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Research for grand challenges.

Helmholtz Water Safety and Security Challenge // Solution Labs

Securing Terrestrial Water Cycles: the Helmholtz SOlution Lab Elbe RiVEr Basin

KA-WSSC-01 - SOLVE

UFZ Halle - Elbe catchment

UFZ| GFZ| AWI| DLR| HEREON| MDC| HZDR

Securing Terrestrial Water Cycles: the Helmholtz SOlution Lab Elbe RiVEr Basin

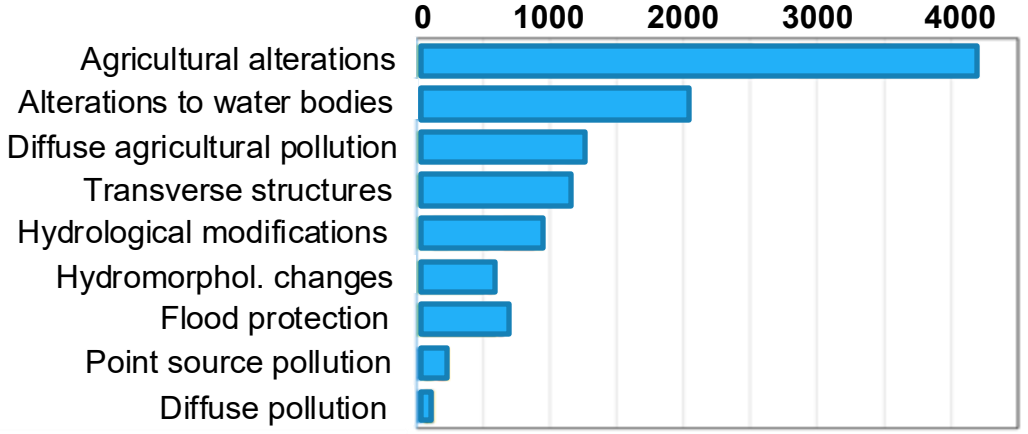
Challenge: need of science-based optimization of water action measures

The Elbe Basin

- LARGE!!
- vulnerable to climate change
- long management history
- central register of past and planned measures

Challenge: need of science-based optimization of water action measures

Number of measures to prevent degradation due to:



to fullfill the European Water Framework Directive:

~25000 measures planned in Elbe River Basin

- Unknown: how measures impact **water cycle** and **ecosystem health**.
- Missing: **co-designing** of measures, based on a holistic, science-based assessment.

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Objectives

1) Identify & optimize measures to effectively regulate
Landscape water cycle

3) Support the assessment of measures by setting up a
Water Action Hub

2) Quantify impacts of measures for
Ecosystem health

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The Consortium

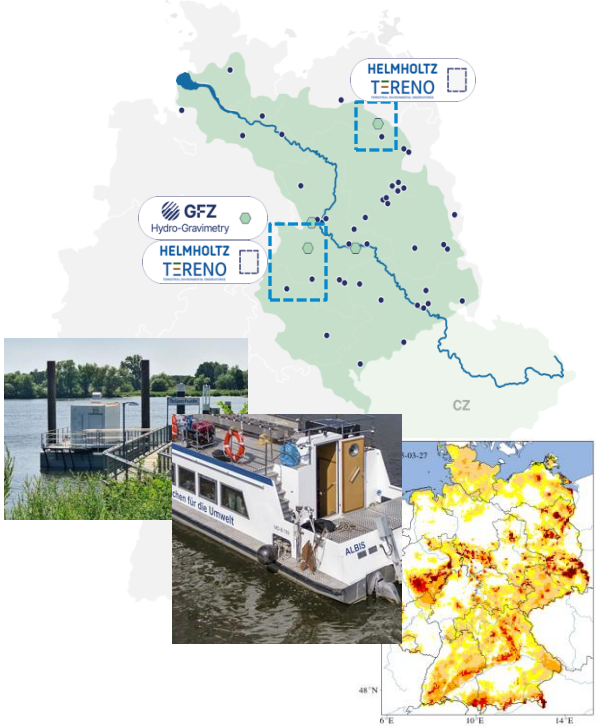
7 Helmholtz Centres

4 Research Fields

Natural and Social Sciences

UFZ
GFZ
AWI
DLR
GERICS Climate Service Center Germany
hereon
MAX DELBRÜCK CENTER
HZDR

Research infrastructure



Major stakeholders

National level

Umwelt Bundesamt
DVGW
THÜNEN

River basin level

FGG ELBE

Regional level

LfULG
LHW
LfU Landesamt für Umwelt
Berliner Wasserbetriebe

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Objectives -> WPs -> planned sub-projects

1) Identify & optimize measures to effectively regulate

Landscape water cycle

3) Support the assessment of measures by setting up a

Water Action Hub

2) Quantify impacts of measures for

Ecosystem health

Work package 1: Landscape water balance & management measures

Work package description:

Runoff generation and groundwater recharge are key regulators of the landscape water balance. While high runoff generation accelerates drainage and increases **flood risk**, strong groundwater recharge sustains **long-term water reserves for humans and ecosystems**.

Past human interventions have often **increased runoff while reducing groundwater recharge**.

Objective: identify **processes and optimize measures** that regulate **runoff and groundwater recharge** in the Elbe River basin.

Work package 1: Landscape water balance & management measures

Sub-Project proposal (GFZ, UFZ, AWI, DLR, LfU Brandenburg, LHW, LfULG, BGR, Thünen, UBA):

"Canaries and Gate Keepers for Landscape Water Balance and Management"

- Based on basin-wide analyses of soil moisture and water storage dynamics using satellite-products, in-situ data, numerical models and innovative AI-approaches we will identify spatially distributed critical locations ("gate keeper locations") for flood risk, drought severity and groundwater recharge.
- Analyses will rely on existing data sets, processing chains, models and expertise on linking GRACE satellite products with terrestrial gravimetry and could also include a detailed assessment of forest contributions to water storage, infiltration, and runoff regulation.
- Gate-keeper locations can either serve as "canaries in the coal mine" in terms of early warning, but are likely also locations where management measures are especially effective.
- Potential monitoring and measures to be carried out in these locations will be assessed together with the stakeholders.

Work package 2: Quantify impacts of measures for Ecosystem health

Work package description:

To understand and quantify how water management measures

- **unfold at the catchment scale and**
- **impact ecosystem health.**

To allow for management impact predictions, a coherent scientific framework will be developed by assessing the response of the regional water cycle, biodiversity, and ecosystem functioning to past and newly implemented measures at a variety of temporal and spatial scales.

Work package 2: Quantify impacts of measures for Ecosystem health

Sub-Project proposal (AWI, GFZ, Hereon, MDC, UFZ):
"Catchment-scale impacts and Ecosystem health"

- Catchment wide-nutrient loads and eutrophication **monitoring (incl. remote sensing) and modelling** (past & future)

- Leveraging **eOmics** to reconstruct and monitor management impacts on **water ecosystem health** and to the impact of sedimentary **legacies**

Sampling & field work & mesocosm experiments has focus on **Mittel-Elbe** (around Magdeburg)

Work package 3: Assessment of measures & Water Action HUB

Work package description:

WP3 aims to **integrate and synthesize** findings from WP1 and WP2 with existing knowledge, **translate scientific insights into accessible and actionable information** for diverse stakeholder groups with varying backgrounds, perceptions, and priorities, and enhance the accessibility and usability of water data to support informed decision-making.

We will co-design and establish, in collaboration with stakeholder partners, a **water action hub (incl. task forces)** that serves as the scientific foundation for developing effective, sustainable, and economically feasible water management strategies to ensure future water security in the Elbe catchment

Work package 3: Assessment of measures & Water Action HUB

Sub-Project proposal (UFZ, GFZ, DLR, AWI, UBA, DVGW (IWW), LfU Brandenburg, LHW, LfULG, Thünen, …):

„BasinWise- emphasizes strategic basin-scale interventions“

- The project develops a strategy to design **effective water management interventions**—especially nature-based solutions (NBS)—at **the river basin scale.**
- Using **large datasets** on runoff, groundwater, and soil moisture, together with **hydrological models** and Helmholtz **monitoring infrastructure** (at selected locations), we will assess how NBS enhance groundwater recharge and reduce flood risks.
- A social science component will **analyze stakeholder perspectives**, barriers, and **co-benefits** through interviews and concerns-benefits assessments.
- Based on these insights, a **simulation tool** will be created to **optimize basin-wide NBS implementation** under current and future climate condition

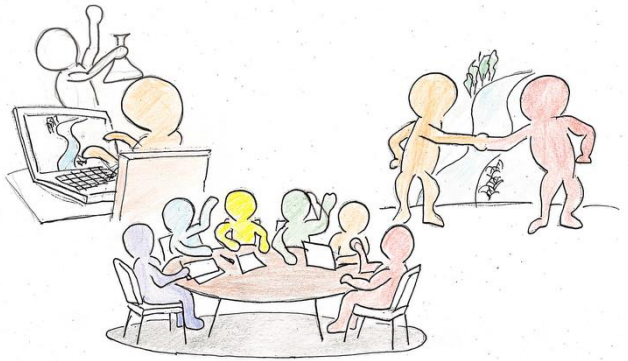
SOLVE‘s Water Action Hub

- is a **co-designed platform** where all SOLVE members will actively contribute (ca. 20% resources)
- is built by **task forces** to deliver consistent, science-based information to assess water management actions.

  Initial Phase: Scoping Studies & Needs Assessment

  Mid-Project Phase: Research Alignment & Integration

  Final Phase: Synthesis & Knowledge Transfer
- provides **synthesized products** (data, simulations, projections, expert studies)
- will establish a quality seal “co-designed/co-implemented measures”



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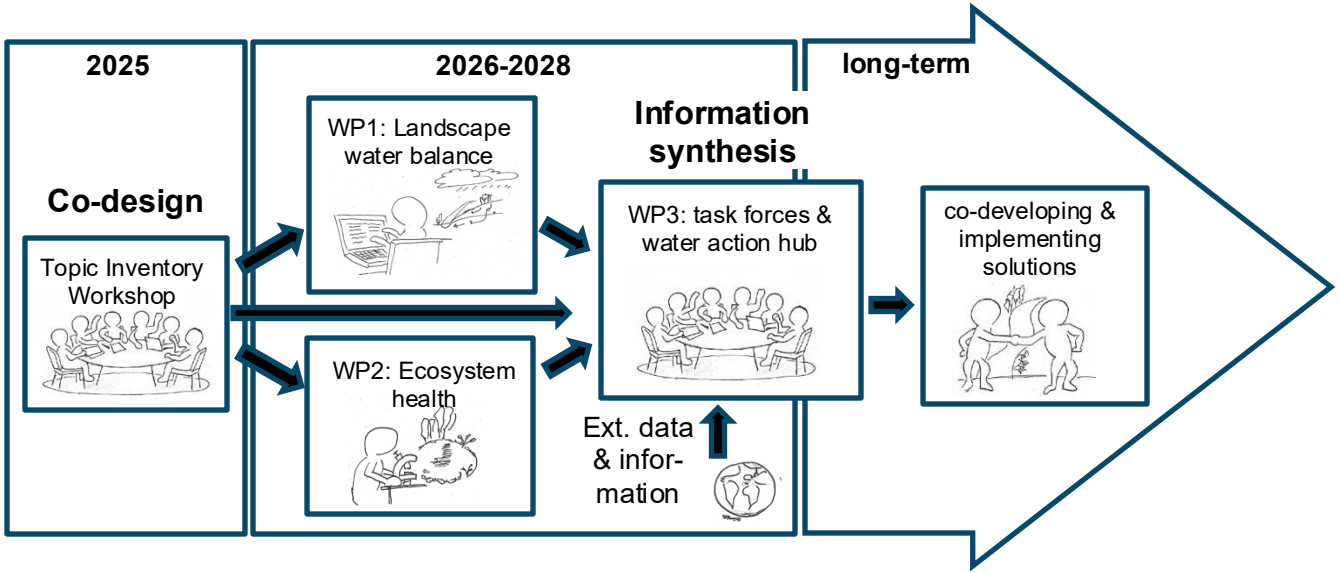
The Water Action Hub - toward a permanent facility dedicated to transfer



Co-design
to align research to develop solutions

Task Forces to support **Water Action Hub**

Vision Workshop
for long-term perspective

Our success measures:

1) **Water Action Hub** is a **permanent facility** e.g. at UBA
2) It is **transferable** to other river basins
3) **„Approved by Water Action Hub“** is a **quality seal** for scientifically robust and policy-relevant information

Date of Topic Inventory workshop (online, 2nd half of June) will be fixed soon!

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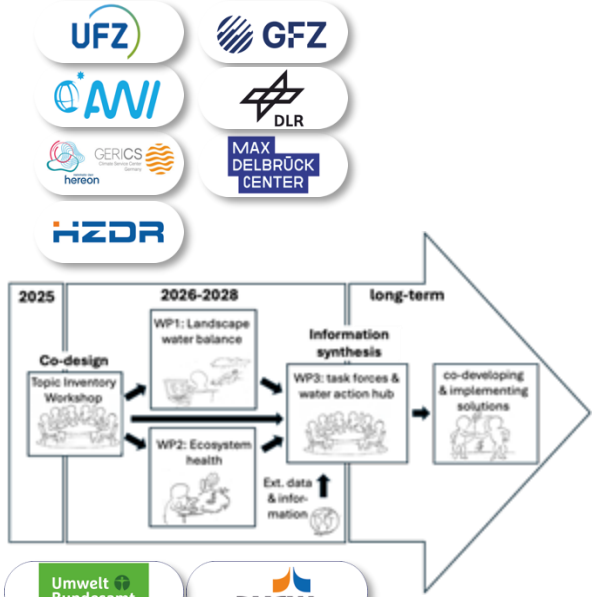
Long story short:

Who:

- Is eager to **develop solutions** for securing water safety in the **Elbe River basin**
- Wants to conduct research in **close collaboration with stakeholders**
- Is willing to contribute to **existing sub-project** proposals
- Brings innovative research ideas that **align with the overall project objectives**
- Is committed to **actively contributing to the Water Action Hub** throughout the entire project duration

please contact **ralf.merz@ufz.de.**



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