Network Nature

Shifting the water paradigm: managing water through nature

This Factsheet explores common water-related challenges, such as water availability, quality, and management, their associated risks, and relevant policies, while proposing nature-based solutions as a paradigm shift. By outlining key benefits of using nature for an integrated and ecosystem-based water management approach, and best practices in different contexts and ecosystems, the factsheet demonstrates the potential of shifting away from conventional 'grey' solutions. Thus, it aims to provide practitioners, developers and policymakers with inspiration, resources and opportunities to increase the uptake of nature-based solutions targeting the ever-growing water-related challenges.

Who should read this?

Are you a practitioner, infrastructure planner, developer or engineer looking to tackle water-related challenges in non-conventional ways, using the power of nature? Are you a policymaker working on areas linked to nature-based solutions, namely environmental, climate, land and water policies? This factsheet is for you!

Water resources management: common trends and challenges

According to (FAO,2017), the rate of water consumption has been almost twice the rate of population increase, and around 30% of the global population is estimated to live in areas routinely impacted by flood or drought events (WWAP, 2018). These trends show an urgent need to improve water management to ensure human wellbeing in the long-term.

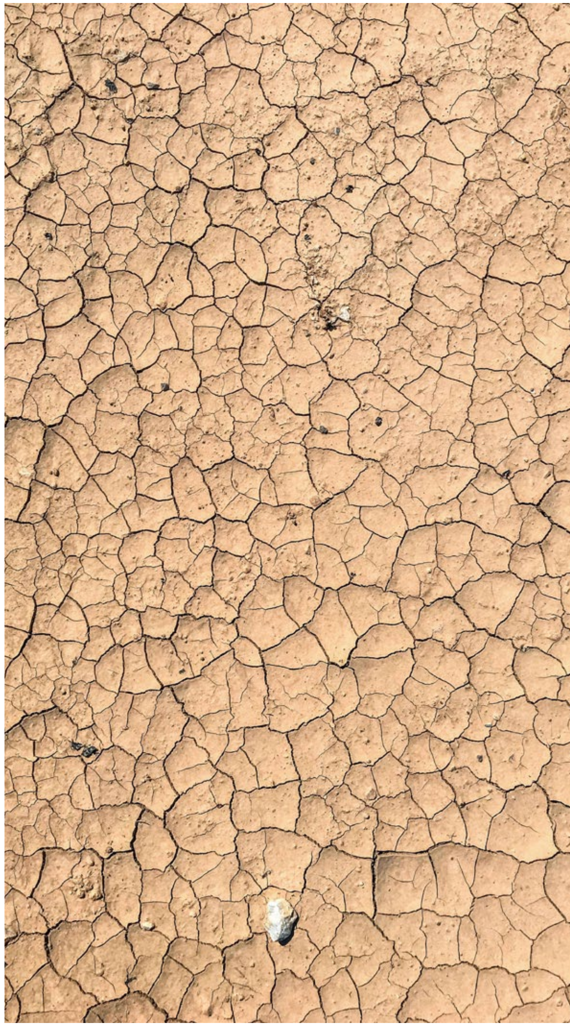
Societies depend on water bodies for various ecosystem services they provide. For instance, coastal ecosystems, such as coral reefs and mangroves, can store carbon up to 55 times faster than rainforests, and peatlands store 30% of all land-based carbon despite only covering 3% of the Earth's surface. Wetland ecosystems contribute to the livelihood of more than 4 billion people and 40% of all the world's species are dependent on wetlands for shelter and breeding (Convention on Wetlands, 2021). Water insecurity poses a significant threat to the global economy through loss and damages from floods, food losses from droughts and disrupted ecosystem services due to environmental degradation, especially in the context of climate change.

Approximately 2 billion people do not have access to safe drinking water (WHO and UNESCO, 2021).

Traditionally, water-related risks, water availability, and water quality have been addressed solely by engineering techniques implemented locally. While these interventions have brought benefits, they have also often been found to generate unexpected trade-offs and environmental degradation, such as loss of ecosystem services, negative effects on biodiversity, decreased river stability, and water quality degradation due to increased erosion (Charlton, 2008).

Degraded ecosystems are the leading cause of increased water resources management challenges, as increasingly poor soil resources are found to negatively impact water cycling (e.g. through low soil water storage, high surface runoff and increased erosion)(WWAP, 2018). Further, floods and droughts are amplified by human alteration of the water cycle. At a global scale, land use change has increased water runoff by 7% and reduced evapotranspiration by 5% (Sterling et al., 2013). At a local scale, land use change impacts are even more pronounced: A study on soil sealing in the city of Leipzig showed that between 1870 and 2003 runoff increased by 282% (European Commission, 2012).

90% of the most disastrous events since 1990, impacting 4.2 billion people and leading to US$ 1.3 trillion in damage are water-related (UNISDR, 2014).



Managing water through nature

Healthy and functioning ecosystems are vital for water security as they ensure the delivery of water-related and water-dependant ecosystem services. Nature-Based Solutions (NBS) can support efficient management of water resources, conservation and security. Therefore, a new paradigm on water management builds on the integrated water resources management approach (Grigg, N.S, 2008; Biswas, A.K, 2004) while integrating NBS across different ecosystems with built infrastructure. This can enhance overall water security by improving water availability and quality while reducing water-related risks and generating social, economic and environmental benefits, as well as enhancing biodiversity (WWAP, 2018).

70% of freshwater withdrawals go to irrigated agriculture and food production is estimated to increase by 60% by 2050 (FAO,2017).

This synergistic paradigm shift, that acknowledges the central role of ecosystems in water management, can simultaneously provide benefits for the built infrastructure and environment. For instance, it is estimated that the City of Zurich has reduced wastewater treatment costs by removing stream flows from sewer networks, with each litre per second of diverted river flows generating annual savings in treatment costs of around 5,000 CHF (European Commission, 2020).

Forest and mountain ecosystems provide renewable water supplies to at least two thirds of the global population (MEA, 2005). Different land uses, land covers and land management practices in forests, grasslands, croplands, urban areas, and wetlands determine runoff, evaporation, and groundwater recharge. It is estimated that up to 40% of global terrestrial rainfall originates from upwind plant transpiration and other land evaporation (WWAP, 2018).

A report from the Joint Research Centre (Burek et al., 2012) concluded that NBS for managing agricultural land would be the most effective measures to reduce flood peaks for a 20-year-flood in France, Spain and Portugal. Similarly, different types of wetlands play a central role in water management, despite covering only 2.6% of the global surface (WWAP, 2018).

NBS are built on ecological processes. Some key ecological processes that relate different land and soil ecosystems with water ecosystems are: erosion, sediment transport, and deposition within the drainage basin (Charlton, 2008). These processes influence water quality and the way it moves through the landscape. Rivers and water bodies adapt their forms and dynamics to the sediments, in turn influencing these processes (Leopold, 1994). This relation is at the core of the negative impact of artificial barriers in fluvial ecosystems (Charlton, 2008), addressed by the proposed EU Nature Restoration Law, that sets the objective of restoring 25 000 km of rivers to a free-flowing state by 2030. Several NBS projects work on restoring these key processes. For instance, the LIFE Ribermine project improved the water quality of the Tajo River by restoring an offsite erosive abandoned mine with a geomorphic approach. Other relevant examples of water-related NBS built on ecological processes rely on the nutrient cycling capacity of wetlands, and through such processes they aim to mitigate the impact of human interventions.

The following case studies show NBS in different ecosystems that deal with water management, and outline the possibilities of a new paradigm of water management: managing water through nature.

Learning from experience

Lower Danube Green Corridor

Constructed wetland for rural wastewater treatment in the River Ingol

Green and blue infrastructure in the Stiemer Vallei, Genk

Case Study 1
Lower Danube Green Corridor

NBS type: Wetland and Forest landscape restoration
Location: Bulgaria, Romania, Republic of Moldova and Ukraine
Type of landscape/ecosystem: Wetland
Timeframe: 2000 - ongoing
Cost/budget: 183 million EUR

Short description of project:

In 2000, the governments of Bulgaria, Romania, Ukraine and Moldova signed the Lower Danube Green Corridor Agreement to establish the corridor along approximately 1,000 KM of the Lower Danube River. This commitment aimed to enhance the protection of 775,000 hectares of existing protected areas, add 160,000 hectares as protected areas, and restore 224,000 hectares of the degraded Danube's original floodplains, including important former wetland areas. Restoration measures included clearing invasive vegetation species, planting native trees, and removing the Dikes to allow the river resume its natural course.

Figure 1 *- Kalimok marsh, Bulgaria. © Alexander Ivanov*

Benefits:

Environmental benefits:

- Restoration of 60,000 ha of floodplains and contribution to biodiversity reservation
- Improvement of the functional connectivity of ecological networks alongside the river
- Improvement of water quality with the nutrient inputs to the Black Sea from the Danube
- Management of invasive species
- Formal protection of 1.4 million hectares of wetland areas along the river

Social benefits:

- Flood and drought management
- Water purification through filtration
- Community engagement through restoration activities (tree planting, cleaning and clearing)
- Climate change mitigation and adaptation

Economic benefits:

- Expected annual earnings of €111.8 million from ecosystem services through avoidance of flood control, drought management, water purification, sediment and nutrient retention, recreational and tourism activities and creating a reservoir for biodiversity
- Estimated provision of €500 per year in ecosystem services through the restoration of each hectare of floodplains, contributing to the local livelihoods.

Context:

Transnational cooperation and stakeholder involvement have been one of the strong aspects of this initiative. At the very local level, communities and children have engaged in restoration activities and community-level authorities have been important players in the process. International organizations have played an important role in the implementation of the project, which received support from the European Commission through the LIFE projects and the World Bank in funding carbon sequencing projects in the region.

Challenges addressed:

- Degradation of natural habitat in floodplains, especially riparian forests
- Proliferation of non-native invasive tree and shrub species leading to negative changes in natural species composition and structure of riparian forest habitats
- Eutrophication resulting from anthropogenic pollution
- Flood management

Grey solutions alternative:

- Grey infrastructures such as dikes and dams
- Unsustainable forestry practices that do not take into consideration the biodiversity of riparian forests such as deadwood, hollow trees, nurse trees, and especially preservation of old-growth forests

More information:

1. Lower Danube green corridor: floodplain restoration for flood protection
2. Lessons Learnt from 20 Years of Floodplain Forest Restoration: the Lower Danube Landscape
3. Lower Danube Green Corridor agreement

Case Study 2

Constructed wetlands for rural wastewater treatment in the River Ingol

NBS type: Constructed wetlands for wastewater treatment
Location: River Ingol, England
Type of landscape/ecosystem: River in rural area
Timeframe: 2017-2019
Cost/budget: £500,000

Short description of project:

In 2019, Anglian Water in partnership with Norfolk Rivers Trust pioneered and financed the construction of a wetland treatment site that improves treated effluent before allowing it to return to the river Ingol. The wetland - made up of 4 shallow, interconnected points planted with native chalk wetland species - filters the water after it has passed through the existing treatment plant to ensure it meets high-quality standards, replacing the need for conventional, energy-intensive infrastructure. The project was funded by Anglian Water to improve water quality.

Figure 2 *- Jonah Tosney / Norfolk Rivers Trust*

Benefits:

Environmental benefits:

- Water quality improvement through cleaning of up to 1 million litres of water a day by removing ammonia and phosphate, enhancing the status of the environment and ecosystem
- Biodiversity enhancement by hosting of a wide array of native plants, which create a welcoming habitat for local species of pollinators and birds

Social benefits:

- Opportunities for local environmental organisations and councils to form partnerships
- Flood management
- Climate change mitigation
- Pollution alleviation

Economic benefits:

- £1.5 million saved through the wetland in comparison to using the traditional engineering approach available

Context:

This initiative provides an interesting case of private sector engagement with NBS. Anglian Water invested £500,000 into the project, financed through customer charges approved by the economic regulator, and including the lease of the land for 20 years, the initial cost and maintenance of the site. In addition, the scheme allowed to work directly with a landowner for the provision of the land, and included communications with farmers through advisors with agricultural or farming backgrounds. A customer engagement strategy was initiated by the utility provider for the local people to assess local support for NBS.

Challenges addressed:

- Poor water quality
- Emissions reduction
- Nutrient mitigation
- Biodiversity enhancement

Grey solutions alternative:

- Conventional wastewater treatment

More information:

1. How a £500,000 wetland is protecting a Norfolk river from waste water pollution
2. Nature-based solutions utility spotlight: Anglian Water
3. River Ingol Wetland creation

Case Study 3

Green and blue infrastructure in the Stiemer Vallei, Genk

NBS type: Blue-green infrastructure
Location: Genk, Belgium
Type of landscape/ecosystem: Urban ecosystem
Timeframe: 2010- ongoing
Cost/budget: The 2020-2025 pilot projects are estimated at a total budget of €13.8 million.

Short description of project:

The redevelopment of the Stiemer valley is an urban development programme of the city of Genk with the aim of upgrading the urban valley area of the Stiemer to a multifunctional blue-green artery that increases resilience and quality of life in the city. The development of this programme utilises the natural stormwater management potential of the large catchment area, making the existing ecosystems more robust. The programme is operationalised through four sub-projects: Sustainable urban Drainage Systems financed by a water company; Constructed wetland and redesign of green/blue infrastructure areas as part of a flood mitigation and renaturalisation programme; *Gardens of Waterschei* - transformation focused on biodiversity enhancement; *Vallei Route* using nature-based solutions to deliver an active travel route through the Stiemervallei.

Figure 3 *- Stiemer Vallei, Genk | Susanna Gionfra*

Benefits:

Environmental benefits:
- Biodiversity enhancement by identifying and bringing back rare and unique species
- 48ha of Natura 2000 habitats in Stiemer valley

Social benefits:
- Placemaking: Citizens proud of the Stiemer Valley

Economic benefits:
- 44 social innovation partnerships through Stiemerdeals
- 15 new products produced from sustainable food to tourism

Context:

The Stiemer Programme was developed through an integrated approach with a strong participatory character. The co-creation approach adopted by the City of Genk has enabled the engagement of stakeholders, both internal (other governmental departments) and external (other agencies, NGOs, businesses and citizens), also independently from the city Connecting Nature team.

Challenges addressed:

- Poor water quality
- Biodiversity enhancement
- Lack of recreational space along the river
- Flood and stormwater overflow management

Grey solutions alternative:

- Conventional drainage systems and stormwater management

More information:
1. Oppla case study on Stiemer Vallei, Genk
2. Connecting Nature Stiemer Exemplar in Genk
3. Connecting Nature Infographic

Shifting the water paradigm through policy and practice

The potential of NBS is widely recognized by the adoption of the concept in multilateral environmental agreements that have a strong water focus. The Contracting Parties to the Convention of Wetlands recognize the potential of NBS for the protection, conservation, restoration, sustainable use and management of wetland ecosystems in addressing climate change (Ramsar COP14 Doc.18.20 Rev.3) . The UNCCD COP15[1] in 2022 invites Parties to explore complementarities in international agreements, by "the implementation of sustainable land management, ecosystem-based approaches or nature-based solutions" (UNCCD Decision 15/8). Further, NBS are considered relevant within existing EU-policies such as the Water Framework Directive, the Floods Directive and the Urban Waste Water Treatment Directive (European Commission, 2020).

More recently, the proposed EU Nature Restoration Law, with the aim to protect and restore 30% of European land and sea by 2030, promotes the improvement of water resources and their availability, recognising their crucial importance to human well-being, the environment and the economy. In line with the proposed Law, this factsheet promotes an integrated ecosystem-based approach to water management. By balancing the water needs from different sectors, and recognising the broader context in which water is managed and used across ecosystems as well as its finite availability, affected by natural and human interactions, such an approach calls for the development of NBS in all ecosystems.

Policymakers have a key role to play in promoting restoration and conservation actions which fall under the umbrella of NBS. In order to meet policy expectations, practitioners, planners and developers need to be equipped with the required knowledge and practice to make the water paradigm shift happen.

Key messages

- **Degraded ecosystems are the leading cause of water resources management challenges**
- **A new paradigm shift in water management requires NBS implemented across terrestrial and aquatic ecosystems to improve and restore their functions leading to significant benefits to water resources management**
- **Policies and laws are needed to sustainably manage terrestrial and aquatic ecosystems, as they serve all human activities, support life on Earth, across national boundaries.**
- **An integrated ecosystem approach is crucial to maintaining ecosystems and ensuring the sustainability of water supply**
- **Decisions on actions and solutions implementation in one place can have significant consequences for water resources, people, the economy and the environment also in distant locations**
- **More evidence is needed to demonstrate the interlinkages between ecosystems and their functions, for a sustainable and integrated management of water resources**
- **Data, evidence and guidance are key to demonstrate the efficacy/effectiveness of NBS across ecosystems for water management, while encouraging the implementation of similar actions**

1 15th session of the Conference of the Parties of the United Nations Convention to Combat Desertification

To continue building the evidence base on NBS for water management, NetworkNature collaborates with EU-funded NBS research projects within the Horizon2020 and Horizon Europe programmes, which are directing their actions towards water management challenges across ecosystems. A complete overview of all EU NBS research projects by ecosystem and challenges addressed is provided in the [NetworkNature visualisation].

EU NBS projects working on water management across different ecosystems include:

GrowGreen, Interlace, Invest4Nature, Marine SABRES, MarinePlan, MULTISOURCE, MERLIN, NAIAD, Naturance, Nature4Cities, Naturvation, NICE, RECONECT, REGREEN, UNaLab.

More information on practical examples of NBS for water can be accessed on: NetworkNature case study finder; OPPLA; PANORAMA solutions; UrbanNatureAtlas; Nature-based Solutions Initiative case study platform.

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- NetworkNature biannual newsletter
- Find out more about the work of the H2020 and Horizon Europe NBS projects

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How can you help raise awareness about nature?

- Sharing this fact sheet
- Mapping where your work connects

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