



STARS4Water

SUPPORTING STAKEHOLDERS FOR ADAPTIVE, RESILIENT AND SUSTAINABLE WATER MANAGEMENT

NEWSLETTER ISSUE NO. 4 – SEPTEMBER 2025

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1. EDITORIAL

Dear Reader,

We are pleased to share the 4th STARS4Water Newsletter, designed to keep you updated on our project's progress, outcomes, and other significant developments in the fields of water resource management and climate adaptation. Our goal is to engage a broad audience—spanning the scientific, policy, and business communities—with insights from STARS4Water, inviting your feedback and fostering the growth of a collaborative STARS4Water Community.

STARS4Water is a stakeholder driven EU research project under the Horizon Europe and will develop, in co-creation with stakeholders, the next generation tools and data services to support informed decision-making on actions towards sustainable and climate resilient water resources management. Seven River Basin Hubs are involved in the process, serving as living labs for the co-creation of data services and tools with stakeholder communities and as accelerators for further up-scaling of these services and tools to other river basins worldwide. Our overarching goal is to improve the understanding of climate change impacts on water resources availability and the vulnerabilities for ecosystems, society and the economy at river basin scale, including two distinctive elements: first, the establishment of an international stakeholder community as representatives of the wider river basins' community to address their specific needs and requirements for sound water resources' management and climate adaptation. Second, the development and application of innovative data services, models, tools.

We are entering the 4th year of our project, and we are happy to present our current achievements and outputs (section 2), update you on developments from the water and climate community and upcoming events (section 3), meet the young professionals involved in the project (section 4), and opportunities to get involved and interact with the STARS4Water team (section 5).

For more information about the project please visit our website WWW.STARS4WATER.EU, and feel free to send us specific inquiries using the available [CONTACT FORM](#).

2. INSIDE STARS4WATER: UPDATES ON OUR ACTIVITIES

STARS4Water cuts across the scientific themes of water resources management and climate adaptation, and addresses multiple stakeholders concerned with sustainable water resources management. Different products target a range of groups, tailored to their identified needs. During the past months various activities were implemented. Below we present brief summaries of the following STARS4Water activities:

- **STARS4Water Impact Reporter in now launched**
- **The STARS4Water Academy is now launched**
- **3rd Release of the STARS4Water Metadata Portal**
- **Data-driven modelling tools for the STARS4Water River basins**
- **Added value of the models for assessing future water resources availability in the STARS4Water River Basin Hubs**
- **STARS4Water Policy brief on climate change impacts on water resources in EU basins**
- **Highlights from the STARS4Water Annual General Assembly and Stakeholders' Meetings, 22-26 September 2025, Drammen Norway**
- **STARS4Water at 75th Anniversary Event of the International Commission of Protection of the Rhine**

▪ STARS4Water Impact Reporter in now launched

We are pleased to announce the launch of the [STARS4Water Impact Reporter](#), which was held during our all partners and stakeholders meeting on the 25th of September, in Drammen, Norway. The Impact Reporter is an online open-access application designed to disseminate and share insights on the impacts of historic flood, drought, storm, and heatwave events. The Impact Reporter provides a comprehensive platform to report biophysical, social and cultural, economic, and health-related impacts of past events, fostering knowledge exchange among stakeholders. Additionally, the application highlights applied mitigation and adaptation measures, enabling communities and decision-makers to learn from past experiences. This information is crucial and currently lacking at a harmonised and easily accessible format.

By consolidating critical data and facilitating collaboration, the Impact Reporter supports vulnerability and risk analysis, empowering stakeholders to make informed decisions and enhance resilience in planning for future climatic challenges. Its added value lies in bridging the knowledge gap and making impact data accessible, which can in turn inform actionable strategies for risk reduction and sustainable adaptation.

The screenshot displays the STARS4Water Impact Reporter web application. At the top, there is a header with the application name and a login button. Below the header is a map of Europe showing various river basins and event markers. To the right of the map is a sidebar with filters for Countries, Event Severity, Event Type, Impact Type, and Impact Significance. Below the map and filters is a table of event entries. The table has columns for Title, Event Type, Start Date, Duration [h], Countries, Severity, Impact Significance, and Impact Types. The table shows five entries, including historical floods in Greece and extreme drought in the Netherlands.

Title	Event Type	Start Date	Duration [h]	Countries	Severity	Impact Significance	Impact Types
Historical flood of Kifissos R...	Flood	1994-10-21	11	Greece	HIGH	HIGH	Environmental, Societal and Cultural, Economic, Health
Historical flood of Kifissos R...	Flood	2013-02-22	9	Greece	HIGH	HIGH	Environmental, Societal and Cultural, Economic, Health
Destructive flood event in The...	Flood	2023-09-04	96	Greece	HIGH	HIGH	Environmental, Health, Societal and Cultural, Economic
Extreme drought / low discharg...	Drought	2022-03-01	4320	Netherlands	MEDIUM	HIGH	Environmental, Societal and Cultural, Economic
Extreme weather Hans - floodin...	Flood	2023-08-07	48	Norway	HIGH	HIGH	

The Impact Reporter is open-access when it comes to viewing the recorded events and related information. The reporting on a new event requires a registration and access is provided by the project for screened users. We welcome contributions from river basin stakeholders across Europe so that we enrich the information available on the Impact Reporter.

To express your interest in submitting new information [please contact us](#).

To learn how to navigate the platform please watch our [Impact Reporter Introductory Video](#).

▪ **The STARS4Water Academy is now launched**

STARS4Water has just launched the [STARS4Water Academy](#) during our all partners and stakeholders meeting on the 25th of September, in Drammen, Norway. The Academy offers an open access structured series of webinars and tutorials designed to share methods, processes, models and tools developed within the projects with researchers, practitioners, and policymakers.

The Academy mirrors the STARS4Water knowledge chain: from observations and data services, through modeling and risk assessment, to decision support. Content is tiered (from the introductory Level 1 to the in-depth Level 3) so users at all experience levels can engage.

Topics of the webinars include local data collection, climate risk indicators, various water management and data-driven models and more, demonstrating how to adapt and apply these tools in your basin or region. Currently, the Academy features 12 webinars, with plans to expand to around 40 in the coming months.

We invite you to watch our webinars, contribute your questions, and help drive uptake of the STARS4Water foreground.



You can watch the STARS4Water Academy teaser video [here](#).

▪ **3rd Release of the STARS4Water Metadata Portal**

To improve the understanding of water resources availability and water use in river basins the STARS4Water project is unlocking global and European data sources by creating easy access to these data sources through the [STARS4Water Metadata Portal](#), which was officially launched in September 2023. The Metadata Portal is a flexible and modular environment easily adaptable to the different needs of the river basin organisations.

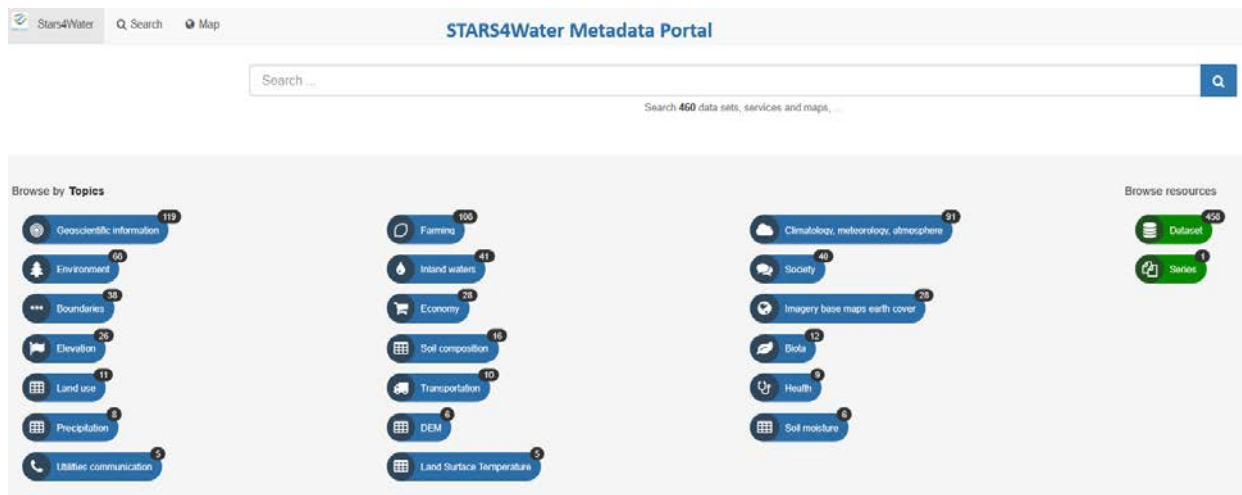
The 3rd release of the Metadata Portal has now been achieved. The current version contains 460 datasets on a wide range of topics relevant for water resources assessments. Since the previous release (in September 2024) we have added:

- Datasets that were generated by the STARS4Water project, such as the WP2 tier1 climate risk indicators. These are scenarios for climate and socio-economic data for each river basin or subcatchment, derived from existing Copernicus data.
- Metadata that were collected by the STARS4Water 'sister project' [SOS-Water](#). SOS-Water made a similar inventory of global data that are relevant to water resources management. The results of that inventory were shared with the STARS4Water project team and several datasets have been added to the Metadata Portal.

The procedure for uploading metadata to the portal has been formalized. Zenodo has been selected as the default DOI-provider for datasets that are generated and published by the STARS4Water project (visit the [STARS4Water Community on Zenodo](#)).

The current platform is based on the Geonetwork catalog application. It is planned that the platform will be migrated to the new STAC (Spatio-Temporal Asset Catalogs) environment in the upcoming months. The fourth and final release of the Metadata Portal is scheduled for September 2026.

To access the STARS4Water Metadata Portal please visit: [Stars4Water \(stars4water.openearth.nl\)](https://stars4water.openearth.nl)



More information can be found in the following STARS4Water project Deliverable:

J. Beckers, Schotmeijer, G.J., & G. Hendriksen (2025): [Third release of the STARS4Water Metadata Portal](#). Horizon Europe project STARS4Water. Deliverable D2.7.

▪ Data-driven modelling tools for the STARS4Water River basins

In recent decades, the unprecedented levels of accessible data and computational power has led to an explosion of applications of data-driven and Machine Learning (ML) models across almost all areas, including that of hydrology and water resources. The STARS4Water project has published a report, introducing a suite of data-driven modelling tools co-developed with river basin stakeholders. These tools respond to the needs identified across the project's seven River Basin Hubs and complement existing process-based models.

The report showcases how machine learning and advanced data techniques can leverage the increased volumes of hydrological, environmental, and socio-economic data for improved water management. Key tools developed include:

- Forecasting of **reservoir storage and inflows** using LSTM and ensemble-tree models to address the need for better quantitative assessments of water resources, and to support decision making for reservoir operation
- **Downscaling of total water storage** (GRACE, ERA5, TSMP) to estimate groundwater depth anomalies.
- Estimation of **agricultural water use and irrigated areas** (MODIS, Random Forest) to assess the impacts of climate change on agricultural water demand.
- **Predictive mapping of groundwater quality** (MLMapper) to identify contamination risks.
- **Quantitative groundwater resource estimation** (TSMP, STT, XGBoost) at multiple scales to refine the estimation of groundwater resources, improving understanding of groundwater impacts on droughts and low flows.

Applications across case study basins (Duero, Seine, Messara, Rhine, East Anglia) demonstrate promising results for reservoir operation, groundwater assessment, and irrigation monitoring. These approaches highlight the potential of data-driven methods to capture non-linear dynamics in a computationally efficient manner and support adaptive, resilient, and sustainable water management. With continued stakeholder collaboration, the

tools can be scaled and operationalised in additional basins. Future work will focus on extending these methods and integrating them into basin-level decision support systems.

An overview of the data-driven tools applied in this work alongside the river basin hub (RBH) they were developed/applied in

Aim	Applied Models	Timestep & Prediction Horizon	Spatial Resolution & Extent	RBH	Input Data Type	Validation Data Type
Reservoir inflow and storage prediction	LSTM	Daily; 1 day ahead	point; multi-reservoir	Duero; Seine	in-situ; global ¹	in-situ
Reservoir storage forecasting	Ensemble -tree	Monthly; 1-3 months ahead	point; multi-reservoir	Duero; East Anglia	in-situ; global ¹	in-situ
Downscaling water table depth anomalies	RF; LSTM	Monthly; n/a	9 km; basin	Seine	satellite; reanalysis; simulated	simulated; in-situ
Irrigated area prediction	RF	Annual; n/a	1 km; basin	Rhine	satellite	in-situ (survey statistics)
Groundwater spatial contamination prediction	Ensemble -tree	n/a; n/a	~km; basin/aquifer	Duero; East Anglia	spatial ²	in-situ
Groundwater storage change prediction	STT; XGBoost	Monthly; 1 month	11 km; basin	Duero	spatial ²	simulated; in-situ

1. global catchment-level data, e.g. meteorological data and static catchment characteristics

2. spatial datasets, such as lithology, land-use and rainfall, which have been produced using a range of methods

More information can be found in the following STARS4Water project Deliverable:

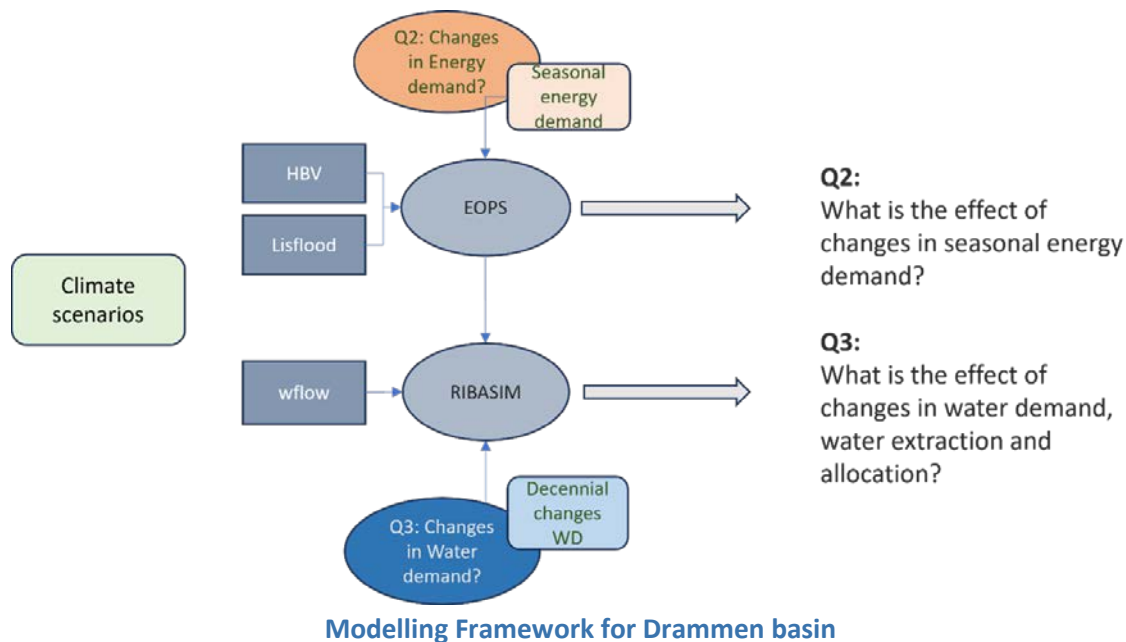
Baron, H., Keller, V., Klotz, D., Kenne, A., Avila, L., Purnamasari, D., Martínez-Santos, P., Aguilera, H., Gómez-Escalonilla, V., Rodríguez del Rosario, M., Díaz Alcaide, S., Beckers, J., Hegdahl, T. J. (2025): [Data-driven modelling tools for the STARS4Water River Basins](#). Horizon Europe project STARS4Water. Deliverable D3.4.

Added value of the models for assessing future water resources availability in the STARS4Water River Basin Hubs

The STARS4Water project has released a report on the “Added value of data-driven models and data services”. The report provides an overview of newly developed or improved data-driven modelling tools for assessing future water resources availability in the seven STARS4Water River Basin Hubs, discussing also how the stakeholders supported the process of calibration and validation of the improved model frameworks. The presented case studies address reservoir operation in Drammen, low-flow risks in the Rhine, water allocation in the Danube, groundwater nitrate mapping in the Duero, reservoir forecasting in East Anglia, drought management in the Seine, and water allocation of the overexploited groundwater resources in Messara.

The models were calibrated and validated using improved datasets and methods such as multi-objective optimisation, split-sample testing, and k-fold cross-validation. The calibration and validation processes also incorporated scenario modelling to test the models under future climate and socio-economic conditions. For example, the Rhine basin models integrated KNMI’23 climate scenarios to predict water shortages by 2050, while the Seine basin models evaluated reservoir management impacts under low-flow conditions.

The report highlights the added value of combining new data services with local knowledge and implementing a stakeholder-driven approach which leads to increasing trust and confidence in the basin-scale modelling framework. This added value stems from collaboration at every stage, starting with understanding and identifying the water management challenges and specific needs in the basins. Stakeholders contribute by helping to improve the accuracy of models through feedback on calibration and validation methods. They also play an important role in ensuring that the models are practical and relevant for real-world use, and they can adequately support decision-making for resilient and sustainable freshwater resource management.



More information can be found in the following STARS4Water project Deliverable:

Preiml, M., Klösch, M., Glas, M., Graf, T. & Habersack, H. (2025): [Added value of data driven models and data services](#). Horizon Europe project STARS4Water. Deliverable 4.1

▪ STARS4Water Policy Brief on climate change impacts on European River Basins

STARS4Water has released a new policy brief highlighting how climate change is reshaping Europe's river basins. The brief warns about more frequent droughts and floods, declining snow and glacier storage, and shifting river flow regimes.

Europe is warming at twice the global average, with cascading impacts on water, food, energy, and ecosystems. Hydropower, inland navigation, agriculture, and drinking water supply face mounting risks. STARS4Water has collaboratively explored future water resource availability and water use in seven diverse European river basins, representing a broad spectrum of hydrological and socio-economic contexts across Europe. Regional differences are stark:

- Rhine & Danube: glacier retreat, summer low flows, and winter flood risks.
- Drammen (Norway): earlier snowmelt, stronger rain floods, altered reservoir operations.
- Messara (Crete): worsening water scarcity and aquifer overexploitation.
- Duero (Spain): declining runoff, more frequent droughts, groundwater stress.
- Seine (France): high uncertainty, more summer low flows, need for adaptive reservoir management.
- East Anglia (UK): extreme sensitivity to hotter summers, wetter winters, and rising seas.

The brief links findings to the European Water Resilience Strategy (2025), stressing the need for basin-specific adaptation. It sets out **six guiding principles**, including holistic river basin approaches, science–stakeholder partnerships, participatory development of future scenarios, and defining a “safe operating space” for water use. The policy brief calls for urgent action to reduce water demand, expand nature-based solutions, and ensure inclusive, resilient water governance.

More information can be found in the following STARS4Water project Deliverable:

Duel, H., Kossida, M., Blind, M., Ramos, M.H. (2025): [Climate change impacts: water challenges of European river basins](#), STARS4Water Policy Brief. Horizon Europe project STARS4Water. Deliverable 6.6.

▪ Highlights from the STARS4Water Annual General Assembly and Stakeholders' Meetings, 22-26 September 2025, Drammen Norway

STARS4Water has recently held its annual [General Assembly](#) meeting in Drammen and Finse, Norway, from 22nd to 26th of September 2025, organized by Norwegian Water Resources and Energy Directorate (NVE) and DELTARES. During this meeting partners discussed the up-to-date project progress, interacted across teams and work packages, and planned ahead for the 4th year of our project. Two significant STARS4Water products, the [Impact Reporter](#) and the [STARS4Water Academy](#) were also launched.

Two stakeholders' meetings were also held back-to-back. The first meeting with the Drammen stakeholders (on 23/09/2025) focused on discussion and tools for the Drammen River, and was attended by the Regulatory Cooperation for all hydropower companies and associations in the Drammen River Basin (RSD), Å Energi, Drammen River Basin District Authorities, Norwegian Water Resources and Energy Directorate (NVE), Glitre Vannverket Water Supply. Stakeholder "Å Energi" (Renewable Energy Power Generation) also presented the flood management responsibilities, challenges and the energy potential in the Drammen river. During the second meeting (on 25/09/2025) stakeholder partners from all the STARS4Water river basin hubs were updated about recent results and plans for final year of the STARS4Water project and provided their feedback.



STARS4Water General Assembly, Finse, Drammen, Norway



STARS4Water meeting with stakeholders from the Drammen River Basin

▪ **STARS4Water at 75th Anniversary Event of the International Commission of Protection of the Rhine**

The [75th anniversary of the International Commission for the Protection of the Rhine \(ICPR\)](#) was celebrated on July 3, 2025, in Düsseldorf, where water management experts commemorated 75 years of international cooperation and discussed future challenges in protecting the Rhine river basin. The ICPR was founded on July 11, 1950, to address transboundary water pollution and has since become a model for similar organizations worldwide, with successes including the return of species like salmon to the river and significant improvements in water quality.

STARS4Water coordinator Deltares presented the project with a poster presentation entitled: "Improving realism of high-resolution hydrological modeling with anthropogenic water use: a study on the Rhine basin".

The poster is available [here](#).

3. NEWS FROM THE WATER AND CLIMATE COMMUNITY

EU LAUNCHES DATA-DRIVEN AND GENDER-INCLUSIVE MEASURES TO COMBAT DESERTIFICATION AND DROUGHT

On 17 June 2025 — coinciding with the [UN's Desertification and Drought Day](#) — the European Commission unveiled two flagship initiatives aimed at bolstering resilience against desertification and drought in a globally inclusive and gender-equitable manner:

1. Water Resilience Indicators Report

- Developed in partnership with **UNEP**, this report delivers data-driven benchmarks to guide policymakers and planners in improving drought preparedness.
- The Commission is also contributing scientific expertise to the [International Drought Resilience Observatory](#), part of the UNCCD's efforts.

2. Training Programme for Women Negotiators

- An EU-led effort to boost women's presence and leadership in environmental diplomacy, focusing on upcoming negotiations under **UNCCD COP17** scheduled for August 2026 in Mongolia.

These moves integrate with the broader [EU Water Resilience Strategy](#), which emphasizes nature-based solutions to safeguard the water cycle, enhance water security, and prepare for natural disasters like droughts. Moreover, they support initiatives in the Sahel and Horn of Africa — such as the **Great Green Wall** and EU-funded K4GGWA

programme — and leverage tools like the **Global Drought Observatory** under Copernicus EMS for real-time monitoring and early warnings.

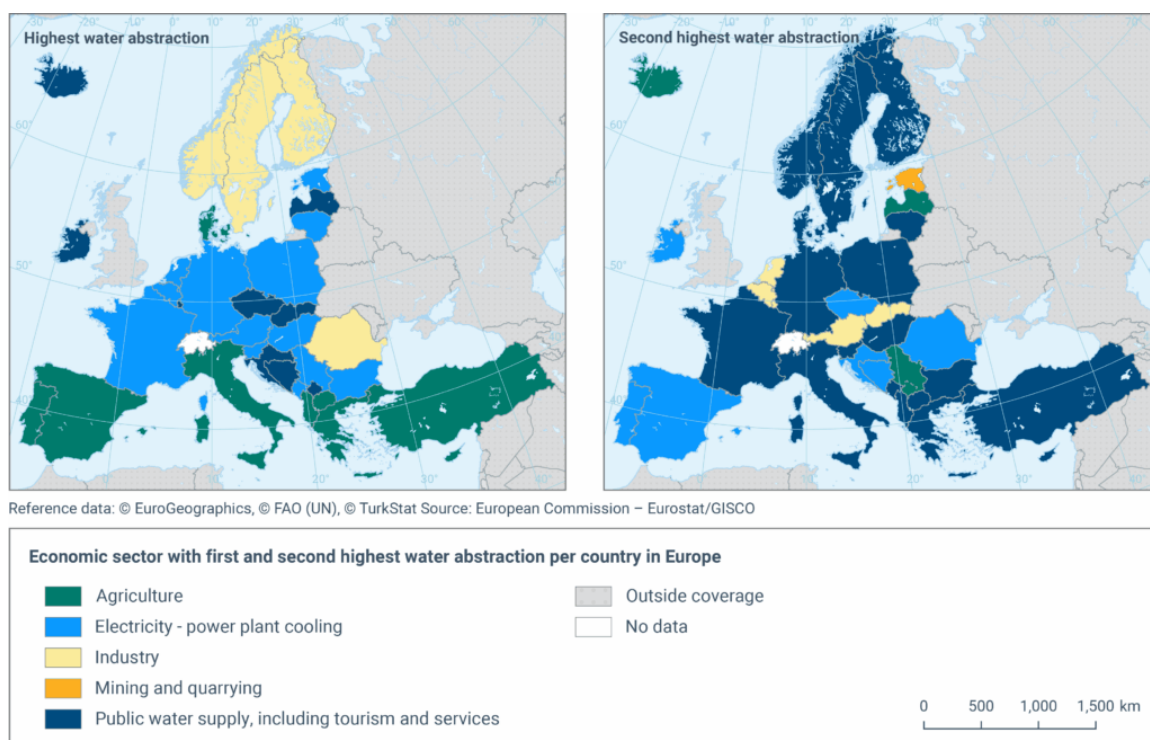
In a nutshell:

- Data & science-driven: New indicators and observatory collaboration enhance global drought readiness.
- Gender empowerment: Targeted training expands women's roles in environmental negotiations.
- Part of EU-wide resilience strategy that spans local and global efforts, ecosystem restoration, and early-warning systems.

Source: https://environment.ec.europa.eu/news/new-eu-initiatives-tackle-desertification-and-drought-2025-06-17_en

RETHINKING WATER USE: NEW PATHWAYS FOR A WATER-RESILIENT EUROPE

The [European Environment Agency \(EEA\)](#) has released a new briefing highlighting the urgent need to rethink how water is used across Europe to build long-term resilience against droughts and water scarcity. The publication, *Water savings for a water-resilient Europe*, explores how sustainable water management can be achieved by using less, polluting less, and reusing more. It calls for stronger integration of water-saving measures into key sectors like agriculture, industry, and households, alongside nature-based solutions to restore ecosystems and recharge groundwater.



Economic sectors with the highest water abstraction pressure at the country level, 2000-2022.

The EEA stresses that smart governance, innovative technology, and public awareness are vital to ensure Europe's water resources can sustain people, nature, and the economy amid a changing climate.

Read the full EEA briefing here: <https://www.eea.europa.eu/en/analysis/publications/water-savings-for-a-water-resilient-europe>

EUROPE FACES INTENSIFYING MID-2025 DROUGHT ACROSS REGIONS

Europe is currently confronting a significant and escalating drought crisis as the summer of 2025 progresses. Multiple scientific agencies report expanding drought conditions, profoundly impacting ecosystems, agriculture, water resources, and communities across the continent.

Extent and Evolution of the Drought

- According to the Combined Drought Indicator (CDI) from the European Drought Observatory, by late May 2025 drought warning levels were observed in extensive areas including the Baltic region, the UK, northern France, Benelux, parts of Germany, Poland, Czechia, Slovakia, Belarus, Ukraine, Romania, Bulgaria, Greece, the western Balkans, Cyprus, Türkiye, and parts of the Mediterranean islands. Alert (more severe) conditions were already in place in southeastern Spain, Cyprus, North Africa, central/southeastern Türkiye, and the Middle East.
- The Joint Research Centre's "Drought in Europe – June 2025" report confirms a severe drought affecting central, northern, eastern Europe, the eastern Mediterranean, and northwestern Africa. These conditions were triggered by low rainfall from March through May and compounded by above-average temperatures (e.g., anomalies exceeding 2 °C in regions like Iceland, southern Norway, Ireland, northern France, and the Alps).

Impacts on Agriculture, Vegetation, and Hydrology

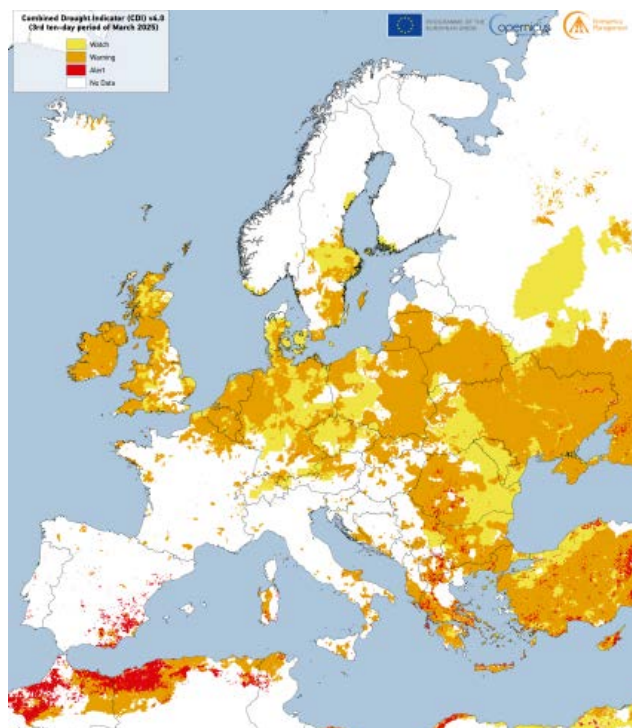
- Emerging vegetation stress is especially notable in eastern Europe, while soil moisture deficits are already hampering plant growth across the Mediterranean region.
- In northwestern Europe—Benelux, northern France, and Germany—agricultural concerns are rising due to severe rainfall deficits, putting winter and spring crop yields at risk. Conversely, parts of the Iberian Peninsula, Italy, and Greece have experienced more favorable conditions and could see yields increase by an estimated 15–20% in Spain and Portugal.

Broader Environmental Stress

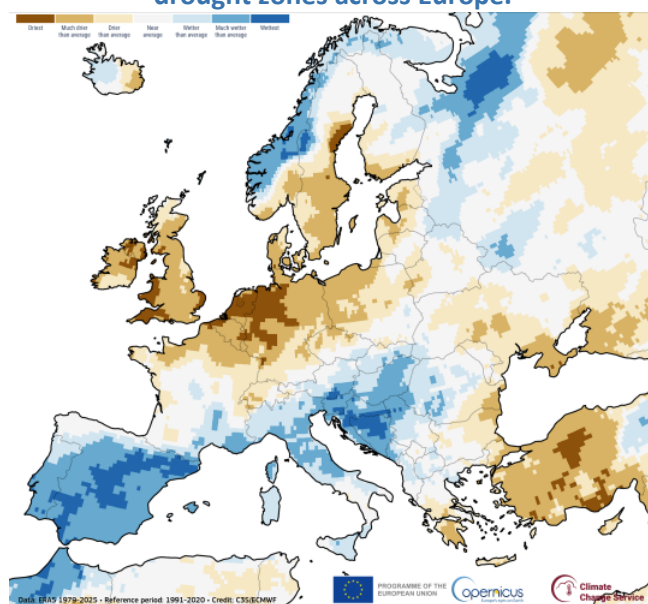
- The April 2025 JRC report highlighted that March in Germany was the driest ever recorded, and the Rhine River levels dropped to roughly half of normal at Cologne by April 12.
- Forecasts projecting into summer warn of continued dry and warm conditions, especially in northern and western Europe—raising concerns for agriculture, river transport, and ecosystem health.

Climatic Context

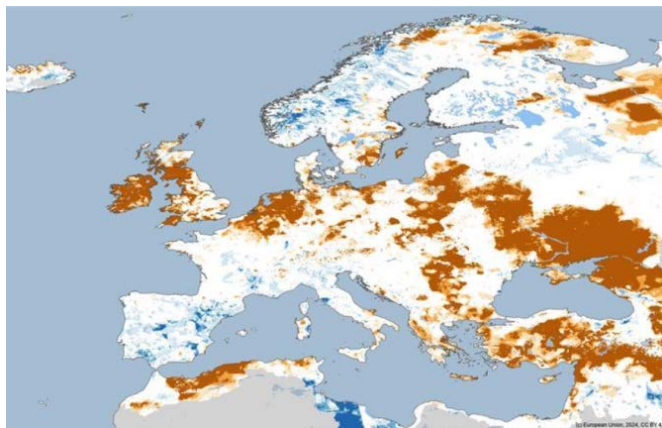
The drought has been strongly driven by persistent rainfall deficits across much of Europe during spring 2025, combined with above-average temperatures that accelerated soil drying and evaporation.



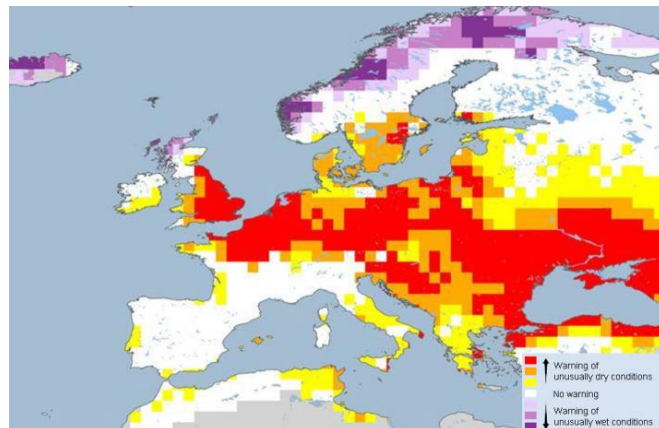
Combined Drought Indicator for March 2025 — showing widespread watch, warning, and alert drought zones across Europe.



Projected agricultural impacts — rainfall deficits in the north vs. improved conditions in southern Europe.



Early April 2025: Rhine River at remarkably low levels and soils in extensive drought stress.



March 2025 precipitation anomalies — significant dryness across NW Europe.

References:

- European Drought Observatory / Copernicus Emergency Management Service – <https://drought.emergency.copernicus.eu/>
- JRC “Drought in Europe – June 2025” report – https://joint-research-centre.ec.europa.eu/jrc-news-and-updates/escalating-drought-threatens-europes-ecosystems-and-agriculture-2025-06-23_en
- JRC April 2025 drought brief – https://joint-research-centre.ec.europa.eu/european-and-global-drought-observatories/current-drought-situation-europe_en
- WMO News – Extreme Heat in Europe – <https://wmo.int/media/news/extreme-heat-grips-europe>

UN SETS THEMATIC PRIORITIES FOR 2026 WATER CONFERENCE

A key milestone in global water governance was reached on **9 July 2025**, when the United Nations General Assembly (UNGA) adopted six thematic pillars for the upcoming **UN 2026 Water Conference**. This decision came during the 84th plenary of the 79th UNGA session, following a broad consultative process with Member States and stakeholders. The draft resolution (A/79/L.101), tabled by **Senegal** and the **United Arab Emirates (UAE)**, lays the foundation for the conference’s structure and strategic focus.

Adopted Themes for the Interactive Dialogues

1. **Water for People** — Focus on the human rights to water and sanitation, including for those in vulnerable situations, fostering healthy societies and economies.
2. **Water for Prosperity** — Emphasizes the water-energy-food nexus, integrated and sustainable water-resource management, wastewater and water-use efficiency, and socio-economic development.
3. **Water for Planet** — Addresses climate resilience, biodiversity, desertification, environmental protection, “source to sea” dynamics, and disaster risk reduction.
4. **Water for Cooperation** — Promotes transboundary and international water cooperation, scientific collaboration, and inclusive governance frameworks.
5. **Water in Multilateral Processes** — Aligns with SDG 6 (clean water and sanitation), the 2030 Agenda, and other global water initiatives.
6. **Investments for Water** — Covers financing, technology and innovation, and capacity building necessary to drive water action globally.

Looking Ahead: The Roadmap to 2026

The **UN 2026 Water Conference**, titled “Accelerate the Implementation of Sustainable Development Goal 6: Ensure availability and sustainable management of water and sanitation for all,” will be **co-hosted by Senegal and the UAE**, and is scheduled to take place in the **UAE from 2–4 December 2026**.

As part of the preparatory process, Senegal announced a **high-level preparatory meeting in Dakar, slated for 26–27 January 2026**, to further reinforce planning efforts.

Source: <https://sdq.iisd.org/news/unqa-adopts-six-themes-for-un-2026-water-conference/>

4. MEET OUR YOUNG SCIENTISTS

FORECASTING SNOW WATER EQUIVALENT (SWE) FOR PLANNING AND DECISION-MAKING IN WATER RESOURCES MANAGEMENT

by *Leandro Avila*

Hydropower generation in Norway is expected to face significant challenges, mainly due to changes in snow-dominated water regimes. Snow has traditionally acted as a natural reservoir, storing water in winter and releasing it gradually through spring and summer melting. Shifts in precipitation patterns potentially affect this cycle, with implications for both the volume and timing of water inflows to reservoirs. These changes create uncertainty for water resources management, as hydropower operators must balance energy production, flood control, and ecological requirements. In this context, forecasting Snow Water Equivalent (SWE) is a key component of planning and decision-making. FZJ, a STARS4Water project partner, is contributing to the development of advanced modelling tools that can be applied across European river basins. One such tool is a CNN-LSTM deep learning model designed to generate high-resolution daily SWE maps and predict snowpack dynamics. By integrating topographic and meteorological data, the model captures the complex, non-linear processes that govern snow accumulation and melt. Within the broader framework of STARS4Water, this work illustrates how data-driven models can enhance operational water management. For Norway, the tool provides hydropower operators with more reliable forecasts to optimize reservoir operations, anticipate shortages or surpluses, and strengthen resilience to hydrological variability.



For the project, it demonstrates how innovative forecasting approaches can support decision-making at the intersection of energy, water security, and climate adaptation. This research focuses on the application, validation, and demonstration of this model in the Drammen River Basin, offering insights into its potential for broader use in other snow-influenced regions of Europe.

Leandro Avila is a postdoc at FZJ. He holds a bachelor's and master's degree in civil engineering from Universidad del Norte, and a PhD from Universidade Federal do Paraná.

5. GET INVOLVED IN THE STARS4WATER COMMUNITY



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- ❖ For general inquiries, cooperation request, invitation to events, dissemination issues etc., please contact us using the available [CONTACT FORM](#)
- ❖ For data access and download please visit our Metadata Portal: [STARS4WATER METADATA PORTAL](#)
- ❖ For information on upcoming events please visit our [STARS4WATER CALENDAR](#)
- ❖ To download available project deliverables, presentations, publications, please visit the ["OUTPUT"](#) section of the STARS4Water website and the [STARS4Water Community on ZENODO](#)

THE PROJECT AT A GLANCE

Title: SUPPORTING STAKEHOLDERS FOR ADAPTIVE, RESILIENT AND SUSTAINABLE WATER MANAGEMENT (STARS4WATER)

Instrument: HORIZON-CL6-2021-CLIMATE-01, EUROPEAN RESEARCH EXECUTIVE AGENCY

Total Cost: 4,584,730 €

EC Contribution: 4,580,979 €

Duration: 48 MONTHS

Start Date: October 1st, 2022

Consortium: 21 partners from 10 countries

Project Coordinator: Stichting Deltares

Project Web Site: www.stars4water.eu ; <https://cordis.europa.eu/project/id/101059372>

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