Advancing the Water Resilience Strategy through Sponge Landscapes and Nature-Based Solutions for a Climate Resilient Europe

Core Message

The European Water Resilience Strategy (EWRS) sets out an ambitious vision: climate-resilient landscapes that are adapted to both floods and droughts. Integral to this is the restoration and protection of the natural water cycle (pillar 1 of the EWRS). Delivering this vision requires a shift in how Europe manages its water and soil systems. Scaling up Nature-based Solutions (NbS), ecosystem restoration, sustainable land management and urban greening are central to this transformation.

Sponge landscapes — ecosystems that capture, store, and slowly release water (Figure 1) — are a cornerstone of this approach. By restoring sponge functioning, Europe can reduce flood peaks, replenish groundwater, and strengthen resilience during droughts. The proposed **European Sponge Facility** can play a pivotal role by consolidating evidence, supporting a community of practice, and guiding Member States (MS) and regions on funding and implementation pathways.

This policy brief outlines concrete policy recommendations for operationalizing the EWRS by addressing key gaps in the interplay between EU-level policy-making, Member State (MS) policy implementation and local action based on lessons learned from EU research projects. It brings together our current understanding of how sponge landscapes can contribute to hydrological functioning and climate resilience, and outlines pathways for EU-level, MS-level, and local actors to deliver sponge strategies at scale and to restore the water cycle and strengthen climate resilience. It draws on evidence and practical experience from EU-funded projects and demonstrates how governance, policy integration, innovative research, stakeholder engagement and finance can enable large-scale implementation, putting the EWRS into practice.

Why Sponge Landscapes Matter

Across Europe, decades of drainage, water abstraction, soil degradation, and intensive land use have weakened natural sponge functioning. Restoring it helps capture rainfall where it falls, slow runoff, reduce flood peaks, and store water in soils, floodplains, and aquifers. These functions support the EWRS's Green and Blue Corridors initiative and complement the objectives of the Nature Restoration Regulation.

Figure 1: Sponge landscapes intercept rainfall where it falls, slow down run-off and discharge and temporally store excess water
(source SpongeScapes policybrief 1)
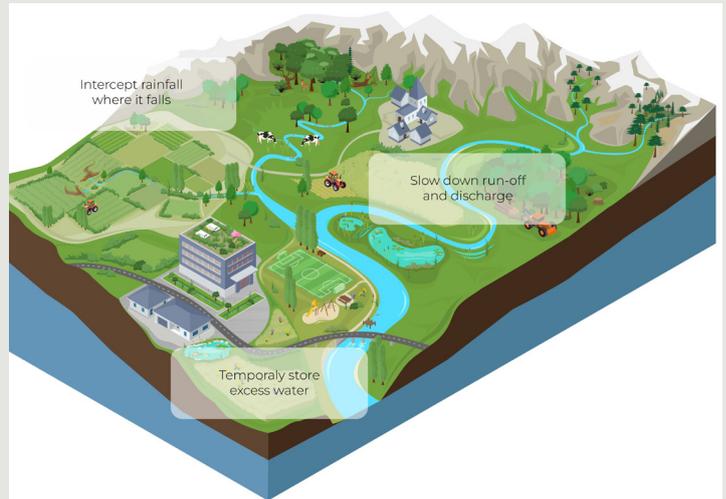
Effective implementation of EWRS goals related to enhancing sponge landscapes depends on stronger connections between EU-level policy design, MS-level planning, and local implementation. Knowledge must flow in both directions: EU institutions need access to local realities and tested practices, while local actors require clear guidance, comparable data, and coherent policy frameworks (Figure 2).

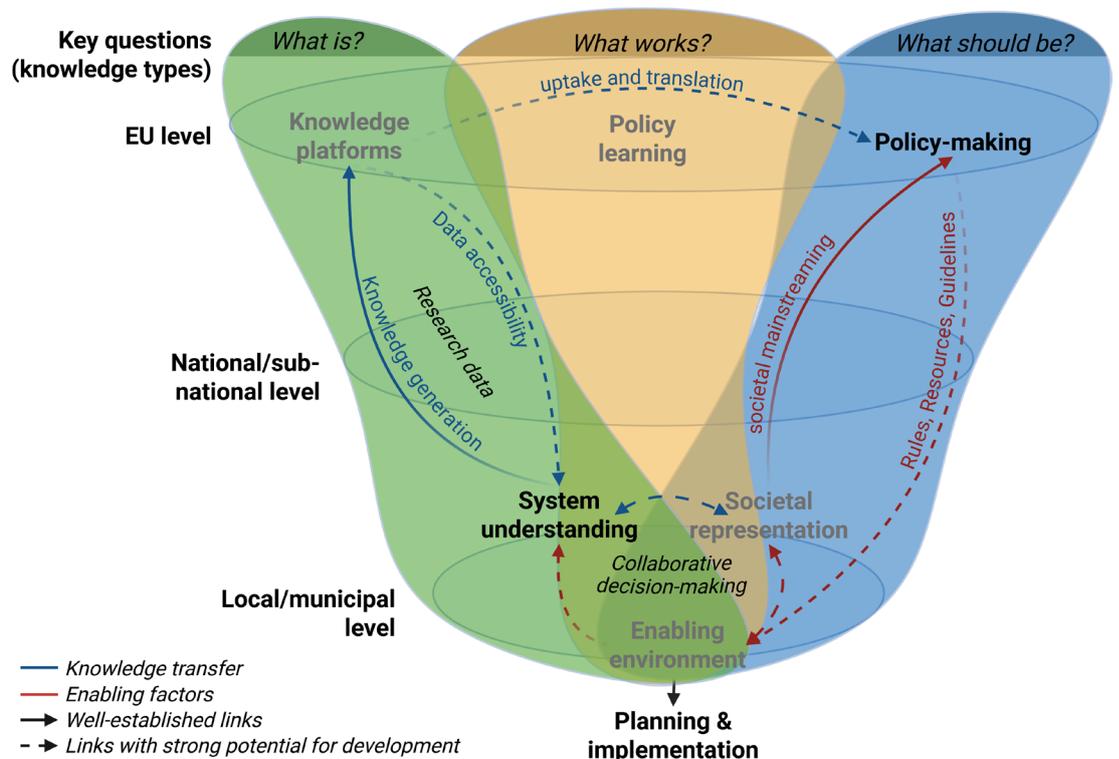## Bridging local system understanding and EU-level policy making

Figure 2: Conceptual diagram on the integration between the local (implementation) and EU (policy) levels.

Many EU-funded project outputs are currently expanding the evidence base on sponge functioning. However, **governance and upscaling** are key bottlenecks in utilizing this knowledge for the delivery of impact at scale.

Upscaling NbS depends on a functioning **enabling environment** – a coherent set of policies, regulations, participatory norms and financing mechanisms that support the long-term implementation of NbS (Figure 2). It requires accurate knowledge about current systems, tested insights into effectiveness and socio-economic realities, and forward-looking understanding of desired futures. This in turn requires strengthening the feedback loops between **local system understanding** and **EU-level policy making**.

Three types of knowledge underpin effective policy (Figure 2): understanding what is (system conditions and data), **what works** (tested practices and policy learning), and **what should be** (visions and regulatory direction).

At the **local level**, the three knowledge types are addressed by an interplay of local system understanding and societal representation. **Societal representation** relates to what works and what should be by harnessing perspectives, knowledge and past experiences of local stakeholders and involving them in a collaborative decision-making process. On one hand, it fosters acceptance by embedding visions, values, and priorities from stakeholders and communities into planning and decision-making through co-creation. On the other hand, stakeholder knowledge can be incorporated into research to enhance **system understanding**. It relates to understanding what is (local biophysical and socio-economic realities) and what works (tested practices, experiential knowledge, and biophysical limits).

Research processes then translate this combined knowledge into accessible outputs. Locally, this provides practitioners with robust data and lessons from other regions. At higher governance levels, it **enables policy learning** by making local insights discoverable and transferable. Policies informed by diverse local realities and strong evidence are more targeted, effective, and implementable.

Despite the substantial evidence generated by EU projects, knowledge remains fragmented across platforms and difficult to access. Improving the **findability, accessibility, interoperability, and reusability of data** would significantly strengthen policy learning and support implementation.

Actions for achieving sponge landscapes

To enhance water-resilient sponge landscapes it is necessary to adopt a '**green where you can, grey where you must**' approach. This approach emphasizes the importance of prioritizing nature-based (green) solutions to address societal challenges while acknowledging that complementary technical (grey) solutions may be required to ensure risk reduction potentials in high-risk areas and during more extreme events, providing additional benefits to those provided by green solutions.

This approach needs to be underpinned with a governance and policy environment that supports mainstreaming NbS. EU- and MS-level institutions can shape the enabling environment by providing actions on **1. Aligning policies and regulations, 2. Strengthening comparability and accessibility of local system understanding, 3. Facilitating stakeholder engagement and co-design** and **4. Enabling flexible financing instruments**, which are outlined below.

1. Aligning Policies

Improved alignment across policy domains ensures that sponge strategies are consistently supported by water, climate, nature, agriculture, and land-use policies. The EWRS offers important opportunities to break down silos across policy domains and place cross-sectoral governance and NbS high on the agenda of the current policy planning processes. The proposed Sponge Facility and the ongoing water dialogues with Member States can serve as platforms to integrate actions needed for the implementation of flood risk management, Water Framework Directive's (WFD) river basin planning, policy frameworks of soil health and land use change and Nature Restoration Regulation (NRR) restoration targets planning (e.g. the National Restoration Plans). Other existing policies to be aligned include the Common Agricultural Policy (CAP) and CAP Strategic Plans (CSP), Climate Adaptation Strategies and, National Energy and Climate Plans (NECP).

Aligning these processes will help ensure that measures are coherent across scales and sectors, and that agricultural (including forestry) and urban policies support rather than undermine water resilience.

Water dialogues and regular exchanges with regions, cities and water authorities, to promote exchange of best practices on "sponge landscapes", are flagship actions of the EWRS governance and implementation enabling areas. Cross-sectoral collaboration is essential, and the EWRS provides the political momentum to convene the right actors at the same table. MERLIN's routemap on cross-sectoral action offers concrete recommendations and examples of measures that deliver multiple benefits across policy domains, such as floodplain restoration, regenerative agriculture, wetland rewetting, and river remeandering.

Recent feedback to the Commission's 2025 open call on climate resilience and risk management shows strong support for resilience by design, harmonised climate risk assessments, NbS as a first line of defense, long-term adaptation funding, and attention to climate-related health impacts. Building on this momentum, the EU should consider requiring Member States to adopt sponge targets under forthcoming climate resilience legislation. This approach is already in place in Belgium, where the Flanders Blue Deal includes water retention / sponge targets for priority catchments.

2. Strengthening local system understanding

The EWRS places strong emphasis on NbS and sponge measures and their effectiveness is now well demonstrated. A substantial evidence base has emerged from EU-funded initiatives: MERLIN's 18 demonstration sites, the 140 examples catalogued at NWRM.eu, the 31 overall cases from SpongeScapes, SpongeWorks and SpongeBoost, and the FutureLakes portfolio of six sites and three associated regions are amongst the +100 projects in the EU on Nature-based Solutions. Together with recent scientific reports — including SpongeScapes Critical review, FutureLakes Innovation Review and the recent publications (e.g. Almasi et al. 2025; Zhu et al. 2024), these projects show that sponge measures can improve hydrological functioning, reduce flood impacts, enhance drought resilience, deliver multiple ecosystem services, and support biodiversity.

Strengthening the evidence base - example SpongeWorks' strip-tilling test in the Pinios basin (Greece) reduced fuel and irrigation costs, improved infiltration, avoided ponding, and supported a successful harvest.

To translate these results into impact at scale, lessons from pilot sites must be learnt and adapted across catchments and regions. This requires embedding evidence into policy and planning frameworks, strengthening organisational capacity for implementation and monitoring, and building long-term support through stakeholder engagement and shared narratives. EU projects are already developing tools to support this transition; MERLIN's Regional Scalability Plans, for example, provide guidance for adapting sponge measures to regional contexts.

Despite a strong knowledge base, gaps remain in the understanding of Europe's freshwater and marine systems, water resource availability, and the water-energy-food-ecosystem nexus. Integrated assessments that combine flood, drought, and biodiversity dimensions are still needed, as are harmonised guidelines for model selection, monitoring approaches, and performance indicators. Tools such as the SpongeScapes model selection map and MERLIN's monitoring and modelling guidance offer a starting point.

Finally, knowledge must be easier to access. Centralised platforms or crosscutting workflows that draw from multiple sources would help ensure that evidence reaches practitioners and policymakers. Existing platforms -including the Copernicus Emergency Management Service, community-based monitoring initiatives and the Global Biodiversity Information Facility (GBIF) can complement EU efforts to strengthen collective resilience.

3. Enhancing stakeholder engagement and co-creation

To make the EWRS work in practice, policies must be underpinned by strong and trusted relationships with the people and sectors that depend on water. Evidence from MERLIN shows that early and continuous stakeholder involvement is essential: listening to local needs, communicating benefits and tradeoffs clearly, and ensuring fair representation all help build acceptance of NbS and reduce conflict. These approaches support the codesign of regional strategies and the coordinated implementation of catchment-wide measures, enabling sectors such as agriculture, hydropower, and conservation to align behind shared water resilience goals.

Longterm resilience also depends on sustained cooperation between sectors and on strengthening local capacity. Providing authorities with training, participatory methods, and social science expertise equips practitioners to engage communities effectively and increases the likelihood that restoration measures can be scaled across Europe. Regularly monitoring who participates and how decisions are made helps ensure that engagement remains inclusive and effective. When paired with well-designed and well-resourced stakeholder processes, the EWRS can foster the trust, shared ownership, and practical momentum needed to secure Europe's freshwater systems.

Innovative tools can further enhance dialogue. SpongeScapes' GeoDesign approach, tested in the Aadal Noord (NL) and Leze (FR) catchments, enables stakeholders to explore future scenarios and codevelop shared visions. Complementary resources – including SpongeScapes' and SpongeBoost cartoon series and games, MERLIN's infographics and SpongeWorks' solution cards, and advanced digital spatial mapping tools - help translate complex concepts into accessible formats. Consolidating these materials within the Sponge Facility would provide practitioners with practical guidance and examples. Crucially, all engagement efforts must be tailored to local contexts, using storytelling and communication approaches that reflect cultural differences across stakeholder groups and Member States.

4. Driving Financing and Investment

Finance remains a decisive factor for scaling NbS and meeting the EWRS targets. **Diversifying funding sources and expanding blended-finance models will be essential** to upscaling NbS implementation. In such models, public actors reduce investment risks through regulation, cofunding, or guarantees, enabling private capital to enter, while private investors provide scale. The Wyre Catchment Natural Flood Management project in England illustrates how such models can mobilise investment, though uptake in the EU remains limited.

Unlocking private finance requires implementing authorities to adopt new financial competencies and to develop NbS projects at a scale that matches investor expectations. This remains a challenge: despite the European Investment Bank's EUR 15 billion commitment for 2025–2027, many NbS initiatives are too small to access such opportunities. MERLIN's financial planning workflow helps NbS managers design more investable upscaling initiatives and strengthen private sector involvement.

Clear evidence on the costs and benefits of NbS is also critical. Economic assessments such as Cost-Effectiveness and Cost-Benefit Analyses must capture the full range of benefits, co-benefits and trade-offs. MERLIN's Cost-Benefit Analysis of floodplain restoration in the "Room for the Rhine" case (Kok et al., 2025) demonstrates how such assessments can support decision-making and strengthen the case for investment.

Public and philanthropic funding will continue to play a central role, particularly through agri-environmental schemes that incentivise landowners to adopt NbS.

Aligning the Common Agricultural Policy with EWRS objectives will be important to unlock this potential. Climate-induced disruptions are already strengthening the case for water investments, and the promotion of co-benefits can attract diverse private funding sources, ranging from the commercialisation of conventional goods and services, credits in environmental markets, to payments for ecosystem services. However, perceived risks, uncertainties, and the small size of many NbS projects still limit private sector engagement.

To ensure sustainable public-private collaboration, **robust governance frameworks** must address market failure, ensuring polluters bear the full cost of their activities, strict compliance with and enforcement of existing regulations. Strong and predictable policy signals will create the regulatory certainty required for responsible private investment and help ensure that NbS financing delivers genuine additionality and integrity.

Recommendations to realize the EWRS aims on sponge landscapes

To fully realize the EWRS vision on restored hydrological functioning at landscape-scale, several priorities emerge. These recommendations can be clustered for different governance levels: EU-level, MS-level and Local level or combinations thereof:

1. **EU: Make sponge targets mandatory for MSs**, providing a clearer regulatory framework, technical standards and legal certainty to stimulate a 'green where you can, grey where you must' approach.

2. **EU: Make the systemic consideration of sponge measures mandatory in climate risk assessments and climate- and water resiliency planning**, by requiring institutional support and the consideration of short- and long-term co-benefits and trade-offs of proposed measures in cost-benefit assessments and decision-making.

3. **EU: Align the EWRS's proposed enhancement of climate resilient landscapes** with existing policies and planning frameworks of the Climate law, WFD, CAP and NRR to ensure coherence across EU water related policies.

4. **EU/MS: Provide resources and infrastructure to systematically collect, organize, and disseminate lessons and recommendations from EU projects** to make the evidence base more accessible, context-relevant and practically usable for a wide diversity of stakeholders.

5. **EU/MS: Develop clear financing pathways** with guidance on cost-benefit analysis, blended finance, and ecosystem service payments. Improvement of co-funding (private/public) frameworks (see MDB Common Nature Finance Taxonomy), streamlining payments for ecosystem services through policies (CAP etc.).

6. **MS/local: Make early and balanced stakeholder engagement mandatory** to facilitate co-design of climate resilient landscapes with a just and inclusive stakeholder group and enhance acceptance through ownership.

7. **MS/local: Upscale successful nature-based practices** by embedding them in co-created regional scalability plans and ensuring early and just stakeholder engagement to enable true transformation at landscape scale. Create platforms to facilitate communities of practice and cross-sector learning.

8. **All: Support inclusive multi-level governance innovation** to bridge EU-level strategies with local implementation, using communities of practice, translation of EU policies into easily digestible information. This should include transboundary and catchment level partnerships such as the ICPDR, ICPR etc.

9. **All: Frame resilience as a multi-benefit opportunity in future policy documents** that address cross-cutting issues such as climate adaptation, biodiversity recovery, water quality, socio-economic gains, and public health and wellbeing. Include the consideration of trade-offs and ongoing monitoring and maintenance to minimise unintended negative consequences and foster positive synergies.

Resentials

This resources list provides a selection of relevant deliverables coming from the MERLIN, SpongeScapes, SpongeWorks, SpongeBoost and FutureLakes projects.

Further resources can be found on the respective websites of these projects.

On technical aspects of enhancing landscape resilience and the evidence base:

- SpongeScapes Critical Review of Existing Knowledge on sponge functioning
- SpongeScapes Modelling Approach Map for Quantifying the impact of sponge strategies
- SpongeScapes Scientific Article on benefits, co-benefits and trade-offs in natural water retention measures: a review of classifications and indicator - Almasi et al. (2025)
- FutureLakes Innovation review
- MERLIN Review on Monitoring and impact evaluation
- MERLIN Deliverable on the MERLIN modelling workflow to assess the bio-physical and economic impact of freshwater ecosystems restoration at catchment scale

On multi-level governance and role of policies in upscaling and mainstreaming

- MERLIN Deliverable on policy opportunities for mainstreaming freshwater nature-based solutions
- MERLIN Deliverable on focus Sectoral Strategies for mainstreaming freshwater restoration
- MERLIN Deliverable of a Cross Sectoral Routemap for Mainstreaming Freshwater Nature-based Solutions in Europe
- MERLIN Regional Scalability Plans

On economic and financial aspects

- MERLIN Deliverable on diversifying Funding for Freshwater Restoration using Nature-Based Solutions
- MERLIN Deliverable on cost-Benefit-Analysis in freshwater ecosystem restoration
- MERLIN Scientific Article on trade-offs in ecosystem services under various river management strategies of the Rhine Branches - Kok et al. (2025)

On stakeholder engagement

- MERLIN Deliverable on sectoral stakeholder engagement

Further reading – Policy briefs

- SpongeScapes Policy brief From Drainage to Water Retention - Advancing a Paradigm Shift Towards Sponge Landscapes for Enhanced Climate Resilience
- MERLIN Policy brief on restoring healthy rivers and wetlands through agricultural policies and water resilient farming practices
- MERLIN Policy briefs

Colofon

This policy brief was written by the SpongeScapes, SpongeWorks, SpongeBoost, MERLIN, and FutureLakes EU projects, that jointly contribute to the EU 'Mission on Adaptation to Climate Change', 'Restore our Oceans and Water' and 'A Soil Deal for Europe'.

Authors: Ellis Penning (Deltares), Christopher Wittmann (Deltares), Giannis Alexiou (WWF-GR), Simon Barreau (Oieau), Anna Bérczi-Siket (WWF-HU), Paul Brotherton (Wetlands International), Laurence Carvalho (NIVA), Chloé Dechelette (Oieau), Alejandro Dussaillant (UKCEH), Benoit Fribourg-Blanc (Oieau), Nicolas Grondard (WUR), Phoebe King (Leibniz Universität Hannover), Maja Koprivsek (ARSO), Christian Albert (Leibniz Universität Hannover)