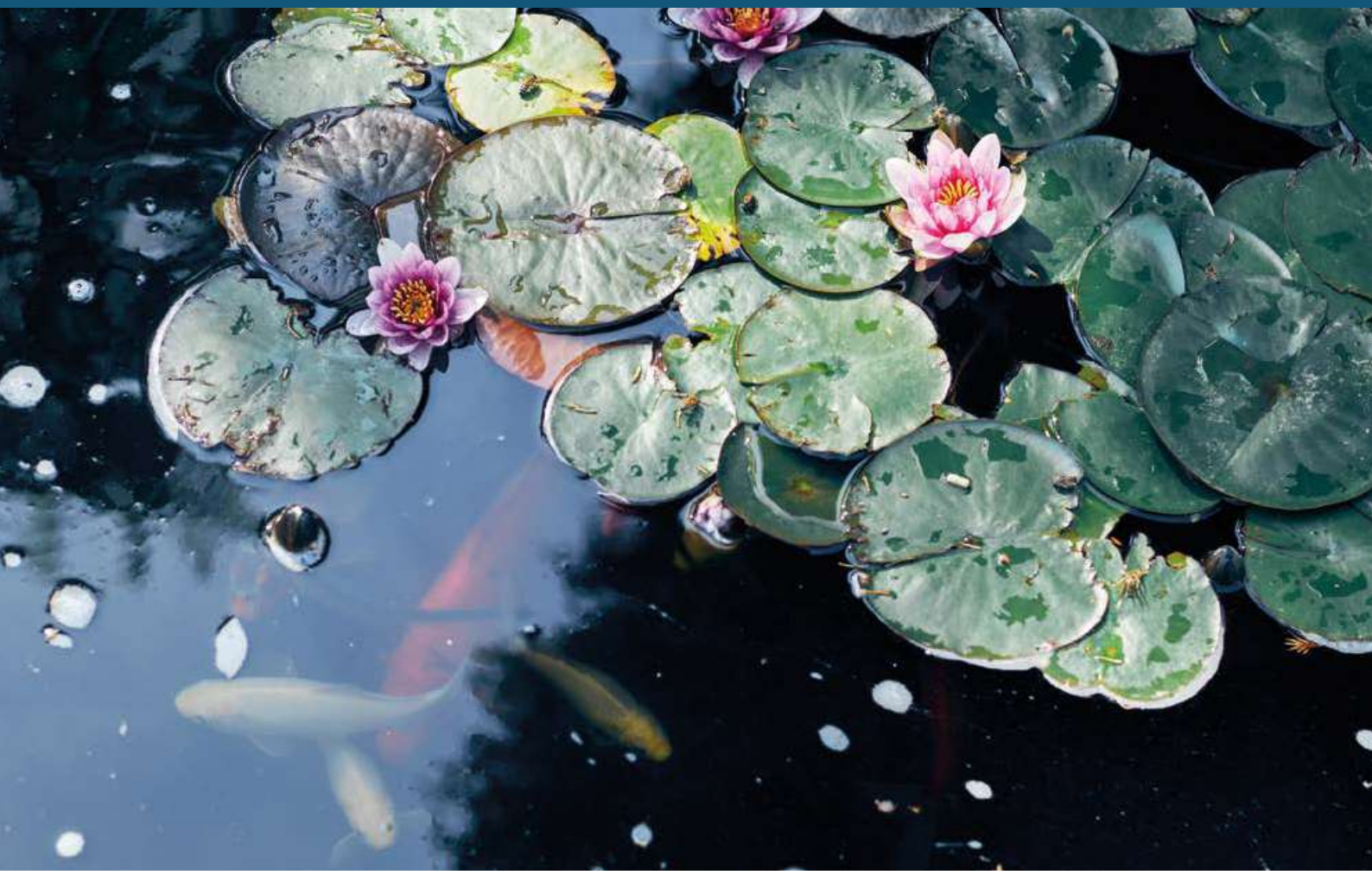
Water4All
Water security for the planet

FUNDED PROJECTS BOOKLET
WATER4ALL 2023 JOINT TRANSNATIONAL CALL

Aquatic Ecosystem Services



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CONTENTS

INTRODUCTION

The Water4All partnership -Water Security for the Planet- started in 2022 under the auspices of the European Union Horizon Europe programme for research and innovation, to concentrate research and innovation on water in Europe and beyond. **Water4All's Vision is to boost the systemic transformations while fostering matchmaking between problem owners and solution providers to ensure water security for all in the long term.**

Alongside other activities, Water4All implements a series of annual Joint Transnational Calls by pooling national financial resources with the participation of ministries, funding authorities and funding organisations. These calls primarily aim to strengthening the Research, Development & Innovation (RD&I) collaboration in the field of water, and producing and sharing top-class water-related knowledge and data.

The 2023 Joint Transnational Call on Aquatic Ecosystem Services is the second call. It was implemented by 36 funding partner organisations from 30 countries, with financial support from the European Union. At the end of a two-step evaluation process, 23 excellent RD&I projects, including nine projects coordinated by early-career researchers, were selected for funding for a total amount of nearly 27 million euros.

OBJECTIVES OF THE 2023 JOINT TRANSNATIONAL CALL

Ecosystems provide what are known as ecosystem service, which offer environmental, health, social, and economic benefits to humans. These services fall into several categories: provisioning services (e.g., food and water production), regulating services (e.g., flow regulation during floods), supporting services (e.g., nutrient cycling and retention), and cultural services (e.g., navigation, swimming). Ecosystem services and water security are closely related, as healthy ecosystems are essential to ensure water quality and availability, and their degradation however, climate change, pollution, overexploitation threaten their ability to provide these services. Adaptation and restoration measures are needed to maintain their functioning. Integrating ecosystem services into decision-making is crucial for human well-being and economic prosperity. However, there are gaps in the assessment and monitoring of aquatic ecosystem services, and transboundary regulations do not always take these services into account.

The Water4All 2023 Joint Transnational Call and its early-career researcher modality aimed to support research and innovation for a better understanding of the status of ecosystem services at varying spatial and temporal scales, underlying pressure factors and integration in the management of water resources. The call sought to deliver knowledge, models, approaches, tools, and methodologies to **integrate ecosystem services** into water resource governance and management at all levels, adapting to global changes; **enhance the mitigation, adaptation, and resilience** of aquatic ecosystems and their ecosystem services; **support EU and international water and biodiversity policies; Increase stakeholder, community, and societal participation** in co-designing water governance and management systems; and **promote comprehensive approaches** to valuing ecosystem services, emphasizing mapping and assessment to achieve policy goals.

THEMES OF THE JOINT TRANSNATIONAL CALL

The general theme of the call was "Ecosystem Services" with a focus on aquatic ecosystems, including inland surface water, groundwater, transitional and coastal water, with water security as a top priority. The 23 research projects of excellence funded under the 2023 Joint Transnational Call and its early-career researcher modality address at least one of the following topics and subtopics.

Topic 1 Mapping, monitor ing, and assessment for a better understanding of ecosystem services in a context of changes, from local to global change

- 1.1 Enhancing the added value of data on the state and trends of ecosystem services: promoting meta-analyses across scales and syntheses of existing data sets.
- 1.2 Supporting a transnational network of harmonized monitoring schemes building upon the work conducted under other initiatives and previous EU projects.
- 1.3 Developing, testing, and comparing methodologies for the biophysical and monetary valuation of ecosystem services in aquatic ecosystems, including intrinsic social and economic values.
- 1.4 Identifying operational ecosystem services metrics that consider the interactions between people and ecosystems.

Topic 2 Understanding and predicting multiple pressures (including anthropogenic pressures) - impact – response relationships in ecosystem services through advanced methods & techniques

- 2.1 Assessing the effect of different anthropogenic pressures from human activities and cumulative effects on ecosystems and ecosystem services.
- 2.2 Improving/Developing approaches aimed at improving our understanding of the impacts of policy interventions for the protection or restoration of ecosystem services at relevant temporal and spatial scales.
- 2.3 Developing innovative approaches for the restoration of aquatic systems (e.g. habitat dynamics, nutrient cycling, trophic relations, morphological conditions, river continuity and connectivity, sediment flows, hydraulic connectivity, groundwater flow, and ecological flow) and ecosystem services.
- 2.4 Analysing the potential for upscaling in space and time successful ecosystem services restoration approaches.

Topic 3 New tools and solutions for a better integration of ecosystem services into the management of water resources

- 3.1 Innovative management and governance strategies for integrating ecosystem services into conservation policies and restoration measures.
- 3.2 Assessing the performance of different governance systems in supporting ecosystem services (resilience, adaptation to global changes, key lessons, failures) and of developing our understanding of existing barriers or resistance in the implementation of ecosystem services frameworks.

BIOTREATED

Advanced bio-based solutions to monitor and mitigate hormonal risks of irrigation waters originating from manure separation technologies

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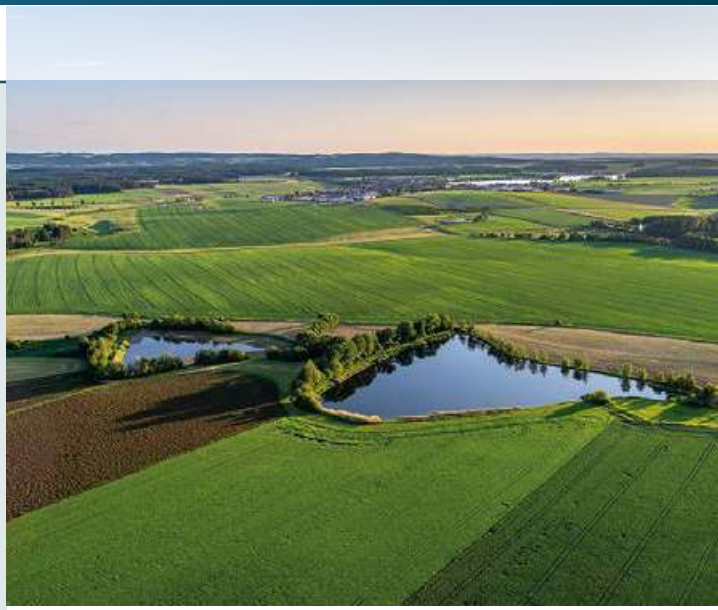
Abstract

In the shadow of climate change, the increasing water scarcity makes it important to use water sparingly and judiciously, including irrigation. At the same time, in the European Union (EU-27) and the UK, more than 1.4 billion tons of manure are produced annually. In compliance with the circular economy concept, the slurry can be reused with separation technologies, dividing the raw material into a liquid and a solid fraction for irrigation and soil fertilization.
However, without treatment, chemical, biological, and hormonal contamination would pose significant anthropogenic pressure on the environment, which often disables direct use. One of these factors is the presence of natural and synthetic steroid hormones originating from the manure of farm animals with a possible impact on the agroecosystem and through environmental transport on human health.
To ensure the safe and sustainable use of slurry-based liquid and solid fractions, the issue of hormonally active compounds should be managed with newly developed, efficient, bio-based technologies and simultaneously monitored with effect-based tools.

BioTreatED provides a new concept for mitigating steroid hormones and hormonally active compounds in slurry-based separated fractions by applying a hormone-degrading microbial consortium and a comprehensive toolkit for monitoring agri- and aquatic ecosystems.
The multidisciplinary research proposal brings together seven research partners from Hungary, Norway, Poland, Portugal, Spain, and Turkey with complementary expertise from different fields to work jointly to increase the quality and availability of Aquatic Ecosystem Services by improving the safety of slurry-based irrigation water originating from the circular economy.

The project is strongly connected to the Water4All Joint Transnational Call as it aims to understand and predict multiple anthropogenic pressures in ecosystem services, performs comprehensive monitoring and mapping with advanced methods to increase our knowledge about the impact-response relationships and develop new tools and solutions for management of water resources.
The applied methods will strongly rely on Aquatic Ecosystem Services and, simultaneously, will improve these services with the insurance of a xenoestrogen-free natural aquatic environment, preserving and increasing biodiversity and protecting wild fish populations.

BioTreatED features a high degree of originality and novelty through the newly developed biotreatment methods and new approaches beyond the state-of-the-art methodologies for analysing hormonal activity. The project's expected outcome is not just the development of functional bacterial consortia but to further improve our knowledge about the environmental transportation and fate of steroid hormones and validate the biotreatment's success.
The safe and sustainable reuse of slurry-based materials would allow the spare of valuable freshwater resources for other (residential, industrial, agricultural) use; therefore, the proposed project could improve the adaptation capacity and resilience of the European community for extreme hydroclimatic events and would simultaneously decrease the anthropogenic pressure on arable lands, groundwaters and surface waters.
The new collaborative network can reach a high scientific, social and economic impact in compliance with the EU Biodiversity Strategy for 2030, the Circular Economy Action Plan, the EU Water Framework Directive, and the EU Habitats Directive.



Project coordinator

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Project partners

- NIBIO - NORWAY
- INSTITUTO POLITÉCNICO DE VIANA DO CASTELO - PORTUGAL
- FUNDACIÓN UNIVERSITARIA BALMES - SPAIN
- INSTYTUT UPRAWY NAWOŻENIA I GLEBOZNAWSTWA - PAŃSTWOWY INSTYTUT BADAWCZY - POLAND
- DOKUZ EYLÜL UNIVERSITY - TURKEY
- MIDDLE TISZA DISTRICT WATER DIRECTORATE - HUNGARY

Funding organisations

NKFIH (HUNGARY) / RCN (NORWAY) / FCT (PORTUGAL) / AEI (SPAIN) / NCBR (POLAND) / TUBITAK (TURKEY)

Duration

3 years

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KEYWORDS

animal husbandry; dairying
livestock raising; agricultural waste
irrigation management
microbiology
nature-based solutions
water and soil pollution

BREATHE

Monitoring river metabolism to assess ecosystem services

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Abstract

Current indicators used in national river health assessment systems (e.g. EU Water Framework Directive) do not reflect well biodiversity, aquatic ecosystem functioning and services as needed for new and proposed policies. Progress in sensor technology over the last 20 years has allowed the continuous monitoring of dissolved oxygen and river metabolism (photosynthesis, respiration, metabolic balance) at unprecedented spatio-temporal scale and resolution.

BREATHE's main objective is to co-design an international sensor-based River Observation System (RIOS) including dissolved oxygen and whole river metabolism to quantify aquatic ecosystem services such as climate regulation, water purification, provisioning fisheries for the implementation of European and global policies (EU 2030 Biodiversity Strategy, European Green Deal net zero greenhouse gas emissions by 2050, United Nations Sustainable Development Goals – notably Water and Sanitation for all.

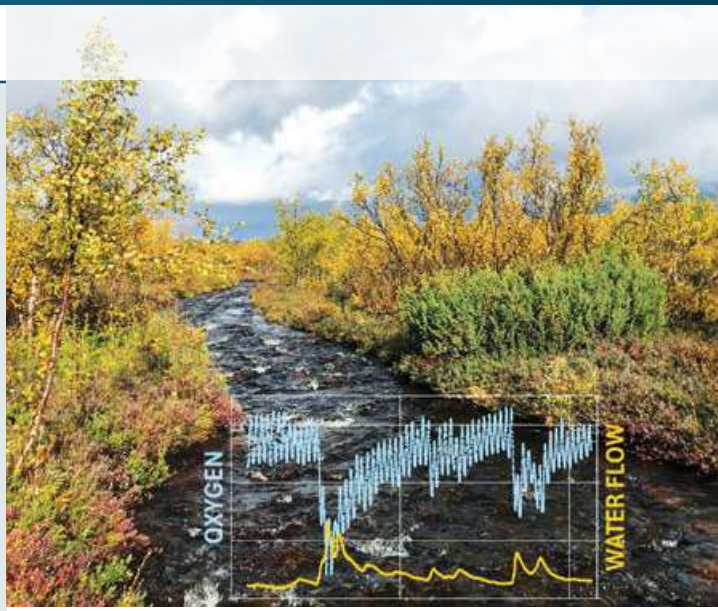
BREATHE will reach this goal by engaging with stakeholders to: first, co-design a workflow from data collection to storage, integration and modelling, and second, co-construct case studies to demonstrate how the workflow may be applied at the local scale and integrated internationally.

The case studies are including key environmental issues in six countries:

- forest restoration (Brazil),
- water scarcity (Spain),
- multiple stressors (Switzerland),
- urban anoxia (United Kingdom),
- water regulation (Norway) and
- peatland restoration (Sweden).

BREATHE will not only identify commonalities among regions, sharing solutions to barriers of implementation, but also focus on region-specific needs in aquatic ecosystem services and policies. Patterns, processes and experiences from low latitude might become future scenarios for higher latitudes.

BREATHE will provide guidance documents to optimise the development of monitoring networks, harmonise data collection and integration, and the modelling of the effect of drivers or remediation actions (restoration) on river ecosystem services.



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Project partners

- UMEÅ UNIVERSITY - SWEDEN
- AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÍFICAS - SPAIN
- UNIVERSITY OF BRISTOL - UNITED KINGDOM
- ECOLE POLYTECHNIQUE FEDERALE DE LAUSANNE - SWITZERLAND
- FEDERAL UNIVERSITY OF SÃO JOÃO DEL-REI - BRAZIL

Funding organisations

RCN (NORWAY) / FORMAS (SWEDEN) / AEI (SPAIN) / EPSRC UKRI (UNITED KINGDOM) / SNSF (SWITZERLAND) / FAPEMIG (BRAZIL)

Duration

3 years

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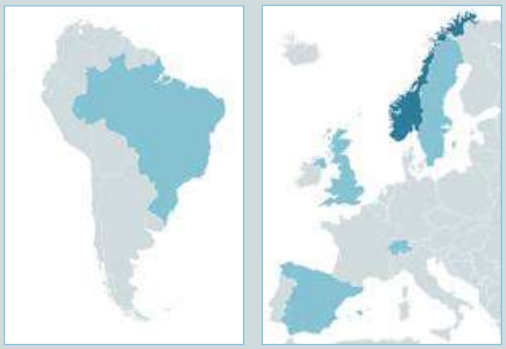

KEYWORDS

river monitoring
in-situ sensor
dissolved oxygen
river functions
ecosystem services

CREATE

Cross-REalm modelling and assessment of Aquatic ecosystem services: Towards a science-based design of nature-based solutions to tackle Eutrophication.

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Abstract

General Objectives:
CREATE addresses knowledge gaps currently hampering the efficient implementation of NBS targeting eutrophication in the Baltic Sea catchment area. The project will identify, assess, and map key ecosystem services (ES) affected by eutrophication, revealing their interconnections. It will then prioritize and spatially align Nature-based Solutions (NBS) to optimize ES supply, minimizing trade-offs and enhancing synergies. CREATE also ensures policy uptake by promoting NBS integration into management practices across the freshwater-coastal-marine continuum.

Scientific Aims:
CREATE will develop ES models spanning freshwater, coastal, and marine realms, accounting for complex ecosystem processes and the condition of ecosystems responsible for the supply of ES. Eutrophication dynamics will be central, enabling a dynamic assessment of ES trade-offs and synergies, overcoming limitations of static, expert-based models. The project explicitly addresses cross-realm ES interactions, fostering integrated management.
A key aspect is the integration of spatial, temporal, and thematic scales. CREATE will harness existing datasets, including Copernicus monitoring products, Sentinel-2 and -3 images, national water monitoring databases, and scientific publications. High-resolution UAV imagery will complement these through state-of-the-art upscaling methods in selected case studies. CREATE will ultimately integrate the aforementioned components into a spatial prioritization tool, allowing for the optimal location of NBS aimed at mitigating eutrophication. Using process-based models, the spatial prioritization tool will maximize ES synergies throughout the freshwater-coastal-marine continuum, while reducing eutrophication processes.

Relevance to the Call:
CREATE aligns with the 2023 Water4All Joint Transnational Call by integrating ES mapping and assessment for mitigation, adaptation, and resilience of aquatic ecosystems through NBS prioritization.
Within topic 1, CREATE harmonizes knowledge, datasets (e.g., Copernicus program), and methodologies (subtopics 1.1 & 1.4) to develop robust provisioning, regulating, and supporting ES models (subtopic 1.3) for the Eastern Baltic Sea's marine, coastal, and freshwater ecosystems.
The compiled data, methods, and tools will inform research and management under global change.
Within topic 2, CREATE develops process-based models to assess eutrophication impacts on key aquatic ES (subtopic 2.1). These models support the selection, spatial prioritization, and operationalization of NBS (subtopic 2.2), while evaluating their effects on ES at multiple spatial scales (subtopic 2.4).

Project coordinator

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Project partners

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- TARTU ÜLIKOOL (UNIVERSITY OF TARTU) - ESTONIA
- MYKOLAS ROMERIS UNIVERSITY - LITHUANIA
- WARSAW UNIVERSITY OF LIFE SCIENCES - POLAND

Funding organisations

AKA (FINLAND) / LZP (LATVIA) / ETAG (ESTONIA) / LMT (LITHUANIA) / NCBR (POLAND)

Duration

3 years

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KEYWORDS

nature-based solutions
eutrophication
Baltic sea
cross-realm
ecosystem serivces

CYANOSERVICES

Securing freshwater supporting services for biodiversity threatened by harmful cyanobacteria across ecosystem boundaries

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Coordinated by Early Career Researcher

Abstract

Harmful cyanobacterial blooms pose an increasing threat to freshwater security worldwide. Eutrophication and climate change are exacerbating the impacts of harmful freshwater cyanobacterial blooms on strategic ecosystem services, such as drinking water resource supply or irrigation. While understanding the vulnerability of these key services is essential for human-well-being, we still know little on how cyanobacterial blooms can harm biodiversity and its services beyond the aquatic ecosystem boundary.

The overarching aim of the CyaNoServices Project is to secure freshwater supporting services for biodiversity threatened by harmful cyanobacteria across ecosystem boundaries, with an emphasis on insect biodiversity and the multiple key ecosystem services that they provide to wildlife and human well-being (pollination, pest control, energy transfer), and that are increasingly at risk across the globe.
To this end, the Consortium proposes an interdisciplinary approach involving a diverse group of ecologists, water managers, and entrepreneurs across bioregions in Europe (Sweden, Denmark, Spain) and South America (Brazil).

The project is organized into four Work Packages (WPs), which aim:

- to understand the largely overlooked link between cyanobacterial bloom occurrence and cross-ecosystem freshwater support to insect biodiversity and their services across climates (WP1);
- to identify specific mechanisms that underlie the above linkages found in real-world landscapes (WP2);
- to enable quantifying the threat of harmful cyanobacteria to ecosystem services beyond the aquatic boundary (WP3); and
- to integrate stakeholders for strategic activity planning and co-design of solutions to manage threatened ecosystem services (WP4).

As part of WP1, we will conduct field surveys of water bodies across Continental, Mediterranean, and Tropical bioregions to generalize our findings as well as to build predictions under different climate scenarios. Moreover, as part of WP2, outdoor and laboratory experiments will be conducted to unravel the single factors and mechanisms that affect the interaction between harmful cyanobacterial blooms and insect biodiversity.
A Consortium workshop will be organized to generate indicators of freshwater ecosystem service delivery (WP3). Finally, as part of WP4, we will use a novel interdisciplinary approach including state-of-the-art digital technology, to engage the stakeholders since the start of the project, seeking their feedback and accounting for their practical views and experience.
We will transfer the knowledge about impacts, mechanisms and indicators gained in the other work packages, as well as co-design together with them management solutions for the control of cyanobacterial blooms to increase security of freshwater ecosystem service delivery.

Results from CyaNoServices will be generalized across climatic regions, and this knowledge will contribute to disentangling the effect of deteriorating freshwater resources and habitat quality for global declines in insect diversity and their ecosystem services, with direct impact to key economic activities and stakeholders. Understanding the relationship between cyanobacterial bloom occurrence and the ecosystem services proposed here would allow identifying reliable indicators for freshwater service support, which is crucial not only for stakeholders but also for current policies and mandatory monitoring schemes, such as the EU Water Framework Directive.

Project coordinator

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Project partners

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- LUND UNIVERSITY - SWEDEN
- UNIVERSIDADE FEDERAL DO RIO GRANDE DO NORTE - BRAZIL
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Funding organisations

AEI (SPAIN) / IFD (DENMARK) / FORMAS (SWEDEN) / CNPq (BRAZIL)

Duration

3 years

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KEYWORDS

freshwaters
aquatic-terrestrial linkages
cyanobacteria
biodiversity
ecosystem services
digital technologies

DEEPTHOUGHT

Evaluating nitrate transformation in aquifers using microbiologic and isotopic tools for an enhanced management of key groundwater ecosystem services

Abstract

Aquifers serve as the primary source of drinking water for Humans worldwide. This use of groundwater mainly relies on ecosystem services provided by aquifers. Among them, natural water purification is a cornerstone ecosystem service, notably mitigating the rise of the pollutants emitted by anthropogenic activities in groundwater. Up to now, this service is poorly taken into account in aquifer management and regulating policies as exemplified by the case of nitrate. The latter is a major pollutant threatening groundwater quality at a worldwide scale. However, its impact can be mitigated by in situ denitrification.

DeepThought aims to understand the mechanisms that lead to denitrification occurring in groundwater and evaluate the impacts of pressures (anthropic and climate change) on denitrification rates. This will provide a holistic toolbox for improved aquifer management. The common goal will be achieved through the use of microbial, hydrogeological, geochemical and isotopic approaches, coupled with laboratory experiments, in situ sampling at three study sites representing different contexts and interactions with main stakeholders through workshops in each country.

More precisely, the project will

- identify the microbial communities that support denitrification and quantify in situ potentials and activities;
- link denitrification processes to hydrogeological and biogeochemical conditions and variations;
- examine and compare the diversity of denitrifying bacteria and their activities at depth profiles intersecting oxic-anoxic interfaces;
- identify the pressures (anthropic and climate change) and their impacts on denitrification thanks to the access to four test sites corresponding to different land uses and pressures; and finally;
- through co-working with stakeholders, provide and include new indicators combining biogeochemical and isotopic measurements to improve aquifer management concerning nitration contamination.

DeepThought primarily focuses on subtopic 2.1 of the Water4All Joint Transnational Call by assessing the impact of different anthropogenic pressures, including exposure to pesticides and other organic pollutants from agriculture and other human activities, on aquifer denitrification and other N-cycling processes.

Furthermore, DeepThought addresses subtopic 2.2 by improving our understanding of impacts of chemical regulation (e.g. pesticides, pharmaceuticals) on N retention in aquifers.

DeepThought will also address subtopic 3.1 as tools (microbial and isotopic) will be selected for a better integration of ecosystem services assessment into the management of groundwater resources. In addition, the project will involve, via workshops and coworking, stakeholders and users of the targeted ecosystem services (i.e. national water agencies, decision makers, drinking water distributors), to establish strategies to enhance nitrate reduction in groundwater.

In summary, DeepThought ambitions to bring new knowledge on an important aquifer nature based solution, natural nitrate depletion, which is at the basis for the provision of many groundwater ecosystem services, in particular clean water supply. DeepThought also aims to provide a pathway for implementing tools that consider these aquifer functionalities into the current frameworks used to manage groundwater.

KEYWORDS

groundwater
nitrate
global change
microbial diversity
water security

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Project partners

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Funding organisations

ANR (FRANCE) / IFD (DENMARK) / FWF (AUSTRIA)

Duration

3 years

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DOWES

Disclosing the overlooked wetlandscape ecosystem services

Water4All
Water security for the planet

Coordinated by Early Career Researcher

Abstract

While wetlands are individual ecosystems with permanent or temporary waters, the novel term "wetlandscapes" refers to systems of wetlands that are hydraulic, hydrological, and ecologically coupled. Although wetland ecosystem services have been investigated for decades, the spatial aggregation of wetlands into wetlandscapes invites their reconsideration. This is most relevant concerning various types of services, such as food and water security services provided to ecosystems and communities beyond the direct area of influence.

The main objective of DOWES is to resolve the interlinkages between water availability in wetlandscapes, their responses and stressors, and the provision of ecosystem services within and beyond their area of influence through synthesis across multiple wetlandscapes. Comprised of six well-known institutions across Sweden, Italy, France, the United Kingdom, and Brazil, DOWES will, in five work packages, address the main objective across six iconic wetlandscape ecosystems.

- The first determines high-resolution changes in the hydrological regime using the latest radar and altimetric missions.
- The second relates water availability to wetlandscape ecosystem responses and stressors.
- The third develops a participatory approach to identify perceptions of potential cultural ecosystem services.
- The fourth adds a layer of complexity by quantifying the provision of ecosystem services of wetlandscapes beyond the area of influence
- Finally, the fifth work package combines these four to develop metrics and guidelines to track and quantify the provision of wetlandscape ecosystem services.

DOWES addresses mostly Topics 1 and 2 of the Water4All 2023 Joint Transnational Call across three subtopics: 1.1., 1.4, and 2.1 by quantifying overlooked ecosystem services, finding how these ecosystem services change in time and space and their relationship with human and climatic drivers. The Project is also aligned with the main theme of the call as it studies wetlandscapes, which are considerably understudied compared to other types of water resources. It also couples with the main vision of Water4All by focusing on water security by providing ecosystem services, using state-of-the-art technologies such as hydrogeodesy, paleolimnology, atmospheric moisture tracking, and participatory methodologies. Stakeholder engagement is ensured through all project phases in a co-creation approach to developing a joint understanding of the wetlandscape concept and services and allows for more targeted environmental and social impacts. The participatory approach involves and disseminates knowledge among wetland researchers, local and national authorities related to wetlands, international wetland organizations like the Ramsar Convention and Wetlands International, and the general public via stop-motion animation videos for all ages. DOWES will bring a breakthrough in the quantification and assessment of wetlandscape ecosytem services (WES), even beyond their direct area of influence, to provide environmental authorities with the tools and know-how to expand the protection, restoration and management of these valuable ecosystems.

Project coordinator

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Project partners

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- POLITECNICO DI MILANO - ITALY
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- INSTITUT DE RECHERCHE POUR LE DÉVELOPPEMENT - FRANCE

Funding organisations

FORMAS (SWEDEN) / EPSRC UKRI (UNITED KINGDOM) / MUR (ITALY) / FAPEAM (BRAZIL) / ANR (FRANCE)

Duration

3 years

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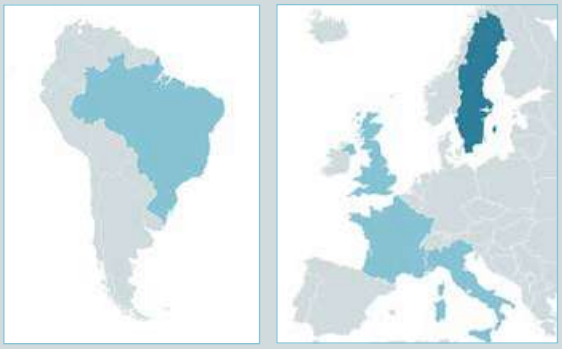

KEYWORDS

wetlandscapes
ecosystem services
water security
hydroclimate

ECO-WADE

Enhanced understanding of carbon and groundwater dynamics in European peatlands and their related ecosystem services

Abstract

Wetlands, particularly peatlands, hold a central position at the intersection of groundwater, surface water, and terrestrial landscapes. To enhance climate adaptation and mitigation, the aquatic ecosystem services provided by peatlands play a central role in the climate policies at EU and national scales.

In these policies, the measure of rewetting degraded peatlands under land use is explicitly mentioned. Peatland hydrology, especially emphasizing the role of groundwater related processes, is recognized as the key driver of vital ecosystem services peatlands provide. However, basic understanding of how hydrology impacts peatland functioning at the European scale, as well as detailed mapping products on groundwater and land use are currently lacking.

To address these knowledge gaps, ECO-WADE focuses on three key ecosystem services provided by peatlands:

- Water Purification: Peatlands play a significant role in water quality regulation by reducing excessive levels of reactive carbon, nitrogen and phosphorus, thereby mitigating eutrophication and improving water quality for drinking water purposes.
- Water Regulation: Peatlands act as natural reservoirs, storing and releasing water. This function is crucial for enhancing resilience during drought periods, sustaining environmental flows, and safeguarding the supply of clean drinking water.
- Climate Regulation: Peatlands are essential in capturing, storing, and preserving carbon, making them integral to national and global climate change mitigation strategies.

The overarching objective is to investigate the connections between hydrology and the three selected ecosystem services via case studies across four countries. High-resolution data products that comprehensively map peatland hydrology will be generated at pan-European scale. These include maps of water table depth, drainage and land use.
The potential impact peatland rewetting has on the three selected ecosystem services will be analyzed through a combination of field observations, data analysis and modelling carried out across case studies.
ECO-WADE will collaboratively develop an ecosystem services assessment tool with key stakeholders while acknowledging the wide variability in peatland functioning across Europe.
ECO-WADE recognizes the importance of a European perspective, as climate adaptation and mitigation require cross-country collaboration and coordination and will therefore develop national storylines to illustrate the historical utilization of peatlands, their current state, and their significance in current policy frameworks.
A diverse group of national agencies overseeing the planning and implementation of rewetting projects will be interviewed for this purpose.
All knowledge and data generated within ECO-WADE will be synthesized to co-design and co-develop an assessment tool of multifunctional peatlands to facilitate a site comparison with respect to potential impacts of rewetting as well as climate change.
Furthermore, ECO-WADE aims to disseminate the obtained knowledge and generated data products effectively to decision makers and landscape planners in order to enhance the effectiveness of rewetting initiatives.

Project coordinator

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Project partners

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- THE UNIVERSITY OF LIVERPOOL - UNITED KINGDOM
- TRINITY COLLEGE DUBLIN - IRELAND
- UNIVERSITY OF TARTU - ESTONIA
- UPPSALA UNIVERSITY - SWEDEN
- GEOLOGICAL SURVEY OF FINLAND - FINLAND

Funding organisations

IFD (DENMARK) / NWO (THE NETHERLANDS) / EPSRC UKRI (UNITED KINGDOM) / EPA (IRELAND) / ETAG (ESTONIA) / FORMAS (SWEDEN) / AKA (FINLAND) / IDF (DENMARK)

Duration

3 years

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KEYWORDS

peatland hydrology
groundwater; water quality
GHG emissions; restoration impacts
water retention
climate change mitigation
climate change adaptation

ECOC2S

Ecosystem services to enhance the resilience of coastal regions and communities to flood risks in a catchment to sea perspective

Water4All
Water security for the planet

Coordinated by Early Career Researcher

Abstract

Coastal and transitional systems provide critical ecosystem services (ES), including flood protection. The effects of climate change are increasing the hazard in such flood-prone areas, putting additional physical pressure on ES, while also adding pressure to the social system. This creates an urgent need for reliable methods of risk assessment, management and communication, as well as innovative approaches to community engagement towards building resilience.
This project will co-develop a holistic approach to flood risk assessment, quantifying the contribution of natural systems and blue-green infrastructure to flood protection in transitional and coastal areas and supporting the co-creation and further implementation of resilient pathways based on ES.

The project will focus on five different topics:

- co-identification of knowledge gaps and valuation of ecosystem services, following a participatory approach,
- characterization of the joint behavior of the geophysical preconditions of the catchment with the atmospheric and marine drivers at the coast,
- integrated modeling framework that includes eco-morphodynamic effects on compound flood hazard,
- co-creation of plausible future scenarios for sustainable and resilient ES, and
- establishment of a framework to guide the development of long-term mitigation measures and management strategies that enhance the resilience of human and natural coastal systems to extreme events.

The EcoC2S consortium consists of six partners with multidisciplinary and complementary expertise in the analysis and modeling of extreme hydrological events and their response to climate change, assessment and valuation of coastal ES, development and implementation of new flood management paradigms, and policy analysis, risk perception and communication.
EcoC2S will lead to scientific and technological advances in the development and application of holistic approaches to flood resilience in a catchment to sea perspective and will have a direct application in providing tools at the frontier of knowledge for the management and protection of coastal regions and communities.
It will contribute to topic 1 of the Water4All Joint Call by developing advanced methodologies for ES valuation, and to topic 2 by assessing human pressures on ecosystems and ES and developing resilience pathways for ecosystem protection and restoration. Engaging local communities and other stakeholders in the co-design and co-implementation of the proposed solutions, taking into consideration the barriers/resistance to the implementation of ES frameworks, contributes to topic 3.
The project will establish a two-tier scheme of Community of Practices (CoPs) to ensure the transferability of the project outputs to other European or international contexts and to support the dissemination of results.
This structured approach will facilitate exchange and learning among stakeholders at both the case study and EU levels and will also enhance the political, social, and practical applicability of the project results. The trans-project CoP promotes interaction with European research initiatives and actors to extend the reach and applicability of research findings.
Concurrently, at the local level, resilience and adaptation plans will be developed in collaboration with diverse sector stakeholders to tailor strategies to specific regional needs. Finally, the data and products developed can be integrated into climate services that can be used by different sectors of society, such as insurance companies and local to regional government.

Project coordinator

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Project partners

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- COOPERATIVA DE FORMAÇÃO E ANIMAÇÃO CULTURAL - PORTUGAL
- INSTYTUT GEOFIZYKI POLSKIEJ AKADEMII NAUK - POLAND
- UNIVERSITY OF SANTIAGO DE COMPOSTELA - SPAIN
- KARLSRUHE INSTITUTE OF TECHNOLOGY - GERMANY

Funding organisations

AEI (SPAIN) / MUR (ITALY) / FCT (PORTUGAL) / NCBR (POLAND)

Duration

3 years

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KEYWORDS

flood risk
disaster resilience
catchment to sea
social dynamics
ecosystem valuation

ECOTWIN

Digital Twin-based solutions for enhanced integration of ecosystem services in water resource management

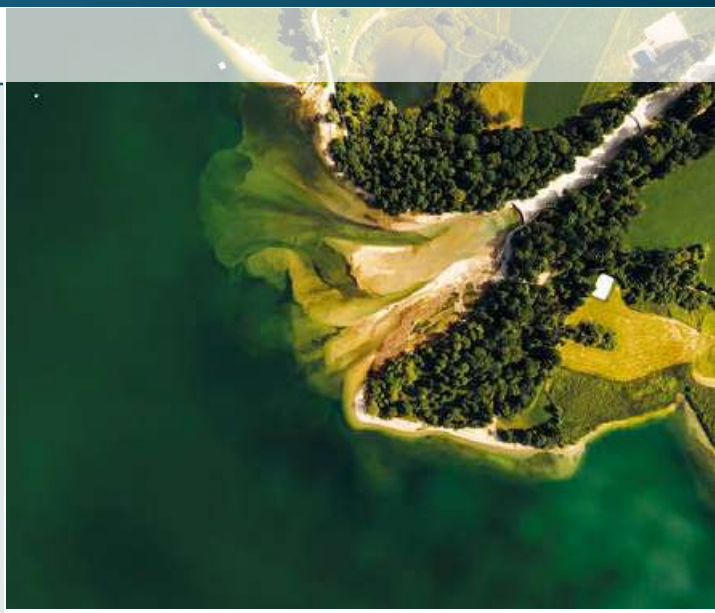
Water4All
Water security for the planet

Abstract

EcoTwin is dedicated to strengthening the integration of ecosystem services within the realm of water resource management, with a specific emphasis on lake ecosystems. Lakes, as crucial components of our natural environment, contribute invaluably to society by offering a diverse array of ecosystem services, ranging from flood and drought regulation to recreation, habitat provision, and drinking water supply.
However, the escalating impacts of climate change pose an imminent and severe threat to the resilience of lake ecosystems, compelling the need for the adoption of advanced technology and methodologies to fortify our understanding, management, and long-term preservation efforts.
In response to this critical challenge, EcoTwin leverages the power of Digital Twins as a transformative tool. Digital Twins represent virtual replicas of physical systems, continuously updated in real-time, enabling sophisticated simulations and in-depth analysis. Their distinctive advantage lies in their capacity to amalgamate a wide array of data sources, including Earth Observation, in-situ observations, and various models, to generate precise simulations of aquatic ecosystems.

Digital Twins enable us to explore how lakes respond to changing environmental conditions, human influences, and management strategies. Beyond that, they promote enhanced communication and engagement with stakeholders by providing visualizations and scenarios that underpin informed decision-making.
EcoTwin is committed to harnessing the potential of Digital Twins to radically enhance the integration of Ecosystem Services in water resource management, with a primary focus on flood and drought regulation, habitat provisioning, recreation, water supply, and carbon and nutrient management.

The core objectives of this project encompass the co-design of an adaptable Digital Twin framework in collaboration with key stakeholders, the seamless integration of diverse data sources, the enabling of short-term forecasting, and the facilitation of long-term scenario assessments, all while enhancing public engagement. Moreover, by integrating an adaptable Ecosystem Service module within a Digital Twin framework, EcoTwin seeks to instigate a paradigm shift in the management of aquatic ecosystems, thereby securing the sustainability and resilience of lakes while optimizing the delivery of essential ecosystem services.
Our project aligns harmoniously with the overarching themes and topics delineated in the call, effectively addressing the multifaceted challenges and pressures that affect ecosystem services. Furthermore, it lends robust support to informed decision-making and adaptation in the face of global change.
EcoTwin demonstrates our firm dedication to addressing the specific requirements outlined in the Water4All Strategic Research and Innovation Agenda (SRIA), with a particular emphasis on enhancing ecosystem resilience, mitigating challenges, promoting adaptation, and facilitating the smooth integration of ecosystem services into water resource management.



Project coordinator

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- DUBLIN CITY UNIVERSITY - IRELAND
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- UPPSALA UNIVERSITY - SWEDEN
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Funding organisations

EPSRC UKRI (UNITED KINGDOM) / MUR (ITALY) / EPA (IRELAND) / NKFIH (HUNGARY) / FORMAS (SWEDEN) / NWO (THE NETHERLANDS)

Duration

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KEYWORDS

hydrology (water science)
water management
political systems and institutions
governance
water system modelling

ENGAGE

Europe Nutrient Management - Guided Approaches for Greater Export reduction

Water4All
Water security for the planet

Coordinated by Early Career Researcher

Abstract

Climate change is expected to profoundly impact catchment nutrient dynamics worldwide. Many European aquatic ecosystems already face serious threats from nutrient pollution and eutrophication. In Europe, the drivers of excess nutrient pollution vary regionally due to differences in climate and human activities, emphasizing the need for better cross-boundary nutrient management. Effective management can enhance ecosystem services, including:

- Provisioning (water supply and food/drink),
- Regulating (contaminant removal),
- Supporting (nutrient cycling), and
- Cultural (recreation).

ENGAGE aims to implement a novel approach to reduce nutrient export and improve ecosystem services in national and international river basins across Europe. The project combines stakeholder engagement with advanced computational hydrology and interactive decision-support (DS) tools. These tools integrate remote sensing, socio-economic factors, governance frameworks, and societal change considerations. This use-inspired approach prioritizes practical needs to ensure application beyond the project, moving beyond the traditional «loading dock» model, where researchers apply existing prediction tools in the hope that they will be useful. Instead, ENGAGE customizes environmental predictions to meet the specific needs of collaborative nutrient management across regional, national, and international levels.
Environmental predictions, defined as quantitative statements about the future of terrestrial and freshwater systems, help communities manage variability and pollution in water resources. Such predictions are crucial as climate change increasingly affects the economy, public health, and ecosystems.

ENGAGE will establish regional stakeholder boards (SBs) comprising local, regional, and national authorities to identify nutrient pollution problems, co-design strategies for nutrient export reduction, and co-identify important elements that should be included in the DS tool to ensure informed decisions. This transdisciplinary approach aims to extend beyond hydrology and soil science by incorporating insights from stakeholder interactions and a regionally integrated perspective.
In parallel, an EU-level stakeholder network (SB-network) will be formed to assess which regional strategies and decision-support tool requirements are scalable and replicable across EU member states. The strategies, modeling needs, and remote sensing techniques will be implemented in three European river basins:

- Guadiana River Basin (Portugal and Spain)
- Gauja-Koiva River Basin (Latvia and Estonia)
- Hobølelva River Basin (Norway)

To ensure the long-term impact and broader adoption of the project's tools and strategies, ENGAGE follows an iterative research plan based on annual cycles. Lessons lea d from each cycle will inform subsequent phases, improving process design and implementation. This iterative approach, in collaboration with the SB-network, will guide the co-design of policy recommendations and guidelines for enhanced large-scale nutrient management across Europe.

By integrating scientific innovation with stakeholder-driven insights, ENGAGE seeks to advance sustainable nutrient management, promote cross-boundary collaboration, and provide practical tools and policies to address nutrient pollution in European aquatic ecosystems.

Project coordinator

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Project partners

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- NODIBINAJUMS BALTIC STUDIES CENTRE - LATVIA
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- MYKOLAS ROMERIS UNIVERSITY - LITHUANIA

Funding organisations

FCT (PORTUGAL) / RCN (NORWAY) / FORMAS (SWEDEN) / LZP (LATVIA) / LMT (LITHUANIA)

Duration

3 years

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KEYWORDS

nutrient pollution
Decision Support Tool (DST)
co-design
transboundary collaboration
multi-scale analyses

FESTIVAL

Final ecosystem services in transition: a view from the aquatic landscape

Water4All
Water security for the planet

Coordinated by Early Career Researcher

Abstract

Today's forests are the legacy of yesterday's societal priorities and climate. Traditionally, European forests have been managed for a final ecosystem service (ES) of wood production delivering timber, pulpwood and primary bioenergy. This focus on terrestrial biomass production has led to a relative neglect of other final ES, including aquatic services.

Appropriately managed forests can contribute to climate regulation through, e.g., rewetting or promote biodiversity through old growth and continuous cover forestry. Furthermore, forestry practices can be adapted to minimize the impacts of floods and droughts in a rapidly changing climate or to limit nutrient runoff.

New societal demands and a rapidly changing climate mean that historical baselines are no longer an adequate guide for future conditions. Thus, our overall objective is to develop new approaches needed for sustainable management of aquatic ecosystem services (ES) from Northern and Central European forest landscapes. We aim to co-create the solutions needed for resilient and multifunctional landscapes that will be sustainable under future conditions.
To achieve this aim we will:

- raise stakeholder awareness about the potential for combining terrestrial (production) and aquatic ecosystem service delivery in the forested landscape,
- articulate a new conceptual model of ES delivery to better support the realities of multi-objective, adaptive management in rapidly changing environments
- build the knowledge base, using micro- to large size case study catchments, to identify current constraints and opportunities for aquatic ES delivery from Northern and Central European forests
- develop already existing water quality models for scenario assessment and stakeholder dialogue
- co-create "climate proof" management scenarios for sustainable aquatic ES delivery
- evaluate and communicate the range of governance options for sustainable aquatic and terrestrial ES delivery.

Forestry impacts on aquatic ES delivery are typically not incorporated in catchment-scale water quality models. Understanding and modelling present and future forestry impacts on aquatic ES delivery is of high societal relevance both in Central Europe and in the Nordic countries. Models will be used to refine and articulate "what if" scenarios and communicate them to the forestry and land-use planning sector, national, regional, and European decision-makers, and the scientific community. This could provide insight and lead to dialogue regarding trade-offs and consequences that might occur if specific management actions are followed.

The project is relevant to the call since it will result in a better understanding of aquatic ecosystem services in forested landscapes from local to a national scale, and help understand and predict multiple pressures on these ecosystems now and in the future through water quality models.

Project coordinator

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Funding organisations

AKA (FINLAND) / FORMAS (SWEDEN) / RCN (NORWAY) / TA CR (CZECH REPUBLIC)

Duration

3 years

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KEYWORDS

ecosystem service delivery
forest landscape
multi-functionality
water quality models
co-creation

HALOBISE

Platform to understand effects of the harmful algal bloom holobiont in a changing environment to predict their impact on aquatic ecosystem services

Abstract

Urgent action is required to create resilient and forward-looking solutions for the early detection and effective management of harmful algal blooms (HABs). These blooms pose a significant threat to society and the environment, necessitating a proactive approach to limit their detrimental socio-ecological consequences by gaining deeper insights into their origins and triggering factors. As our planet experiences global warming, changes in rainfall patterns, and an escalation in nutrient pollution, coupled with the continued growth of the aquaculture industry, the intensification and broader geographic spread of HABs become increasingly likely due to the synergistic effects of all these factors. Although significant efforts have focused on monitoring and predicting HABs, progress remains limited without the knowledge of the HAB holobiont dynamics that shape the bloom.

The overall aim of HALOBISE is to generate comprehensive knowledge about HAB holobiont dynamics, enhancing the predictive capabilities of aquatic monitoring programs. By addressing HABs' biological and societal complexity, the project will develop governance tools to improve management strategies and reduce their impacts on ecosystem services (ES) under multiple environmental pressures.

HALOBISE will address this problem by offering new tools to understand the drivers of HABs and improve HAB prediction and management. The taxonomical and functional metaproteomics analysis of HAB holobionts, co-culture experiments, and adverse outcome prediction in environmental species will offer data to assess the predictive capability.
Outcomes from this proposal will lead to the inclusion of holobiont data in the next generation HAB monitoring programs. Finally, the pilot platform will assess the effects of multiple pressures on the HAB holobiont and the ES impact using a more efficient approach to decision-making. We will promote the harmonisation of the different stakeholders, their needs, and their approaches to implementing ES management and how innovation could respond to the multiple pressures in a changing environment by introducing new methods and tools that improve the prediction of HABs and their impacts on ES. By safeguarding our water bodies' ES, the proposal will contribute to more sustainable management of aquaculture fisheries sectors and increased water security.

The specific objectives are:

- Advancing in understanding HAB holobiont to address HAB drivers and dynamics.
- Mitigate the impact of HABs by predicting the adverse effects of phycotoxins on species supporting ES.
- Co-create a prototype platform to improve valuation, mapping, assessment, and mitigation of impacts of HAB in ES in collaboration with stakeholders.
- Engage stakeholders to integrate their knowledge, interests, and needs to identify gaps to improve the assessment of HAB ES.

Partners at HALOBISE are interdisciplinary leaders in plankton, population and chemical ecology, dynamic modelling, environmental microbiology, phytoplankton, harmful algal blooms, environmental proteomics, and metaproteomics, as well as intradisciplinary members from HAB monitoring programs. Together, we can fill the knowledge gaps hampering our capability to detect HABs early and predict their impacts on ES.

Project coordinator

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Project partners

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- CENTRO INTERDISCIPLINAR DE INVESTIGAÇÃO MARINHA E AMBIENTAL - PORTUGAL
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Funding organisations

FORMAS (SWEDEN) / ANR (FRANCE) / FCT (PORTUGAL) / AEI (SPAIN)

Duration

3 years

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KEYWORDS

algae-bacteria interactions
holobiome, proteomics
metaproteomics
marine assessment
ecosystem service
harmful algal bloom

MISSION

MIcrofluidic sensors for rapId detection of cyanotoxins

Water4All
Water security for the planet

Abstract

The MISSION project seeks to contribute to the monitoring of the freshwater systems' status with respect to Cyanobacterial Harmful Algal Blooms (CyanoHABs) by developing novel miniaturized sensing screening tools for rapid and sensitive detection of two groups of cyanotoxins, microcystins and saxitoxins. Screening tools will be designed to be more portable and cost-efficient compared to the currently available analytical methodologies for freshwater quality and adaptable for use outside of the laboratory settings, by operators without specialized training.
The proposed sensing tools are expected to advance understanding of the status of ecosystem services by providing early warning of cyanotoxin risk, by providing data of their presence in surface waters with high spatial and temporal resolution. Sensing tool outputs will complement currently measured indirect indicators of CyanoHABs, such as chlorophyll-a concentration and microscope cell counting, and, thus, contribute to a more efficient and timely management of freshwater waterbodies.

This project proposes development of an electrochemical (bio)chemical sensor / sensor array integrated into a microfluidic network of channels and chambers facilitating manipulation of sample and reagents that is required by the detection method and applicational settings. Upon introduction of sample and reagents in a sequence optimized for target cyanotoxins into microfluidic channel, sensor system will produce response as a function of both type and concentration of toxins under examination.

The project objectives are:

- to develop and optimize a methodology using chemical sensors for simultaneous sensing of two principle groups of cyanotoxins, microcystins and saxitoxins at the concentration levels corresponding to the World Health Organization - WHO guideline values;
- to develop a user-friendly microfluidic architecture to perform measurements in reduced sample volumes (less than 50 μL) in an automated format that could be used to detect toxins outside of laboratory settings by operators without specialized skills and requiring minimal sample preparation;
- to validate and benchmark the developed microfluidic sensing system against conventional analytical techniques, and to estimate its innovation potential;
- to evaluate feasibility of the optical detection of cyanotoxins;
- to create awareness among stakeholders of the management of freshwater systems;
- to improve competences of consortium members.

The MISSION project addresses an important niche – detection of two major groups of cyanotoxins highly relevant for all European countries. Both climate change and anthropological pressures are recognized as important contributors to the increase of frequency, spatial and temporal distribution, and toxicity of CyanoHABs.

MISSION proposes a screening test that can be deployed on site, providing timely data on the cyanotoxins' presence in the surface waters. This data will contribute to improve monitoring and assessment of the ecosystem services' status in the context of a changing world, which is relevant to Topic 1 of the Water4All Joint Transnational Call. MISSION addresses Topic 1.3. as a screening methodology to be developed and validated in collaboration with stakeholders will contribute to the valuation of ecosystem services. Furthermore, proposed screening tools will contribute to the assessment of the effect of different anthropogenic pressures from human activities on ecosystem services, which is relevant to Topic 2.1.

Project coordinator

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Project partners

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- «TOR VERGATA» UNIVERSITY OF ROME - ITALY
- STIFTELSEN SINTEF - NORWAY
- NORWEGIAN UNIVERSITY OF LIFE SCIENCES - NORWAY
- LABELEC ESTUDOS, DESENVOLVIMENTO E ATIVIDADES LABORATORIAIS, S.A. - PORTUGAL
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Funding organisations

FCT (PORTUGAL) / MUR (ITALY) / RCN (NORWAY)

Duration

3 years

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KEYWORDS

cyanotoxins
microcystins
saxitoxin
microfluidic sensors
electronic tongue
chemical sensors

PLURALAKES

Co-creating pathways to desirable nature futures of temperate lakes

Water4All
Water security for the planet

Coordinated by Early Career Researcher

Abstract

Lake ecosystems are vital for sustaining biodiversity and provide crucial benefits to humanity. However, these systems face significant pressures from multiple human activities. Many temperate lakes in Northern Europe exhibit gaps between their current ecological status and policy targets. Closing these gaps is challenging due to the diverse values and perspectives that stakeholders hold regarding lake ecosystems.

PLURALAKES aims to enhance lake management strategies by integrating diverse values of nature into anticipatory governance processes, ensuring the long-term provisioning of ecosystem services. At the core of the project is the 'Nature Futures Framework' (NFF), a newly developed tool by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) to guide change processes towards desirable futures for nature and people.

We will operationalize the NFF for lake ecosystems through case studies in three catchment areas in Northern Europe (United Kingdom, Finland and The Netherlands), which encompass many of the anthropogenic pressures faced by temperate lakes globally. Together with stakeholders in the case study areas, we will develop three types of knowledge, culminating in a transferable theory of change:

- System Knowledge (what is?) – We synthesize data and use process-based modeling to analyze lake dynamics, ecosystem services, and the effectiveness of management measures under climate change and policy scenarios.
- Target Knowledge (what ought to be?) – We co-produce desired lake futures through participatory visioning and apply valuation methods to quantify stakeholder preferences.
- Transformative Knowledge (how to?) – We identify pathways to desirable lake futures using participatory workshops and target-optimizing scenario modeling, providing actionable strategies for decision-making.

While pathways are tailored to local contexts, PLURALAKES develops a tested theory of change with process design and experiential learning tools for broader application. Leveraging expertise in freshwater ecology, modeling, environmental economics, scenario planning, and water management, the project extends the NFF methodology for IPBES. Aligned with Water4All's 2023 Joint Transnational Call, PLURALAKES contributes primarily to:

- Topic 3 – Developing innovative tools for integrating ecosystem services into water management;
- Topic 2.2 – Co-designing water management strategies and evaluating management efficacy;
- Topic 1.3 – Advancing comprehensive valuation methodologies for aquatic ecosystem services.

The project comprises five interdependent work packages, covering transdisciplinary process coordination, systems knowledge development, target knowledge co-production, transformation knowledge co-production, and overall project management. By bridging policy recognition with real-world lake management, PLURALAKES delivers practical insights and tools for securing sustainable freshwater futures.

Project coordinator

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Project partners

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Funding organisations

FORMAS (SWEDEN) / AKA (FINLAND) / EPSRC UKRI (UNITED KINGDOM) / NWO (THE NETHERLANDS)

Duration

3 years

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KEYWORDS

lake ecosystems
water quality management
plural valuation
IPBES
scenario analysis

REACTION

Navigating the risks of hydroclimatic extremes for freshwater ecosystem services in forest landscape

Water4All
Water security for the planet

Abstract

Europe's freshwater ecosystems, from wetlands to rivers, are essential for biodiversity and human well-being. A significant number of these ecosystems are located within forest landscapes, which in turn constitute the largest portion of the EU's land cover and host most of the terrestrial biodiversity. These forests vary in structure across Europe, with Northern Europe having larger, more expansive and often denser stands, while the South has typically sparser and more fragmented forests. What they share, however, is the complex and multifaceted way forest and freshwater ecosystems are interconnected and mutually dependent.

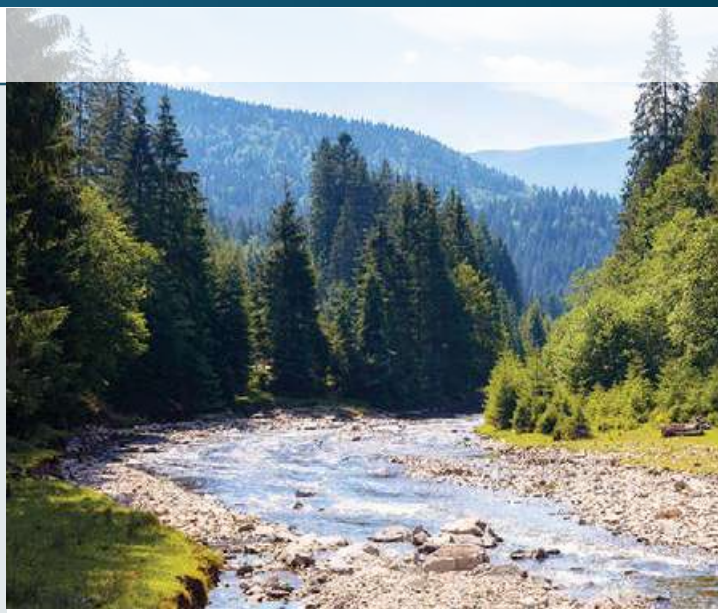
Freshwater ecosystems within forested landscapes provide a multitude of valuable products and services, such as food production, flood control, nutrient and carbon cycling, recreation and water purification. However, these ecosystems are threatened by climate change and human stressors such as land-use change, pollution, river regulation or overexploitation. Furthermore, climate change is an ever-increasing threat. In particular, hydroclimatic extremes like heatwaves, floods, droughts, and heavy rainfall pose a substantial risk, as they can have profound impacts on the services that these ecosystems provide.

Currently, our knowledge of these risks and their geographic extent is limited. This is why the REACTION project has been initiated - to shed light on the risks posed by hydroclimatic extremes and compound events to freshwater ecosystem services in forest landscapes. The project brings together experts in hydrology, ecology, and social sciences to thoroughly study and map these risks in four representative case studies across Europe, while also developing a portfolio of user-endorsed strategies to mitigate these risks and develop effective management and restoration actions that balance human and nature's water needs.

REACTION employs an interdisciplinary integrated risk framework, combined with substantial data harmonization efforts and innovative data-driven modeling techniques to explore existing data resources, co-design relevant indicators and build models that allow us to simulate the complex interlinkages between statistically rare extreme events and freshwater ecosystem functioning and resulting services. This enables us to develop a risk model to provide spatially explicit insights into present-day hydroclimatic risks for ecosystem services provided by freshwater ecosystems in various European forest landscapes, and future risk under a business-as-usual scenario. Considering potential synergies and trade-offs with existing and projected human water uses, we co-develop management and restoration strategies with our stakeholders and test their effectiveness in reducing the vulnerability of freshwater ecosystem services and the risk from hydroclimatic extreme events.

Key outcomes of REACTION encompass:

- the cultivation of new knowledge on the effects of statistically rare and increasingly severe hydroclimatic extremes on ecosystem function and services,
- the synthesis of complex risk information from various sources, combining local watershed data, remote sensing data, climate models, hydrological and hydraulic models to maximize the information content, and
- the co-design of tools designed to share this knowledge/information to enhance stakeholder planning for risk management of freshwater ecosystem services in European forest landscapes.



Project coordinator

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Funding organisations

FORMAS (SWEDEN) / AKA (FINLAND) / AEI (SPAIN) / SAS (SLOVAK REPUBLIC) / FWF (AUSTRIA)

Duration

3 years

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KEYWORDS

drought; ecosystem service; exposure
flood; forest; freshwater; governance
hazard; hydroclimatic extreme
Landscape; management; Natura 2000
risk; river; UNESCO biosphere
vulnerability; wetland

RECHARGE

Restoring catchments and rivers under global change

Water4All
Water security for the planet

Coordinated by Early Career Researcher

Abstract

Climate change is changing weather patterns in Europe, making extreme events such as heatwaves, meteorological droughts and extreme rainfall events more likely. Consequently, hydrological regimes of rivers and wetlands are becoming more erratic and extreme. It affects their ecological functioning and biodiversity, as species are not adapted to these new conditions.
We are also increasingly relying on surface and groundwater resources, especially during drought episodes, when there is already a natural water stress for aquatic ecosystems.
To compromise between higher water demand and the ecological boundaries of sustainability , we either have to reduce water demand or increase water availability. There is still a substantial gain to be realised in increasing water availability. By implementing "Nature based Solutions" (NBS) that restore the catchment's water retention function, we can make better use of periods with precipitation surplus to overcome subsequent periods of droughts.

Our innovative approach involves the development of an integrated indicator framework aimed at comprehensively studying hydrological dynamics across diverse river systems in Belgium, Poland, Portugal and Spain. At the heart of our methodology lies the innovative water battery concept, which analogizes river hydrology to the recharge cycle of a battery. This conceptual framework serves as a guiding principle for investigating how NBS can play a crucial role in replenishing groundwater and bolstering ecosystem resilience, particularly during periods of drought.

A distinctive feature of the project is its emphasis on stakeholder engagement right from the project's outset, ensuring that local communities, water managers, conservation organizations, and other stakeholders are actively involved in the research process. Through this collaborative approach, we aim to develop robust metrics for assessing the outcomes of NBS implementation and facilitate their integration into broader restoration initiatives.

The project's methodology encompasses a multifaceted approach, starting with geomorphological and geospatial analyses to identify suitable locations for implementing NBS. By examining land use patterns and urban planning, we can assess the current status of rivers and their potential for improvement through NBS interventions. Subsequently, the effectiveness of NBS in delivering ecosystem services such as water purification, carbon storage, nutrient cycling, and biodiversity support will be evaluated.

To gauge the efficacy of NBS and their impact on ecosystem dynamics, a suite of indicators will be developed. These indicators will assess various aspects of the water battery, including its size, recharge potential, leakage, utilization, and overall effects on ecosystem services. Through the application of the Driver-Pressure-State-Impact Response (DPSIR) Framework, we will analyze the implications of our findings for current policies and management practices.

By bridging scales and integrating human dimensions into our research framework, RECHARGE offers a holistic and forward-thinking approach to riparian ecosystem management. The insights gained from this project will not only advance our understanding of ecosystem functioning but also inform policy decisions and adaptation strategies in the face of climate change. Ultimately, RECHARGE aims to contribute to the restoration and sustainability of riparian ecosystems, ensuring water security and ecosystem health.

Project coordinator

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Project partners

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- FCIÊNCIAS.ID - ASSOCIAÇÃO PARA A INVESTIGAÇÃO E DESENVOLVIMENTO DE CIÊNCIAS - PORTUGAL
- UNIVERSITY OF THE BASQUE COUNTRY - SPAIN

Funding organisations

FWO (BELGIUM) / NCBR (POLAND) / FCT (PORTUGAL) / AEI (SPAIN)

Duration

3 years

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KEYWORDS

ecosystem services
drought
biodiversity
nature based solutions
hydrological restoration

SECUCOAST

Security and management of coastal groundwater resources and marine ecosystem services

Water4All
Water security for the planet

Abstract

SecuCoast will develop and apply novel geophysical, optical and geochemical techniques to produce significant new understanding of groundwater and seawater interactions in coastal aquifers and the impacts of submarine groundwater discharge on the coastal sea.
This will respond to Water4All Call Topic 1 to map, monitor, and assess groundwater and marine ecosystem services in the context of global change. In addition, we will provide critical constraints for the human and climate change pressures on ecosystem services through well-constrained numerical modeling (Topic 2).

The work has three objectives:

- Securing coastal aquifer water quality. Successful management of coastal aquifers involves finding a balance between groundwater pumping rate so that the sustainable levels are not exceeded and seawater intrusion (SWI) is not beyond control. We will incorporate hydrochemical reactions into the numerical groundwater flow models to better quantify sustainable pumping rates and mitigate climate change impacts.
- Protecting coastal sea ecosystem services. Submarine groundwater discharge (SGD) can be a significant source of nutrients and carbon, causing coastal sea eutrophication and acidification. We will conduct novel geochemical analyses, including radioactive noble gasses, to quantify SGD and associated fluxes, and combine them with microbial and macrofaunal studies, to assess the impacts on coastal ecosystems and ecosystem services.
- Securing coastal infrastructure. We will assess the risk of seafloor sediment types for SGD-induced liquefaction to inform the design of coastal infrastructure and the sustainable use of marine space. We will carry out geochemical and geophysical investigations to evaluate the factors affecting the transport of saline groundwater in fractured bedrock to inform the design of safe underground nuclear waste facilities.

Secucoast will apply a novel combination of recently-developed geophysical survey methods (FloaTEM, amphibious ERT) and sophisticated (isotope and radio)chemical analyses, microbiological and macrofaunal studies, and top-notch reactive transport modeling to better constrain and understand SWI and SGD and their effects to potable water abstraction and to eutrophication and acidification of coastal seas and consequences on marine ecosystem services (Subtopics 1.1, 2.3).

The novel modeling capabilities allow the coupling to external physical forcings (e.g. sea-level rise and glacial dynamics), improving the prediction of groundwater systems for the foreseeable environmental changes over wide spatial and temporal scales. Our results help mitigate the pressures of human activities and climate change on coastal aquifers and coastal sea ecosystems (Subtopic 2.1 of the Water4All 2023 Joint Transnational Call).

We will address the Water4All SRIA Theme II Water for Ecosystems and Biodiversity by improving the knowledge on the quantity and quality of matter flowing across the coastal aquifer and sea continuum (sub-theme II.I) to mitigate their impacts on and improve the management of coastal groundwater resources and marine ecosystem services (sub-themes II.II and II.III). We embrace Theme VI International co-operation by carrying out join R&I activities and knowledge and technology transfer among the consortium partners (sub-theme VI.III). SecuCoast supports Theme VII Governance by active stakeholder engagement with institutions managing water (sub-theme VII.II).

Project coordinator

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Project partners

- STOCKHOLM UNIVERSITY - SWEDEN
- IOPAN - POLAND
- GEOLOGICAL SURVEY OF ESTONIA - ESTONIA
- GEOLOGICAL SURVEY OF NORWAY - NORWAY
- UNIVERSIDAD POLITECNICA DE CATALUÑA - SPAIN
- GEOLOGICAL SURVEY OF ISRAEL - ISRAEL

Funding organisations

AKA (FINLAND) / FORMAS (SWEDEN) / NCBR (POLAND) / ETAG (ESTONIA) / RCN (NORWAY) /AEI (SPAIN) / MOE (ISRAEL)

Duration

3 years

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KEYWORDS

coastal aquifers
seawater intrusion
submarine groundwater discharge
coastal ecosystem services
climate change

SENTINELSPRINGS

Springs as sentinels of climate change and sustainability of aquatic ecosystems

Water4All
Water security for the planet

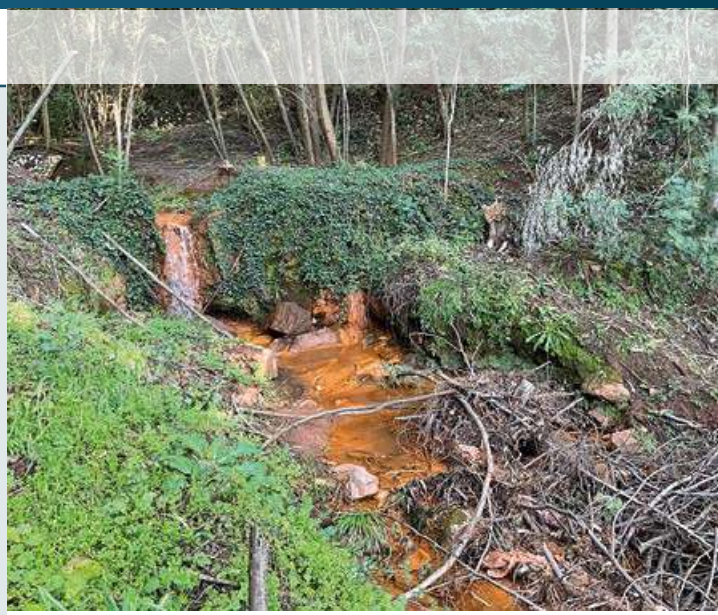
Abstract

Springs are natural groundwater discharge areas emerging in many forms and are said to be windows into the Earth. They have associated unique dependent ecosystems and are sensitive indicators of global climate changes, land-use practices and variations in water quantity and quality. In addition, they often hold great socio-cultural significance playing a vital role as sentinels of sustainable development.
The Water Framework and Groundwater Directives recognise their importance, but very little research has focused on springs' aquatic ecosystems or their dependent species. Nor has there been a systematic effort to establish a standardized methodology for monitoring and comprehensive ecological status assessment resulting in an erratic inventory, classification and data analysis of springs in Europe.
The existing information is often minimal, fragmented and largely unavailable to researchers, land managers and nature conservation organizations with negative implications for the development of resource and aquatic ecosystem protection strategies.
Springs are pivotal gateways between groundwater and aquatic ecosystems and are themselves a dynamic and hence vulnerable ecosystem. The quantitative and chemical status of springs supports the ecological status of their groundwater-dependent aquatic ecosystems in inland, transitional and coastal waters and we believe springs can serve as sentinels of global climate and land use change impacts on aquatic ecosystems services. SentinelSpringS strategically uses an integrated approach to two often separately assessed water systems, groundwater and aquatic ecosystems by focusing on monitoring springs' water and biodiversity status of associated ecosystems. Springs may represent a significantly greater catchment area than monitoring wells and their monitoring can be more cost-effective if they also integrate spring water participatory monitoring.
The main goal of the project will be to link systematic hydrological and participatory spring monitoring results to provide early warning signals of spring and dependent aquatic ecosystem health under present-day global changes and biodiversity crises. The question arises as to which factors are responsible for the sustainability of springs–habitats for unique biodiversity and providers of their aquatic ecosystem services.
The scientific goals are to:

- develop consistent terminology, classification and spring monitoring methodology towards its sustainability;
- identify and characterise springs-dependent ecosystems;
- identify main threats to springs sustainability and that of their aquatic ecosystems services across highly diverse habitat types in Europe;
- develop management frameworks under differing climate change scenarios.

The strategic goals include creating a standardized framework for monitoring springs and an open-access European database for these data. Our policy goal is to: promote the integration of spring quantity, quality and ecology data into EU and national groundwater status assessment and monitoring programs and improve the holistic integration of hydrology and ecology in EU policies and the implementation of the Water Framework Directive.

SentinelSpringS aligns with the European Green Deal, the Biodiversity Strategy and UN SDGs (especially the SDGs 6 and 12-15), addressing the climate crisis and biodiversity loss, providing groundwater quantity, quality and biodiversity monitoring data that support cost-efficient EU policy-making. It contributes to international research on maintaining Earth's viability for human life and assists Environmental Agencies and CIS working groups on Ecological Status, Groundwater, Data and Information Sharing and Task Group on Water Scarcity and Droughts. The project ultimately aims to enhance the management and conservation of Europe's spring aquatic ecosystems.



Project coordinator

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Project partners

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- UNIVERSITY OF LODZ - POLAND
- BUREAU DE RECHERCHES GEOLOGIQUES ET MINIERES - FRANCE
- ENERGY AND WATER AGENCY - MALTA

Funding organisations

FCT (PORTUGAL) / IFD (DENMARK) / MUR (ITALY) / NCBR (POLAND) / ANR (FRANCE) / MEEC (MALTA)

Duration

3 years

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KEYWORDS

spring hydrology
groundwater monitoring
aquatic biodiversity
spring-dependent ecosystem dynamics
localized ecosystem resilience

SERVICO2

Impacts of climate, N and P deposition and land use on water as a driver of the greenhouse gases regulatory ecosystem service in headwater catchments

Water4All
Water security for the planet

Abstract

Catchments provide a vital ecosystem service by regulating atmospheric CO2 globally, a process strongly influenced by water, and therefore closely related to the provisioning of water service. Climate, atmospheric deposition, and land use affect the quantity and quality of water.

This project aims to enhance our understanding of the role of water in headwater catchments' functioning regarding the regulation of atmospheric CO2, as well as other climate-relevant gases (CH4, N2O, BVOC). The project aims to assess the social and economic value of these ecosystem services to inform policy and decision-making.

To achieve this, the project will be organized into five work packages, which aim at:

- Improving the consideration of CO2 regulation ecosystem services in relevant policies, conducting social and economic valuations, and fostering awareness through co-creation with researchers and stakeholders.
- Reanalyzing, meta-analyzing, and modeling long-term data series to gain insights into the role of catchments in regulating greenhouse gas emissions.
- Developing innovative approaches and cost-effective technology for monitoring greenhouse gas fluxes, with a focus on high-resolution measurements.
- Conducting field measurements throughout the seasonal cycle in a network of headwater catchments across Europe, considering climate, N-P deposition gradients, and local land use effects, to determine the balance of CO2 and other climate-relevant gases inferred from their fluxes.
- Communicating project results to policy-makers, environmental managers, authorities, the general public, and the scientific community.

The project SERVICO2 aims to influence international policy design, generate new knowledge on the combined effects of deposition, climate, and land use on Greenhouse Gas (GHG) regulation and water quality, improve carbon balance estimates, models, and projections, as well as enhance valuation and monitoring methods for this ecosystem service.

It also intends to have influence within advisory bodies guiding emissions control policies. A policy brief will be prepared and delivered to national and local authorities at the project's conclusion.

Project coordinator

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- UNIVERSITÀ DEGLI STUDI DI PADOVA - ITALY
- CZECH GEOLOGICAL SURVEY - CZECH REPUBLIC
- UNIVERSITAT POLITÈCNICA DE CATALUNYA - SPAIN

Funding organisations

AEI (SPAIN) / AKA (FINLAND) / FORMAS (SWEDEN) / MUR (ITALY) / TA CR (CZECH REPUBLIC)

Duration

3 years

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KEYWORDS

carbon balance
water quality
meta-analysis of long-term data series
socio-economical valuation
new sensors development

SUSTAIN-R

Sustainable nutrient cycling of nitrogenous and phosphate wastes for aquatic ecosystem restoration and nourishment

Water4All
Water security for the planet

Abstract

The SUSTAIN-R project aims to introduce innovative approaches (tools, methodologies and devices) for the restoration of aquatic systems with nutrient cycling and reuse of excess and legacy N and P nutrients, preventing, minimising and remediating aquatic systems and fostering associated ecosystem services.
A variety of anthropogenic pressures from human activities including agricultural excess nutrients, Recirculation Aquaculture Systems (RAS), wastewater treatment plants, (livestock) result in nutrient pollution causing eutrophication due to nitrogenous and phosphate wastes. To evolve our countering technical proposals and methodologies in a controlled environment, RAS has been chosen to serve as a test-bench for proof-of-concept demonstration. RAS tail water includes particulate matter, ammonia, nitrate, nitrite, phosphate and other hazardous substances produced by the processing of feed to organism growth.
Recovery of nitrogenous and phosphate waste from such systems will be achieved using capacitive deionization (CDI) technology producing resources for re-use as fertilizers or as precursors. Thus, nitrogenous matter can also be used for decentralized ammonia production for energy generation using electrocapacitive devices. In parallel, a pilot sequencing batch reactor (SBR) that uses controlled cycles between anoxic and aerobic conditions will be tested for removal of nitrogen and phosphorus from wastewater.

The project team has diverse background coordinated by the Functional NanoMaterials group at The Royal Institute of Technology (KTH), Sweden. KTH group has scaled a novel flow-through CDI design for water treatment and nutrient recovery and will design a novel membrane free device for transforming nitrates to ammonia and will be coordinating the project working closely with all the partners.
The Department of Hydraulics, Soil Science and Agricultural Engineering at Aristotle University of Thessaloniki (AUTH), Greece, specializes in water and soil research, focusing on hydrological and water quality modelling developing and applying methods for water resources management and environmental impact assessment. AUTH will simulate & test membrane-free electrocatalytic devices in Greek agricultural landscapes and highlight improvements in ecosystem services and aquatic ecosystem health.
Aarhus university, Denmark, will advance CDI technology towards practical implementation in Recirculating Aquaculture Systems (RAS) where CDI will be optimised to remove ammonia as well as nitrite, nitrite and phosphate ions from feeding trout, improving water quality management and reducing the need for extensive purging processes.
AERIS, Spain, a spin-off of the Universitat Autònoma de Barcelona comprising experts from the GENOCOV research group founded in 2009, designs and builds automated pilot plants for research and industry.
In SUSTAIN-R, Aeris will design, construct, and operate a pilot plant for biological N and P removal using synthetic and real water samples.

The project is relevant to Topic 2: Understanding and predicting multiple pressures (including anthropogenic pressures) -impact –response, covering subtopics 2.1, 2.3 & 2.4 of the Water4All 2023 Joint Transnational Call.

Project coordinator

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FORMAS (SWEDEN) / GSRI (GREECE) / IFD (DENMARK) / CDTI (SPAIN)

Duration

3 years

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KEYWORDS

nutrient cycling
ecosystem services
capacitive deionization
electrochemical nitrate reduction
nitrate; ammonia
ecosystem services

WATERPATH

Understanding and improving water-driven ecosystem services for the production of drinking water and treated wastewater for agricultural reuse

Water4All
Water security for the planet

Abstract

Problem addressed

The latest European regulations focusing on the integrated management of water resources - i.e., water intended for human consumption, treated wastewater (TWW) for re-introduction into aquatic ecosystems and reuse in agriculture - already adopted (Directive 2020/2184 and Regulation 2020/741) or recently updated (Directive on Urban Wastewater Treatment, 2024/3019), pay increasing attention to understanding the anthropogenic pressures of contaminants of emerging concern, their transformation products (CECs/CEC-TPs) and antimicrobial resistant bacteria and genes (ARB/ARGs) in aquatic ecosystems, as they affect the quality of ecosystem services.
Despite the high environmental concern caused by CECs/CEC-TPs and ARB/ARGs, the available data on their occurrence are often incomplete, fragmentary and mostly limited to «target» studies, which necessarily implies a limited ability to assess the risks associated with their presence, hampering the activities of policy makers.

Strategic objectives

WATERPATH aims to achieve the important and ambitious strategic objective of providing regulators with complete and updated information on the state of CEC/CEC-TP and ARB/ARG contamination in three model geographical areas to support the updating of European environmental policy.
WATERPATH also aims to identify strategies to reduce chemical contamination in order to improve the chemical and biological status of water bodies.

Specific objectives

The strategic objectives mentioned above will be achieved by pursuing the following specific objectives:

- Collect comprehensive chemical data on CECs/CEC-TPs in continental (river water), peninsular (river and groundwater) and island (marine water) ecosystems using advanced analytical techniques.
- Integrate qualitative chemical data with «two-way» quantification of CECs through (a) retrospective non-targeted analysis (NTA) and (b) workflows for targeted analysis of specific CECs/CEC-TPs.
- Perform a risk analysis using the risk quotient index for the quantified CECs/CEC-TPs.
- Collect comprehensive and quantitative data on the above ecosystem services of ARB/ARGs through metagenomics and targeted cultivation for meta-analysis.
- Identify biomarkers that can be used to assess mitigation processes.
- Integrate the chemical and biological qualitative-quantitative data obtained with site records of drinking, surface, ground and marine waters available from national monitoring authorities and scientific literature to obtain spatial and temporal trends of CEC/CEC-TP and ARB/ARG contamination.
- Meta-analysis of chemical and biological data obtained through NTA and targeted workflows, integrated with appropriate qualitative descriptors, to identify effective indices for assessing the anthropic pressure exerted by the presence of CECs/CEC-TPs and ARB/ARGs on the ecosystems under study, following a «one health» approach.
- Evaluate low- and high-tech mitigation strategies as potentially suitable approaches to restore chemical and biological ecosystem quality.

Project coordinator

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- G.I.D.A. SPA - ITALY
- AGENZIA REGIONALE PER LA PROTEZIONE AMBIENTALE DELLA TOSCANA - ITALY

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MUR (ITALY) / AEI (SPAIN) / UEFISCDI (ROMANIA)

Duration

3 years

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KEYWORDS

contaminants of emerging concern
antimicrobial resistant bacteria/genes
non-target and target analysis
internal and marine waters
environmental and human health risk analysis

WATERWEAVE

Weaving knowledge together for healthy and resilient aquatic socio-ecosystems: towards a methodological and modelling framework

Water4All
Water security for the planet

Abstract

Due to their complex and interconnected nature and the multiple demands placed on them by human activities, trade-offs may arise in the provision of ecosystem services by aquatic ecosystems and sometimes these services may not meet their demand. These tensions are exacerbated by climate changes and higher occurrence of extreme events but also by increasing water demand and land use changes.
Finding new innovative ways of managing water resources, while preserving freshwater ecosystems and ensuring equitable access to their services, is a major challenge that must be addressed by accounting for the intertwining of societies and ecosystems. To advance research on this burning topic, WaterWeave brings together an interdisciplinary and international consortium to develop an integrative and interactive tool (IIT) to promote social learning and help managing water resources and freshwater ecosystems in a context of land-use and climatic change.
The IIT will combine biophysical determinist, probabilistic or data-driven models to represent ecosystem functioning and ecosystem service provision and multi-agent-based interactive models to represent the social components of the system. It will be kept simple to ensure easy handling, straightforward interpretation, and adaptability to local context. Its development will be nurtured by interactions with a panel of key stakeholders (i.e., managers, decision-makers, and different groups of end-users such as local traditional communities' representatives), recruited from three test sites in Brazil (Sao Paulo, Rio Grande do Sul and Pará states) and one in Luxembourg.
In each site, starting from a diagnosis of freshwater ecosystems, including the associated services and demand using existing scientific and local knowledge, datasets, and models, we will debate water and related ecosystem issues, identify the main direct and indirect drivers (including governance systems), and frame the scope of the IIT within the project lifetime.
Next, we will initiate a retrospective analysis using existing datasets and models completed by sediment core sampling targeting e-DNA and anthropogenic contaminants. This will be conducted in close collaboration with the stakeholder panel and through the lens of public policies and management decisions. This will highlight past successful/unsuccessful measures and define realistic management scenarios they would like to explore as a guide for further development of the IIT.
Finally, we will explore prospective scenarios driven by future climatic projections for different greenhouse gas emission scenarios. The ITT will enable the stakeholder panel to test their management proposals for different time horizons and explore alternative scenarios by modifying decisions or social behaviour to collectively find more sustainable ways forward for their territory.

WaterWeave is relevant to several dimensions of the Water4All call.

- First, we will deeply rely on existing data, especially remote-sensing data, and artificial intelligence (machine learning to extract key-information on the links between ecosystem state and services trends) (Topic 1.1), that will support the IIT development and the diagnosis, retrospective, and prospective analyses.
- Work with the stakeholder panel and questionnaires targeting different social end-user groups will provide a wide range of views on the values given to nature and its services (Topic 1.3).
- Second, the analyses conducted in each site will allow assessing the effects of different anthropic pressures and their cumulative effects and to identify how policy, governance and management decisions shaped their evolution (Topic 2.1, 2.2).
- Finally, the retrospective and prospective activities with the IIT aiming to investigate the effectiveness of past decisions and collectively define new governance systems and water and ecosystems management strategies will increase socio-ecological resilience while guaranteeing equitable access to ecosystem services (Topic 3.1, 3.2).

Project coordinator

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- UNIVERSIDADE FEDERAL DO RIO GRANDE DO SUL - BRAZIL
- UNIVERSIDADE DE BRASÍLIA - BRAZIL
- UNIVERSIDADE FEDERAL DO OESTE DO PARÁ - BRAZIL

Funding organisations

ANR (FRANCE) / FNR (LUXEMBOURG) / FAPESP (BRAZIL) / FAPERGS (BRAZIL) / FAPDF (BRAZIL) / FAPESPA (BRAZIL)

Duration

3 years

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KEYWORDS

aquatic socio-ecological systems
integrative and interactive multi-agent-based modelling
remote sensing
artificial intelligence
participatory research
Nature's Contributions to People

WETREAT

Optimising Wetland-Based Solutions for improved micropollutant treatment efficiency from Wastewater Treatment Plant (WWTP) effluent

Water4All
Water security for the planet

Coordinated by Early Career Researcher

Abstract

The WeTreat project is at the forefront of enhancing the removal efficiency of micropollutants such as pharmaceuticals and polyfluoroalkyl substances (PFAS) from wastewater treatment plant (WWTP) effluents through the strategic use of optimized wetland-based solutions.
The project utilizes constructed wetlands (CWs) that harness natural processes including biodegradation, sorption, photodegradation, and phytoremediation to address the persistent challenges posed by these pollutants.
Central to WeTreat's innovative strategy is the use of wetland plants that have been specifically selected and cultivated for their superior ability to absorb and metabolize pollutants.
Advanced plant tissue culture (PTC) techniques are employed to propagate elite plant varieties known for their high pollutant accumulation capacity, enhancing the effectiveness of CWs and ensuring biodiversity conservation and carbon sequestration. This aligns with broader environmental sustainability goals.

The project is powered by a transnational consortium of experts from Portugal, Italy, Luxembourg, and the Netherlands, encompassing agronomists, biologists, engineers, chemists, and biotechnologists. This diverse team brings deep expertise across various disciplines including plant physiology, bioremediation, microbial interactions, and ecological engineering.
Together, they drive a comprehensive approach to the development and optimization of CW systems.

WeTreat is committed to identifying and propagating the most effective plant species for micropollutant uptake and metabolism. It focuses on optimizing plant growth, resilience, and environmental adaptability.
The project enhances the scalability of in vitro propagation methods to maintain genetic diversity and ensure sustainability in plant cultivation.
Additionally, it involves designing and piloting CW systems adaptable to various environmental settings and scalable for broad implementation.
The impact of plant-based micropollutant removal on water quality, plant health, and ecosystem functionality is rigorously evaluated, with specific assessments of interactions between plant roots and the rhizo-microbiome.

Stakeholder involvement is a priority to ensure the developed technologies are accessible and applicable across diverse geographic and climatic conditions. WeTreat aims to extensively disseminate its findings through scientific publications, workshops, and conferences, promoting widespread understanding and adoption of its innovative water treatment solutions.

The project anticipates establishing a robust repository of elite wetland plant varieties, optimized CW systems for diverse environmental settings, and a deepened understanding of plant-pollutant interactions, informing future applications and policies. In doing so, WeTreat contributes significantly to the sustainable management of water resources, aligning with the EU's Green Deal and the updated EU urban wastewater directive, which mandates improved treatment standards to mitigate environmental threats.

Project coordinator

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Funding organisations

FCT (PORTUGAL) /NWO (THE NETHERLANDS) / MUR (ITALY) / FNR (LUXEMBOURG)

Duration

3 years

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KEYWORDS

micropollutants
phytoremediation
constructed wetlands
water quality
biodiversity restoration

DISCLAIMER

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ACKNOWLEDGMENTS

The Water4All Partnership have received funding from the European Union's Horizon Europe programme for research and innovation under Grant Agreement N°101060874. We wish to acknowledge the contribution from the Water4All RDI Funded Projects scientific coordinators and team members.

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Water4All
Water security for the planet

Co-funded by
the European Union