite

Development of technology for growing seeds of hemiparasitic plants and its application in invasive species reduction in lowland meadow wetlands

Water4All
Water security for the planet

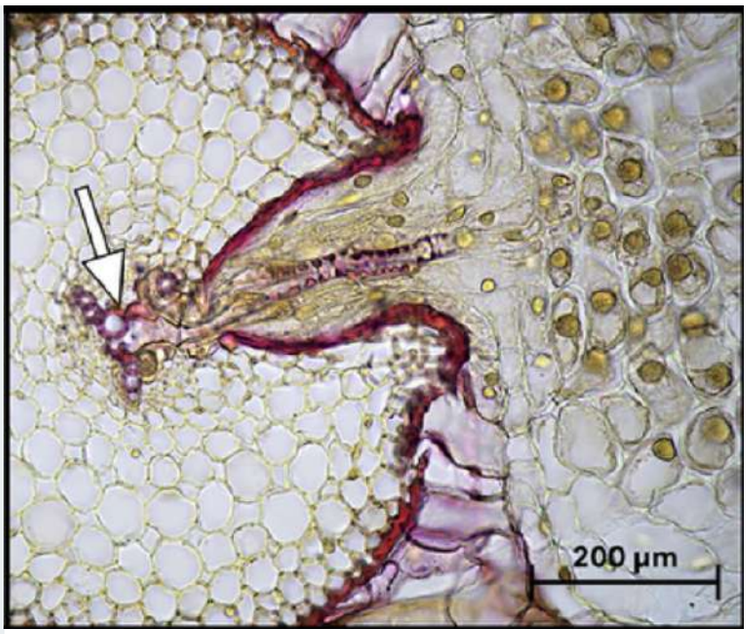
Abstract

Wetlands have historically served as critical water reservoirs, natural climate regulators, and habitats for diverse ecological communities. However, in recent decades, they have become increasingly endangered due to the proliferation of invasive species such as Symphyotrichum lanceolatum (asters), and Solidago spp. (goldenrod), resulting in reduced biodiversity and the dominance of homogeneous plant communities. These ecosystems are indispensable for their roles in water retention, biodiversity support, and landscape stability. The Wetland Hemiparasite project introduces an innovative environmental strategy aimed at the restoration of degraded wetlands.

The project combines the use of hemiparasitic species, Odontites vernus and Melampyrum arvense, with grazing and mowing to control invasive plants overgrowth. These hemiparasites parasitize the underground organs of invasive species, providing a more effective control method than conventional grazing or mowing alone, which only removes aboveground biomass. This integrated management approach is expected to restore the landscape and strengthen ecological stability.
In addition, the project includes comprehensive biodiversity monitoring of plants and arthropods in wetlands threatened by plant invasions. A multidisciplinary methodology will allow valuable insights for future wetland care practices, contributing to the conservation and restoration of these critical ecosystems.

The expected outputs include a Summary Research Report, which will detail new findings on the restoration of lowland wet meadows through the sowing of Odontites vernus and Melampyrum arvense combined with maintenance by mowing and grazing. Furthermore, approved Methodologies will introduce methodologies validated by relevant authorities for (i) using hemiparasitic plants to suppress invasive species in lowland wetland habitats (sowing procedures, optimal seed quantities, aftercare), and (ii) cultivating seeds of Odontites vernus and Melampyrum arvense, significantly increasing seed availability.

This project has the potential to significantly contribute to the conservation and restoration of wetlands, reestablishing their ecological functions. Results will be disseminated through methodologies, workshops, and educational materials, benefiting both scientific research and practical applications.



Aims

- Develop and test efficient methods for cultivating hemiparasitic plant seeds.
- Assess the impact of these plants on invasive species and overall biodiversity in wetland ecosystems.
- Assess the impact of grazing and mowing on vegetation.
- Perform comprehensive biodiversity monitoring of plant and invertebrate communities, including arthropods and rare wetland species.
- Create methodologies and tools for practical applications in wetland habitat restoration.

Keywords

Ecological restoration, Eutrophic habitats management, Hemiparasite, Melampyrum arvense, Odontites vernus, Plant invasion

Project Coordinator

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Funding Institution

Technology Agency of the Czech Republic – Funding Institution
Masaryk University – Lead institution
Mendel University in Brno – Partner Institution

Duration

3 years

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WET-PEAT
Re-wetting of peatlands for enhanced restoration

Abstract

Ireland's peatlands, occurring as raised bogs, blanket bogs or fens, host specialised plant and animal communities, which contribute to global biodiversity, carbon regulation and other ecosystem services. However, exploitation has reduced the habitats' distribution and damaged their ecohydrological functioning. In particular, cutaway bogs, produced by large scale industrial production, have resulted in peat compaction, peat instability, impacted soil chemistry and exposure of underlying substrates. Similar issues exist, albeit at a smaller scale, for cutover bogs, that have been domestically cut for peat, but which generally have greater and more variable depths of peat remaining.

There is currently significant work underway in Ireland to restore degraded peatlands, cutaway and cutover bogs. This includes the creation of bunded wetland areas, raising of main outfalls, blocking of drains and outfalls, fertiliser application to encourage plant growth, and the transplantation of wetland plants. However, these types of rehabilitation present issues such as nutrient release, potentially altered hydrology, and silt run-off.

WET-PEAT applies state-of-the-art modelling techniques to a representative selection of Ireland's peatlands to provide a data and model-informed evaluation of the ongoing restoration work and, where needed, to conceptualise design, construct and evaluate alternative enhancement measures. As part of this work, hydrological and ecohydrological modelling is used to evaluate the impact of restoration on hydrology and water quality, vegetation growth and carbon emissions. The work is supplemented by drone and satellite data, combined with ground truthing, to model water depths and the progress of vegetation growth after rewetting.

Aims

The specific objectives are to:

- Provide independent assessment of current peatland restoration work in Ireland and supplement existing data collected at specified study sites.
- Deliver recommendations for any changes in management and execution of the restoration programme.
- Assess, measure and evaluate water quality parameters and flows from peatlands after restoration.
- Evaluate the overall benefits and drawbacks associated with improvements and alterations to catchment flows.

Keywords

Peatlands, Re-wetting, Water quality, Computational modelling, Machine learning

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4 years

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Vision for Future Collaboration

Subcluster NATURA, STRIPCROPP and BIO-JUST

Within AQUA-WISE – the Water4All TAP Action on Water and Biodiversity – the projects **NATURA** (Instituto IMDEA Agua, Spain), **STRIPCROPP** (Brno University of Technology, Research Institute for Soil and Water Conservation, Palacký University Olomouc and agricultural enterprise Rostěnice a.s., Czech Republic), and **BIO-JUST** (Instituto Universitario de Investigación Social y Turismo – Universidad de La Laguna, Spain) form a dynamic subcluster that promotes collaboration toward shared goals in biodiversity, sustainability, and environmental justice and governance. By analysing and implementing socio-ecological ensemble models, nature-based solutions, and adaptation measures, the subcluster works to promote water management and soil and water conservation. The partnership brings together complementary expertise and anthropological, engineering, and economic perspectives to address water-related challenges.

In October 2024, the BIO-JUST team organised a research seminar at the Facultad de Ciencias Sociales y de la Comunicación of the Universidad de La Laguna, with active participation from members of the NATURA and STRIPCROPP projects. Additionally, STRIPCROPP and BIO-JUST met several times (on the island of La Palma and in the Czech Republic) to hold meetings at universities and in local towns with interdisciplinary colleagues and stakeholders, share experiences, methodologies, and results, and visit sites where both teams conduct their respective research.

Another joint initiative between NATURA and BIO-JUST was a serious game held on the island of La Palma in September 2025, designed as a participatory research activity on water management. The game brought together more than twenty participants to critically assess a range of water-management policies and explore their potential effects. Through this interactive process, it fostered dialogue, reflection, and the exchange of diverse perspectives among researchers, farmers, policymakers, ecologists, technical experts, local water communities, public-administration representatives, and residents. The main goal was to promote constructive discussion and build a shared understanding of the trade-offs and challenges involved in local water governance under changing environmental conditions.

Building on these shared experiences, the subcluster is now planning new collaborative activities, such as co-developed **policy recommendations**, joint scientific publications, **cross-regional case-study comparisons**, and **transferable tools.** These efforts will further strengthen the connection between the projects and enhance their overall impact. **Through coordinated research and stakeholder engagement, the subcluster aims to co-create actionable knowledge and innovative practices that deliver practical solutions to improve water resilience, strengthen biodiversity, and support just and inclusive environmental governance.**

Vision for Future Collaboration

Subcluster WHIRL: GRiWA, Hemiparasite, HymoGuide, WETPEAT and WETZONE

Across our network of projects — **GRiWA**, **HEMI-PARASITE**, **HymoGuide**, **WETPEAT**, and **WETZONE** — we share a commitment to understanding and safeguarding aquatic and wetland ecosystems in the face of rapid environmental change. While each project has its distinct expertise and focal questions, the common ground between them forms a powerful platform for integrated research, innovation, and conservation action.
Our collaborations are anchored in shared thematic pillars: **biodiversity**, **ecosystem functioning**, **spatial heterogeneity**, and **restoration ecology**. Together, these pillars provide the conceptual framework for advancing ecological understanding from the microbial scale to entire landscapes.

Linking Biodiversity and Ecological Processes
The intersection of **ornithology, entomology**, **community ecology**, and **invasion biology** across WETZONE and HEMI-PARASITE opens the door to novel insights into how species interactions shape diversity patterns and functional resilience. By combining these perspectives with GRiWA's expertise in spatial structuring of freshwater ecosystems and nutrient enrichment dynamics, we can examine biodiversity as both a driver and a consequence of ecosystem processes. This synergy will enable us to better predict how ecological communities respond to environmental pressures, from invasive species to eutrophication, and to design interventions that promote stability and recovery.

Spatial and Temporal Heterogeneity as an Unifying Lens
Heterogeneity — in habitat structure, nutrient distribution, and hydrological regimes — emerges as a recurrent theme across our collaborations. WETZONE's spatial ecology approach, GRiWA's focus on freshwater environments structure, HymoGuide's involvement in process-based catchment/reach-scale science and restoration, and WETPEAT's work in peat bog revitalization together provide a rich foundation for understanding how variation in space and time governs ecosystem trajectories. Through comparative analyses across wetlands, lakes, and peat bogs, we can uncover generalizable principles of heterogeneity that apply across ecosystem types and climatic regions.

From Microbes to Landscapes
The linkage between WETPEAT and GRiWA in studying **microbial communities and activity** offers a fine-scale view of biogeochemical processes that underpin greenhouse gas (GHG) fluxes, nutrient cycling, and overall ecosystem health. When these microbial insights are scaled up to WETZONE's landscape-level perspectives, we create a multi-scale research framework capable of tracing ecological change from microscopic processes to regional patterns.

Restoration as a Shared Objective
Wetland restoration represents a clear point of convergence for our efforts. WETPEAT's focus on rewetting peat bogs, HymoGuide's focus on hydromorphology, WETZONE's landscape-based approach, and GRiWA's expertise in nutrient management together form an integrated toolbox for revitalizing degraded ecosystems. By working collaboratively, we can explore the biodiversity outcomes, carbon balance, and hydrological impacts of restoration initiatives, using comparative sites at various stages of recovery — including the newly established Czech climatic data collection station — as a living laboratory.

- **Peatland rewetting and climate mitigation** (WETPEAT, WETZONE) employ hydrological engineering, vegetation management, and long-term monitoring to assess changes in greenhouse gas fluxes and biodiversity recovery.
- **Control of invasive and expansive plant species** through the use of hemiparasitic plants (HEMI-PARASITE) offers an innovative, nature-based solution to restore habitat diversity and suppress monocultures.
- **Catchment-scale restoration approaches** (WETZONE, WETPEAT, GriWA, HymoGuide) integrate land–water interactions, nutrient management, and habitat connectivity for holistic ecosystem recovery.
- **Spatial structure optimization in aquatic systems** (WETZONE, GRiWA) helps identify how nutrient regimes and hydrological connectivity influence restoration trajectories.

A Roadmap for Collaborative Action
In the coming years, we envision a networked research agenda that:

- Integrates biodiversity monitoring across taxa, from microbes, macroinvertebrates, to vertebrates using standardized protocols to enable robust cross-site comparisons.
- Links nutrient dynamics and spatial heterogeneity to ecosystem function, with special emphasis on predicting tipping points in lake and wetland systems.
- Expands restoration experiments to capture gradients of rewetting, eutrophication, and invasion pressure, using these as opportunities to test ecological theory in applied contexts.
- Leverages shared data infrastructures and modeling tools to synthesize findings across scales and ecosystems.

By embracing the complementary strengths of each project and focusing on our overlapping themes, we can create a **pan-ecosystem research platform** that delivers both fundamental ecological insights and practical solutions for biodiversity conservation, climate change mitigation, and ecosystem restoration. This vision is not just about parallel research — it is about building a **living, collaborative laboratory** in which diverse expertise converges to tackle the urgent ecological challenges of our time.

AQUA-WISE TAP Action cluster

2024 - 2026