Network Nature

Science Policy Brief 1

Nature-based Solutions for Urban and Regional Water Resilience: What to do with too much (dirty) water

Nature-based Solutions for Urban and Regional Water Resilience: What to do with too much (dirty) water?

KEY MESSAGES

- Water resilience is critical if we are to strive for sustainable urban and regional transformation. The recent Water Resilience Strategy published in June 2025 clearly emphasises this and promotes actions and implementation measures.
- Water-related NbS must be integrated into urban and regional water plans and strategies, as they are not only cost-effective but multifunctional, offering a range of co-benefits that support water resilience. However, this requires coherent policies to avoid conflicting interests.
- Water is often managed by multiple departments or agencies; it is essential to overcome siloed approaches. Holistic planning with clearly defined responsibilities for integrating NbS is needed, supported by shared governance models, standardized procedures and flexible regulatory frameworks.
- Although evidence supports the effectiveness of NbS over traditional grey infrastructure, securing long-term investment for NbS in water management remains difficult. Greater efforts are needed to make NbS more appealing to investors and businesses.
- Long-term sustainability of water-related NbS depends on local stewardship, which can be fostered through participatory processes that actively involve and empower community members in planning and management.

What is the aim of this policy brief?

This policy brief explores the opportunities and challenges in the integration of Nature-based Solutions (NbS) into urban and regional water resilience planning. The brief draws from research, policy, and good practice from the wider NbS community, and presents recommendations to enhance the integration of NbS. The contents were co-created through a science policy event in February 2025.

Who is this brief for?

The policy brief is aimed at policymakers and other experts interested in how and why NbS should be integrated into their water resilience planning.

What are Nature-based Solutions?

NbS are defined as "*Actions to protect, conserve, restore, sustainably use, and manage natural or modified terrestrial, freshwater, coastal, and marine ecosystems. These actions address social, economic, and environmental challenges effectively and adaptively, while simultaneously enhancing human well-being, providing ecosystem services, and boosting resilience and biodiversity.*" [1]

What's happening in Practice?

Story 1 – CARDIMED

Figure 1 - Living Wall demonstration site in Sicily, the CARDIMED Project.[2]

The CARDIMED project focuses on boosting Mediterranean climate resilience through the widespread adoption of NbS. CARDIMED is based in Catania and Ferla municipalities, Sicily. Due to extreme weather conditions leading to water scarcity and droughts, the municipalities are employing NbS such as Rain Gardens and Living walls. A rain garden can intercept, filtrate, and treat road runoff supporting the replenishment of groundwater with treated stormwater. Living walls can be used for the treatment of greywater in local schools and its reuse for toilet flushing, reducing water consumption. Besides providing direct solutions to the water challenges, these NbS also enhance biodiversity and deliver other benefits such as thermal regulation.

Story 2 – NBRACER

Figure 2 - Marais-mouilles, river morphology restoration in the Nouvelle-Aquitaine Region. Photo: Romuald-goudeau.[3]

NBRACER supports the European Atlantic Biogeographical area in developing transformative adaptation towards climate resilience and the mainstreaming of NbS at the landscape scale. One of its demonstrating regions, Nouvelle-Aquitaine, is implementing a range of solutions to enhance natural and artificial surface water recharge to mitigate low water flow during summer in rivers. The region features two demonstration sites: the artificial recharge of the Garonne water table and the maintenance of water levels in the Marais Poitevin. The first pilot site aims to experiment with the recharge of the alluvial aquifer of the Garonne to support low water levels of the river during the summer period with cooler groundwater, improving the hydraulic conductivity and water quality. The second pilot site aims to optimise groundwater recharge by slowing water flow within the marsh through the restoration of river morphology. The aim is to combine continuous water presence throughout the wetland with the availability of water for different purposes, while mitigating the risk of saltwater intrusion into the coastal part of the Marais.

Story 3 – MULTISOURCE

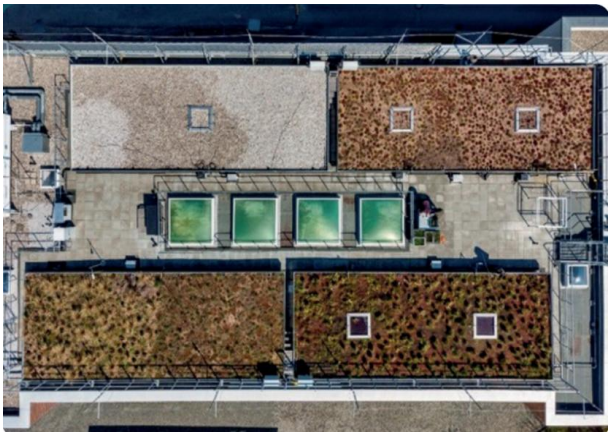

Figure 3 – UFZ Pilot Green Roof platform in Germany. MULTISOURCE Project. [4]

MULTISOURCE demonstrates the use of NbS to enhance urban water treatment, storage, and reuse. The project includes a range of pilot sites implementing NbS to manage various types of wastewaters, runoff, and rainwater. The Leipzig pilot focuses on rainwater retention and stormwater reduction. By integrating green roofs, the site aims to store rainwater, reducing both stormwater runoff and flood risk while also supporting local biodiversity and improving the thermal regulation of buildings. Additionally, the project has developed Nat4Wat, an online decision-support tool that enables users to explore and compare the feasibility of NbS for water management.

Story 4 – NICE

Figure 4 – NbS wastewater filtering in the Urban Real Lab, Algeciras, NICE Project. [5]

Figure 5 – Pilot Green wall in Turin, Italy. The Nice Project.

NICE implements NbS for water treatment, runoff reduction, and water reuse. In Turin, the project showcases green walls as a solution for treating and reusing greywater in schools. In Madrid, wetlands have been installed at building level to treat and reuse greywater, while in Algeciras, they help manage greywater and stormwater, helping to reduce pollution episodes in the port area. However, a key challenge for scaling up these solutions is the uncertainty surrounding permits and the legal framework, which remains a limiting factor for broader implementation.

The Policy Landscape

The urgency of improving water resource management has been underscored by recent extreme weather events across Europe, which have led to severe droughts and catastrophic flooding. Additionally, the EEA report of Europe's State of Water 2024 highlights the significant pressures exerted on aquatic ecosystems by both point and diffuse pollution sources.

As a result, more than half of the EU's surface water bodies and groundwater sources fail to achieve good quality status. These water challenges are multidimensional, requiring a holistic approach that considers water quantity (supply and availability), water quality, and the health of aquatic ecosystems. Moreover, given the interconnected nature of water resources, solutions cannot be confined to the local level alone but must be addressed at broader watershed or even river basin scales, requiring the effective integration of solutions and planning. Among the most effective solutions, NbS stand out for their ability to tackle water challenges comprehensively, delivering co-benefits that can be adapted to different scales. NbS can also restore the physical dynamics of the components of the water cycle and support the cities in water-related extreme weather events.

To effectively address these challenges, it is essential to consider the various water-related policy frameworks within the EU. The Water Framework Directive plays a central role, including the Recast of the Drinking Water Directive and the Recast of the Urban Wastewater Directive. Additionally, the Regulation (EU) 2020/74 on-water reuse establishes minimum requirements for agricultural water reuse, promoting the use of alternative water sources.

Furthermore, the newly published EU Water Resilience Strategy explicitly refers to the CAP and the importance of water usage within farming practices. Thereby making an explicit and direct link to the agricultural and farming stakeholders. Flood risk management is addressed through the Floods Directive, which translates into the development of River Basin Management Plans for regional flood mitigation. Furthermore, the Nature Restoration Regulation supports the rewilding of rivers, mitigating floods and enhancing the resilience of water ecosystems. Finally, it is important to highlight the EU climate adaptation strategy as NbS are Frequently championed as providing important climate adaptation benefits.

Water management is strategically crucial for achieving the objectives of key EU initiatives, including the European Green Deal, the Zero Pollution Action Plan, the Circular Economy Action Plan, and the EU Biodiversity Strategy for 2030. A major step towards integrating these water-related policy frameworks is the European Commission's Water Resilience Strategy, which provides a comprehensive, multi-annual, cross-sectoral plan with milestones leading up to 2040. The strategy aims to strengthen Europe's water resilience by ensuring sustainable management of water resources, addressing scarcity, enhancing the competitiveness and innovation capacity of the water sector, and promoting a circular economy approach.

Challenges

Evidence and recognition of NbS The potential to effectively address water resilience risks and water management challenges while providing a host of other co-benefits is mounting. Yet, the integration of NbS in urban and regional water planning remains weak. Often considered as add-ons rather than core components of local water resilience strategies, NbS deployment at scale is still hindered by a series of bottlenecks, such as Regulatory gaps, policy fragmentation, and lack of coherence. While the European Green Deal has significantly contributed to integrating, implicitly or explicitly, NbS across policy areas, horizontal and vertical policy gaps, fragmentation, and lack of coherence persist. The lack of clear mandates and regulatory frameworks that prioritise the use of NbS in urban water management is a major barrier. The EU water policy framework promotes sustainable water management, but it falls short of effectively mainstreaming the use of NbS.

The main issue is that there are no binding strategies or regulatory obligations to prioritise NbS; hence, encouragement to use NbS found, for example, in the new water resilience strategy remains more aspirational than factual. While water-related policies remain fragmented, they are often managed separately by different agencies with different, and sometimes at odds, mandates—a complex shared governance. Water management responsibilities are divided between municipal, regional, national, and EU governance levels, with differing priorities and interests and a lack of coordination often adding to this complex governance. Furthermore, water is deeply cross-sectoral, intersecting with urban planning, climate adaptation, biodiversity, and public health. However, within public administrations, these sectors often work in silos, limiting the potential for NbS to serve as an integrated solution.

While environmental and climate policies acknowledge NbS, urban planning and infrastructure investments often overlook NbS in favour of other options because:

- NbS deliver benefits over longer time frames, which can be politically unattractive compared to immediate, measurable results from traditional, often outdated (e.g. grey infrastructure or techno-fixes) solutions.
- Decision makers often lack awareness of or trust in the performance, cost-effectiveness, and scalability of NbS.
- Financing models tend to prioritise short-term and familiar infrastructure investments over long-term, adaptive solutions like NbS.

Institutional capacity challenges that cities and regions are often left to grapple with:

- Short-term funding cycles. Many NbS projects rely on temporary funding mechanisms (such as EU or national grants), but lack sustained financial models for long-term maintenance, adaptation, and monitoring.
- institutional expertise. Many local authorities lament a lack of expertise in designing, implementing, and managing NbS effectively over the long term.
- Weak monitoring and data collection. Unlike traditional infrastructure, NbS require ongoing monitoring to assess their hydrological, ecological, and socio-economic performance. However, standardised indicators are still underdeveloped, while limited financial support makes it challenging to sustain monitoring over time.
- Stakeholder engagement gaps. Successful NbS design, implementation, and viability over time requires collaboration across different actors and stakeholders, including urban planners, water utilities, and local communities. While best practices exist, the monitoring and assessment of such processes is often overlooked.

Overcoming These Challenges – Recommendations

1. Identifying and applying standardised indicators that are mainstreamed, holistic, and multiscale.

While traditional water indicators (e.g., water quality, flood reduction, or groundwater recharge and runoff) are essential, we must take a holistic approach and plan in co-benefits such as biodiversity enhancement, but also social ones like public health or aesthetic value.

2. Assessing the entire NbS lifecycle.

To realise the full benefits of water-related NbS and consistently evaluate them, it is crucial to consider their entire lifecycle: design, implementation, monitoring, and maintenance. However, long-term funding and upkeep are often overlooked, with many projects facing budget limitations after initial implementation (for example, in the case of constructed wetlands, river restoration, etc.). Continuous monitoring of NbS is essential to track environmental, social, and economic outcomes and to demonstrate their long-term impact. Without this, we hinder the ability of NbS to reach their full potential over time, while assumptions about benefits (such as biodiversity improvements) may go unverified. To ensure lasting impact, NbS must be supported by long-term planning and dedicated funding for both monitoring and maintenance.

3. Exploring ways forward to fund NbS

Funding the lifecycle of NbS through development, implementation, monitoring, and maintenance of these solutions requires sustained financing streams.

a. Public funds may also help to incentivise private sector involvement, perhaps through tax incentives, legislation or by improving the enforcement of the Polluter Pays Principle, as highlighted in the UWWTD. For instance, opportunities arise from municipal funding. NbS contribute to an extensive range of objectives that are often not monetised, but which demonstrate the multi-functionality of these interventions. This raises an opportunity to develop and organise a coordinated approach and to set nature as a priority for a municipality (hence, capitalising on different departmental budgets).

b. Alternative/Innovative financing models, such as region-wide loans or pooling small-scale projects, could help address financing gaps for NbS implementation. Additionally, the exploration of municipal bonds and biodiversity credits is critical for ensuring long-term support. Building on alternative financing models, blended financing combines public and private funding for NbS through different models.

c. Biodiversity credits are a potential tool as a mechanism to help companies invest in NbS. However, regulatory support is needed to enforce these credits and ensure that NbS projects are consistently funded.

4. Bridging the current disconnect between the financial sector and the NbS community.

Although there is some interest in NbS for water-related projects such as SUDs or floodplain restoration, from the financial sector, investment is low due to several barriers.

a. Project readiness and capacity: Many of these NbS projects lack the technical expertise and maturity required to attract investment. Building financial capacity and developing credible economic cases is essential.

b. Unclear financial returns and long-term costs: Investors are often hesitant due to limited evidence of economic returns and uncertainty around long-term costs (including monitoring and maintenance). Standardised methods for cost-benefit analysis (considering avoided costs, for instance, by flood damages) could improve the reliability of economic valuation and, in turn, the attractiveness of NbS investments.

c. Regulatory and policy barriers: The current policy and regulatory framework falls short of creating an environment conducive to private investment in NbS. A supportive and flexible framework that reduces risks is needed.

Experts participated in three tailored fishbowl discussions focused on.

1) Indicators for NbS.

2) Financing of NbS around water.

3) Integrated Planning of NbS.

Figure 6 – Science Policy Workshop – February 2025

5. Integrating informal NbS initiatives into local planning.

Integrating NbS into local planning presents several challenges, including the risk of them being phased out over time. Some cities have found success by starting at a small, local scale before scaling up regionally, especially when communities, stakeholders, and citizens are actively involved in defining NbS impacts and indicators. This participatory approach ensures that design and delivery align with community needs and expectations. An effective strategy involves transitioning NbS from informal to formal, institutionalised systems. Community-led initiatives, such as urban gardening, stormwater harvesting or community rain gardens, often begin informally but can gain institutional support once proven effective. This highlights how innovation frequently emerges from informal practices, which can evolve into integral components of city planning. Additionally, cities often view temporary NbS solutions with scepticism. Normalising and formalising these approaches can help embed them more permanently into urban planning frameworks and strengthen water security.

6. Nature-based solutions vs. traditional engineering.

Integrating NbS into urban planning can be more challenging than it is for traditional engineering projects. Unlike hard engineering solutions such as concrete drainage systems, water-focused NbS, such as bioswales, floodplain restoration, or green roofs, are dynamic and evolve, making it harder to control and plan for in a conventional urban setting. Embedding adaptive planning and investing in long-term monitoring and maintenance can reduce uncertainty and provide the flexibility and adaptability needed to reap the full benefits of flood mitigation, water purification, and other initiatives over time.

7. Enhancing collaboration and stakeholder engagement to facilitate an inclusive process around the NbS lifecycle.

A critical element of making NbS not only effective but also viable over time is communication and engagement with different stakeholders. Reaching out to decision-makers and the public is essential, especially given the need to build social and institutional acceptability and trust. Using non-technical language and avoiding jargon is crucial to making NbS more accessible and understood.

8. Building capacity.

Capacity building is crucial, especially in terms of technical expertise and governance structures. Many local governments lack the resources or knowledge to implement NbS effectively, and building this capacity is vital for scaling up their use. However, even when there is a desire to develop this capacity, the lack of resources remains a significant barrier. More support, especially at the EU level with more emphasis on the roles and responsibilities of local governments, is needed to help different stakeholders collaborate more effectively and integrate NbS into their planning processes. It is also important to acknowledge that integrating NbS into planning requires transformative change, not just incremental steps. Effective governance structures that support both public and private actors are essential for this transformation to happen. One example of capacity building around water can be seen in the Flemish Blue Deal, in which 27 local coalition groups have been established to facilitate local-scale collaboration across different water-related infrastructure projects.

9. Data for better alignment of disciplines, governance, and regulation.

Effective NbS implementation requires coordination across disciplines, governance levels, and regulatory frameworks. However, a key enabler of this alignment is data—its availability, quality, transparency and interoperability. Standardising data collection across regions would improve comparability and support the integration of NbS into planning processes. Reliable data also allows policymakers and stakeholders—from local authorities to the private sector—to assess outcomes, secure funding, and align with broader regulatory targets such as EU emissions goals and climate neutrality.

Striking the right balance between transparency and data protection, ensuring that experts can track down the entity responsible for the data and the details of its collection. Cities in Europe have been using real-time sensor data, historical trends, modelling (such as runoff and drainage infrastructure), as well as weather forecasts as data-driven approaches towards water management for a long time. This enables enhanced flooding forecasts and emergency preparedness, supporting climate adaptation. By way of example, Valencia had recent flooding, and they are participating in a project which uses a "data-driven methodological framework to support decision-makers"

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What to Learn More?

About the Stories

CARDIMED - https://www.cardimed-project.eu/

NBRACER - https://nbracer.eu/

MULTISOURCE - https://multisource.eu/

NICE - https://nice-nbs.eu/

From other publications

D4RUNOFF - HRB-D4RUNOFFWATERUN-STOPUP Innovative urban water runoff management across Europe [Available at: Joint Policy Brief HRB-D4RUNOFF-WATERUN-STOPUP - stopup.eu]

CORDIS - Nature Based Solutions for re-naturing cities: knowledge diffusion and decision support platform through new collaborative models | Nature4Cities | Project | Results | H2020 | CORDIS | European Commission

MULTISOURCE - ModULar Tools for Integrating enhanced natural treatment SOlutions in URban water CyclEs https://multisource.eu/storage/2023/03/Multisource-PB_mw_jn_lc_mw.pdf

RESTORING WETLANDS IN EUROPE - Alfa wetlands https://alfawetlands.eu/policy-briefs/

NICE - H2020 nice innovative and enhanced nature-based solutions for sustainable urban water cycle https://nice-nbs.eu/project

Network Nature Factsheet 3: Shifting the water paradigm - managing water through nature https://networknature.eu/product/28653

References

[1] The definition was multilaterally agreed though Resolution 5 of the Fifth United Nations Environmental Assembly (2022). For more information about NbS, including a visualisation and the IUCN Global Standard for NbS, visit the IUCN website.

[2] Figure 1 - Living Wall demonstration site in Sicily, the CARDIMED Project. Available at: https://www.cardimed-project.eu/demo-sites/catania-ferla-urban-resilience-nbs/

[3] Figure 2 - Marais-mouilles, river morphology restoration in the Nouvelle-Aquitaine Region. Photo - Romuald-goudeau. Available at: https://nbracer.eu/restoration-of-river-morphology-through-sediment-recharge/

[4] Figure 3 – *UFZ Pilot Green Roof platform in Germany. MULTISOURCE Project. Available at*: https://multisource.eu/storage/2025/03/Factsheet-UFZ-pilot-7-2-pages.pdf

[5] Figure 4 - *NbS wastewater filtering in the Urban Real Lab, Algeciras, NICE Project. Available at:* https://nice-nbs.eu/urban-real-labs/algeciras-spain

[6] Beyond biodiversity and climate adaptation strategies, we will also explore sectoral policies, including the EU Renovation Wave and the new approach for a sustainable blue economy, among others.

[7] For an exhaustive mapping and analysis, please refer to NetworkNature's NbS Policy Screening and Analysis of Needs and Gaps for 2024-2030.

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