



INVESTING IN NATURE TO BUILD RESILIENCE:

The economic rationale of Nature-based Solutions in Europe's rivers and wetlands

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NATURE-BASED SOLUTIONS FOR FRESHWATER MANAGEMENT

Amidst a global health and economic crisis, and with an ongoing climate and biodiversity crisis more evident day by day, the call to transition to a green and inclusive economy rings very loud. In this new economy, one of the key elements is working with instead of against nature.

Nature-based Solutions (NbS), understood as solutions that use natural systems or processes to help achieve a societal goal, are in fact gaining more and more traction: from Sustainable Development Goals, Sendai Framework for Disaster Risk Reduction, to UN Decade on Ecosystem Restoration, European Green Deal or Climate COP 26. NbS are mentioned everywhere, although their implementation is not yet mainstream.

Considering economic valuation often plays an important role in the selection of solutions by public authorities, WWF analyzed the socioeconomic costs and benefits, and thus the economic viability, of several freshwater management cases in Europe.

This study contributes to the growing evidence base that investments in Nature-based Solutions for freshwater management are economically the preferred choice when taking into account all benefits humans derive from healthy, well-functioning rivers and wetlands, going clearly beyond the monetary benefits of single-use approaches typically considered in grey infrastructure analysis.



RIVER SYSTEM OPPORTUNITIES

- **In upper river sections** Nature-based Solutions include sustainable land use management, restoration of natural forests, grasslands and peatlands and stream protection.
- **In middle and lower river section**, this includes re-meandering, riparian shading, protecting marshy streams and floodplains, reviving or creating side channels, restoring, reconnecting, widening and lowering floodplains, restoring wetlands and constructing natural water retention areas.
- **In urban areas**, improved rainwater drainage, permeable pavements and urban wetlands replacing impermeable surfaces, contribute to reducing flooding in the city.

KEY FINDING 1

Nature-based Solutions for freshwater management can contribute to climate change mitigation and adaptation while reversing biodiversity decline.

There is an increasing record that by recovering the proper functioning of freshwater ecosystems we can contribute to climate change adaptation and mitigation, like in the case of the Elbe or in the Dutch program “Room for the River”, while providing better and more diverse habi-

tats for biodiversity to recover. On the other hand, there is clear evidence that many other approaches to deal with climate challenges from the traditional or grey infrastructure side are having a negative impact on biodiversity, as shows the last IPBES-IPCC report on Climate and Biodiversity. **NbS can give a response to a key need identified in the report: that biodiversity loss & climate change won't “be successfully resolved unless both are tackled together.”**

CASE STUDY: COST-BENEFIT ANALYSIS OF FLOOD MANAGEMENT - LOWER DANUBE AND DANUBE DELTA

BUSINESS AS USUAL

Short term measures of dike building and maintenance

- **€ 572 million per year.** Cost to preserve the current flood protection level in the lower Danube by **maintaining degraded embankments**
- **€ 3,3 billion.** Spent in total by year 2100 in **additional flood protection measures** due to increased climate change-related risks
- **Higher risk.** The Danube's floodplains use will remain largely agricultural and little diversified, making the **model sensitive to economic and climatic shocks** – already yields are declining due to salinization and aridification

NATURE-BASED SOLUTION

Large-scale restoration 4000 km² floodplains

- **€ 230 million per year.** **Cost reduction in flood risk** protection measures as floodplain restoration will reduce flood risk in the long term
- **€ 1,36 billion.** Spent in total by year 2100 in additional flood protection measures due to increased climate change-related risks

The resulting ecosystem services will support **diversification of the economy** bringing benefits to many sectors:

- **€ 1,15 billion in tourism**
- **€ 140 million in fisheries**
- **250,000 short term jobs**

In a recent report, Deltares estimates a CBA of flood management in the lower Danube and its delta, concluding that under current management or business as usual, ecological degradation of the basin will continue, with consequent loss in ecosystem services and possible penalties for non-compliance with EU Habitat and Water Framework Directives, or high opportunity costs required to meet objectives. If floodplain restoration is favored, it will contribute to **improve ecological quality, restore hydrological and morphological processes, water quality and biodiversity, reduce risk from disasters and support local livelihoods by diversification of local economy.** Once multiple benefits and ecosystem services are taken into consideration, NbS offer a sustainable way forward and moving away from business as usual.

Source: Van Wesenbeeck, B, Kok, S, Benitez Avila, C, Gwee, R, Penning, E (2021) Economic rationale of NBS in freshwater ecosystems. Deltares, 11206081-002-ZKS-0001



KEY FINDING 2

Nature based Solutions for freshwater management create employment opportunities on the short and medium term and stimulates economic sustainable development in the long term.

Investment in ecological restoration directly creates from 6 to 33 jobs per invested million €. In the long term, enhanced ecosystem services stimulate employment in a range of industries such as the fishing and recreational sectors, and through supplier and increased household spending effects. As such, investments in NbS have the

potential to contribute to a shift towards nature-friendly, low-carbon, diversified local economies.

Failing to invest in nature and continuous use of grey infrastructure can have downward spiral effects in the achievement of SDGs, whilst the increased application of NbS contributes to societal benefits and at the same time contributes to implementation of Sustainable Development Goals.

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CASE STUDY: ECOSYSTEM SERVICES EDDLESTON WATERSHED RESTORATION, SCOTLAND

ECONOMICALLY VALUED BENEFITS

Net present value over 30 years:

- Carbon sequestration €0,9 million
- Biodiversity €0,3m
- Timber production €0,5m
- Education €0,2m
- Recreational and health €0,9 million (estimation)

NOT ECONOMICALLY QUANTIFIED BENEFITS

- Increased lag time before flood peaks
- Increased infiltration in the woodland area
- Better and more diverse habitats for fauna

Natural flood management in Eddleston restoration included the recovery of 225 ha of woodland, 28 ponds and 116 log dams. The analysis of ecosystem services derived from the intervention concludes that, when other benefits than the standard data based on flood-risk reduction and ecological restoration are considered, the economic case is significantly strengthened – we're talking about carbon sequestration, timber production, recreation and tourism benefits, as well as other ecosystem and biodiversity benefits. As such a wider ecosystem service assessment is not the conventional approach in flood scheme appraisal procedures in the UK, these economic arguments are in danger of not being weighed in investment decisions. This can be rectified by a structured NbS approach.

Source: Comins, L. & Spray, C. *The Eddleston Water Project*. www.tweedforum.org <https://tweedforum.org/our-work/projects/the-eddlestone-water-project/> (2020), and Spray, C., Fiselier, J. & Moons, J. *Elaborated business case Eddleston Water*. (2020) as cited in Van Wesenbeeck et al (2021).



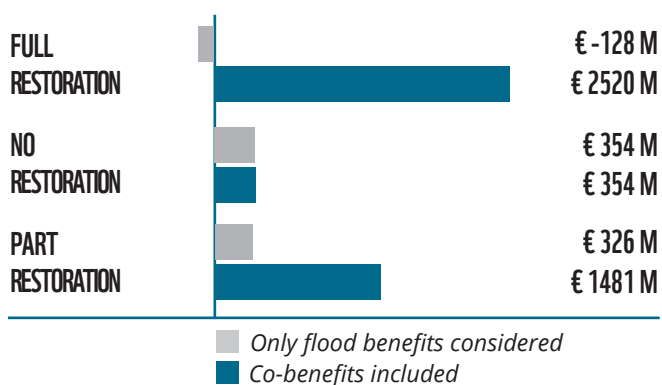
KEY FINDING 3

Nature-based Solutions for freshwater management are efficient from a socioeconomic point of view when taking into account all benefits from rivers and wetlands.

Healthy rivers and their floodplains provide a wide range of vital ecosystem services that benefit humans: water retention and regulation, biodiversity, drinking water provision, flood protection, carbon sequestration, erosion protection, spatial quality, recreation, nitrate and phosphorus cycling.

As shown in recent Deltares report, cost benefit analyses of projects across Europe demonstrate that Nature based Solutions are more attractive investments from a socio-economic point of view than their grey alternatives, when taking the full range of functions and ecosystem services into account. EU and national policies are increasingly recognizing and promoting NbS in freshwater management due to its multisectoral approach and ability to achieve greater results for society and economy.

CASE STUDY: COST-BENEFIT ANALYSIS OF ELBE FLOODPLAIN RESTORATION



Three alternative floodplain restoration strategies in the Elbe where analysed: 1) large-scale floodplain restoration with dike reallocation (full restoration); 2) controlled retention polders, keeping the current land use and dike location (no restoration), and 3) a combination of controlled retention polders and floodplain restoration (partial restoration). The results of the economic comparison show that full floodplain restoration is the most attractive from socio-economic point of view, when additional benefits to water quality and biodiversity are considered and monetized.

Source: de Kok, J. & Grossmann, M. Large-Scale assessment of flood risk and the effects of mitigation measures along the Elbe River. *Nat. Hazards* 52, 143-166 (2010) as cited in Van Wesenbeeck et al (2021)

CASE STUDY: MULTIPLE BENEFICIARIES OF WERRA RIVER RESTORATION

Challenges

- Poor water quality
- Ecosystem degradation
- Lack of livelihoods opportunities

Hybrid & Nature based Solutions

- Improve river morphology and continuity
- Reduce pin-point and diffuse

Economic benefits

€150-197 million over 20 years
5 x the investment costs

Effect of measures

Increased fish stocks
Improved drinking water quality
Improved recreational opportunities in catchment
Improved habitat provision, biodiversity, nutrient retention, improved water quality
Conservation of biodiversity in the river ecosystem

Beneficiaries

Professional fishing companies
Increased health; citizens Drinking water company
Tourism / Recreation sector
Authorities responsible for good ecological status
Local population; those who value preservation of biodiversity

Conservation and improvement of current biodiversity in the Werra catchment has economic benefits of 11-15,6 million €/ year. **Recreational benefits linked to water quality and morphology are valued at 4,2-4,6 €million /year. This amounts to a present value (with discount rate 3%) of €150-197 million over 20 years. These benefits outweigh the investment costs of measures up to 5 times.**

Source: Hirschfeld, J., Dehnhardt, A. & Dietrich, J. Socioeconomic analysis within an interdisciplinary spatial decision support system for an integrated management of the Werra basin. *Limnologica* 35, 234-244 (2005), as cited in Van Wesenbeeck et al (2021).



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A CALL TO ACTION

As shown in the previous examples, Nature-based Solutions in freshwater systems have a great potential to help us adapt to climate change while contributing to recover biodiversity and to create a greener economy. Despite these facts, investments in green approaches are still anecdotal and quite far from the €1 Trillion the Green Deal aims at mobilizing. In the national recovery plans submitted to the Next Generation EU Recovery and Resilience Facility, investments in nature restoration are, at most, barely mentioned as an element for a green economy or for resilience. Urgent action is needed at local, national and European scale in order to foster and benefit from the implementation of NbS, and benefit from their multiple facets.

Recommendations to practitioners at local or national level

- **Define a standard clear methodology for cost-benefit or cost-efficiency analyses of public investments that allows to show the various benefits of Nature-based approaches**, considering and valuing all ecosystem services and using a sufficiently large spatial scope and time horizon.
- **Include Nature-based Solutions as key measures in national and regional plans on water, climate, disaster risk reduction, energy, agricultural and transport sectors, ensuring cross-sectoral coordination.** Start with River Basin Management plans right now under discussion and with the implementation of the Next Generation EU funds,
- **Develop engaging participatory processes to ensure the most relevant societal challenges are being considered when looking for solutions to specific problems and to identify trade-offs.** This will not only help guide interventions and facilitate their implementation, but will allow for a more efficient use of resources, through the application of integrated Nature-based Solutions.

Recommendations to EU decision makers

- **Include in the upcoming EU Nature Restoration Law legally binding, ambitious restoration targets, in particular for river floodplains and wetlands.** Measures should be prioritized to enable large scale restoration and land use change through the creation or recreation of natural habitats, in order to both increase the resilience to climate change impacts, and improve the overall ecosystem health of existing natural habitats. WWF advocates for an overarching area-based restoration target by 2030 of at least 650.000 km² of land (15% of overall land area).
- **Phase out harmful EU subsidies to sectors and activities which counteract the deployment of Nature-based Solutions**, especially in floodplains, wetlands or rivers, such as intensive agriculture, navigation, or hydropower or other activities involving the construction of artificial barriers.
- **Introduce a “nature-based” requirement to EU funds earmarked for investments in water, climate, disaster risk reduction, energy, agricultural and transport sectors**, so that only interventions which both address societal challenges and preserve or improve biodiversity conservation can benefit from public funds. Moving one key step beyond the “do no harm” criterion.

LIVING EUROPEAN RIVERS

Living European Rivers is a WWF-led initiative to bring life back to Europe's waters for the benefit of people and nature. Involving other civil society organizations, governments, investors, businesses and communities, the initiative aims to protect rivers, lakes and wetlands that are still in good health and restore the ones that have been degraded. To achieve this ambitious goal by 2030, the initiative works to improve water governance, redirect financial flows towards nature-based solutions, remove dams, fight unsustainable hydropower, and raise awareness about the values of freshwater ecosystems.

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