

Seasonal School

WAT-CHANGE - Water-related ecosystem services and nature-based solutions for adapting societies to climate change

HYBRID WORKSHOP

Nature-based solutions and Managed Aquifer Recharge. Application, case studies and market perspectives.

5th November 2025 — 14.00 pm to 18.15 pm CET
Palazzo Pilo Boyl — Scuola Superiore Sant'Anna
Via S. Cecilia 24, Pisa (Italy)
or online



Participation is free — registration mandatory
(12 seats still available in presence)

For registering please write to giacomo.vescovo@santannapisa.it specifying:
name and surname
Institution
country
attending online or in presence

For further information write to: *Rudy Rossetto – rudy.rossetto@santannapisa.it*

Presentation of the IAH Nbs and MAR Community of Practice

Integrating Nature-based Solutions into the WASH Systems: few examples of improved water security in the African semi-arid



**Daniela Benedicto
Van Dalen**

**Acacia Water
IAH MAR
Commission**

We explore the integration of Nature-based Solutions into improved water delivery services, for nature and human to enhance water security in semi-arid regions of Africa. Through selected case studies, we highlight how ecosystem-based approaches—such as watershed restoration and small-scale infrastructure—can complement traditional Water, Sanitation, and Hygiene interventions. The examples explore an IWRM approach to demonstrate improved resilience, water availability, and community engagement in water resource management.

Daniela Benedicto is hydrogeologist with international experience in groundwater management, Nature-based Solutions, and water buffering in water-scarce regions. She applies integrated, multidisciplinary approaches to strengthen WASH systems and improve water security, particularly in the semi-arid areas of the global South. Her work combines technical expertise with a strong commitment to sustainable and locally adapted solutions.

MAR Solutions in Veneto - Ensuring Safe Groundwater Replenishment through Infiltration Basins and Long-Term Monitoring



**Mara Meggiorin
Ramboll Italy**

Ramboll partnered with Sanpellegrino S.p.A. to achieve a Positive Water Impact through a Forested Infiltration Pond for water replenishment. Volumetric Water Benefit Accounting was used to assess and validate the effectiveness of water stewardship activities. This nature-based solution was then selected for aquifer recharge, thereby addressing groundwater depletion linked to water scarcity, replenishing approximately 780000 m³ per year, enhancing local biodiversity, and supporting CO₂ sequestration. Crucially, long-term monitoring has been planned to ensure safe groundwater recharge and sustained impact, addressing both environmental and public concerns.

Mara Meggiorin (Eng.), Consultant at Ramboll since 2021, holds a PhD in Environmental and Land Engineering from the University of Padova. Her expertise includes hydrogeological characterization, groundwater modeling, data management and analysis.

Quantifying Groundwater-dependent Ecosystem Services provided through MAR



Anne Schultze

**Technische
Universität
München**

To quantify the potential benefits arising from the implementation of managed aquifer recharge on Groundwater-Dependent Ecosystem Services (GDES), we are assessing the applicability of the InVEST model suite. Southern Bavaria, near the Alps, strongly depends on local GDES—particularly for agricultural and tourism-related purposes. We are comparing ecosystem services provided during a historical period (1931–1960) with those in a modern period (1991–2020) to assess changes over time. In the follow-up, potential MAR sites will be integrated and evaluated.

Anne Schultze is a PhD researcher with a background in Applied Biology at the Technical University of Munich. Since 2024, she has been part of the Chair of Hydrogeology, working on the Smart-SWS project, which focuses on combining flood protection and drought prevention. Her research emphasizes the potential of Managed Aquifer Recharge for supporting agricultural irrigation and enhancing ecosystem services.

Water from Scarcity to Strategy.

Unlocking the Strategic Value of Water in a Changing World



Andrea Gigliuto
ERM Italy

Water is no longer just about quantity—it's also about quality, governance, and strategic management. Businesses must shift from reactive approaches to basin-level stewardship to ensure long-term resilience. Nature-based solutions and Managed Aquifer Recharge offer scalable ways to restore ecosystems and secure supply, strengthening business continuity and operational stability. In this context, we must rethink the role of water: it is not just a resource to protect, but a catalyst for innovation, sustainability, and competitiveness.

Andrea is a Partner at ERM and serves as the General Manager for ERM Italy. He holds a PhD in Hydrogeology and brings over 20 years of experience in environmental consulting and water sustainability. Andrea is a recognised expert in Water Stewardship and Water Sustainability, supporting initiatives from corporate-level commitments to on-the-ground implementation at individual facilities.

UNESCO Ecohydrological Nature based Solutions within the IHP-IX



Rahmah Elfithri

UNESCO-IHP

The presentation outlines how ecohydrology serves as a core component of UNESCO's Intergovernmental Hydrological Programme (IHP-IX, 2022–2029). It highlights ecohydrology as a transdisciplinary science linking hydrology, ecology, and social dimensions to support NbS for water security. The programme promotes research, innovation, education, and integrated water management through global demonstration sites and designated UNESCO areas as “living laboratories.” Over 51 ecohydrology demo sites in 32 countries showcase applications addressing pollution, land-use pressures, and ecosystem degradation. UNESCO's approach integrates science, culture, and governance to enhance ecosystem resilience and sustainable water management worldwide.

Rahmah Elfithri is Chief of Section for Capacity Development and Water Family Coordination at UNESCO's Intergovernmental Hydrological Programme in Paris. She leads initiatives on ecohydrology, water quality, and water education, with over 15 years of experience in water, environment, and sustainable development. She authored over 300 publications on IWRM, sustainability, and community-based water management.

Managed Aquifer Recharge: a kind of water-related Nature-based Solution



Rudy Rossetto

**Scuola Superiore
Sant'Anna**

Nature-based solutions and managed aquifer recharge are essential strategies for adapting to climate change and ensuring sustainable water management. NbS imitate natural processes to improve water quality, enhance biodiversity, and strengthen ecosystem resilience while also delivering social and economic benefits. MAR practices, such as infiltration basins, bank filtration, and forested recharge areas, deliberately increase groundwater storage and improve quality. Although MAR is often considered a form of NbS, more evidence is needed to demonstrate its contribution to biodiversity enhancement. Overall, the integration of NbS and MAR, through participatory design, robust governance, and consistent monitoring, offers a pathway to resilient and environmentally sound water management.

Rudy Rossetto is a researcher at the Scuola Superiore Sant'Anna, Italy, with his main in water resources management and Managed Aquifer Recharge. He runs research under national and EU-funded projects on sustainable water resources and nature-based solutions. His work focuses on integrating ecohydrology, policy, and innovative technologies for climate-resilient water systems.

Coupling stormwater protection and water supply for hop gardens: First results from a pilot plant



Lea Augustin
Technische
Universität
München

The Hallertau region is one of the world's largest areas for hop cultivation. The high demand for irrigation is primarily met by extracting groundwater, which puts significant stress on local aquifers. Conversely, there have been several severe flooding events caused by stormwater, which has damaged infrastructure and left the region unused. Some of this stormwater is now used in a managed aquifer recharge pilot plant to restore the aquifer's balance. Built in fall 2024, the pilot plant consists of a retention basin, a treatment and control unit, an injection well, and an observation well. Hydrochemical parameters are closely monitored to evaluate the filter's efficiency and the impact on the aquifer.

Lea Augustin is a PhD researcher at the Chair of Hydrogeology at the Technical University of Munich, focusing on the growing challenges of water management in a changing climate. With a background in Environmental and Civil Engineering, Lea joined the Smart-SWS project in 2022 to help develop innovative solutions that link flood protection with drought reduction.

A simplified model to investigate the hydrological regimes of temporary wetlands: the case study of Doñana marshland (Spain)

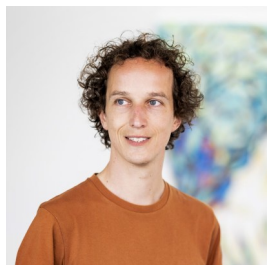


Ivan Portoghese
IRSA-CNR

Despite their ecological importance, wetlands remain underrepresented in hydrological modelling studies, especially regarding their specific water needs under changing environmental conditions and different scenarios. This study aims to estimate the water requirements of a temporary wetland through a simple hydrological balance model, ultimately facilitating the identification of strategies for its long-term sustainable management.

Ivan Portoghese, Research Scientist at the Italian National Research Council - Water Research Institute (CNR - IRSA), has a long experience in hydrological characterization of Mediterranean basins. In his research, he has authored more than 40 scientific articles published in international journals, book chapters, conference proceedings on innovative methods and tools for water resource planning and management.

Assessing the impact of Managed Aquifer Recharge on Coastal Wetland Health: Insights from the Magdalena Region, Colombia

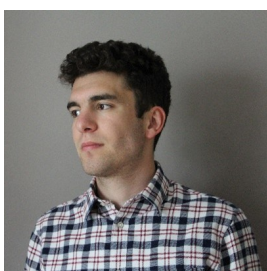


Niels Mulder
Deltares (NL)

In Colombia's Magdalena region, MAR is being piloted in a banana plantation to improve sustainable water management for banana producers and explore the potential to upscale it and improve water security in the catchment. Beyond on-farm benefits, upscaling MAR will also influence freshwater flows to the Ciénaga Grande de Santa Marta, a wetland of high ecological value that depends on adequate river inflow. Using a water allocation model, we assessed how replacing surface water intake by MAR during the dry season and increasing the intake of surface water for MAR during the wet season, affects the hydrological balance and consequently the nexus water-agriculture-nature. Our findings illustrate how basin-scale modeling can guide the integration of MAR into broader water and ecosystem management strategies.

Niels Mulder, hydrogeologist at Deltares, Unit of Groundwater and Subsurface Systems, graduated as physical geographer from Utrecht University. He works in the humanitarian/public sectors for improving freshwater availability. His work combines numerical modeling, fieldwork, and the development of serious games.

Restoring Nitrate-Contaminated Aquifers: Evaluating Managed Aquifer Recharge, Nature-based Solutions and Fertilizer Reduction Strategies in an Irrigated Agricultural District



Giacomo Vescovo
Scuola Superiore
Sant'Anna (Italy)

This study evaluates MAR and NbS for nitrate remediation in Spain's Los Arenales aquifer. A transient groundwater flow and solute transport model tested six scenarios combining MAR NbS and fertilizer reduction. Results show MAR effectively dilutes nitrates through advection and dispersion, while enhanced forest recharge had limited impact. Reducing inorganic nitrogen inputs proved most effective, lowering nitrate concentrations up to 23 mg/L in five years. Sustainable remediation ultimately depends on reducing excessive fertilizer use protecting groundwater and reducing agricultural emissions.

Giacomo Vescovo is a junior geologist at the Institute of Crop Science – Scuola Superiore Sant'Anna (Italy). He deals with field experimental activities and numerical groundwater flow and density-dependent transport modelling.