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Final Report

JPP INTPA PROJECT: UNLOCKING INVESTMENTS IN NATURE-BASED SOLUTIONS IN OUR INTERNATIONAL COOPERATION

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Glossary of Abbreviations

APOC	Anaerobic Digestion Photocatalytic Oxidation
CAP	Common Agricultural Policy
EC	European Commission
EIB	European Investment Bank
EIBs	Environmental Impact Bonds
ERDF	European Development Fund
ESG	Environmental, Social and Governance (standards)
EU	European Union
FRB	Forest Resilience Bond
GEF	Global Environmental Facility
GIS	Geographic Information Systems
IBRD	International Bank for Reconstruction and Development
IUCN	International Union for Conservation of Nature
MOOC	Massive Open Online Course
NBS	Nature-Based Solutions
NDICI	Neighbourhood, Development, and International Cooperation Instrument
NGO	Non-Governmental Organisation
NWP	Dutch National Water Plan
ONAS	National Sanitation Utility
OPEX	Operational and Maintenance Expenditure
PPPs	Public-Private Partnerships
PES	Payment for Ecosystem Services
PFS	Pay for Success
SDG	Sustainable Development Goal
SVIR	National Policy Strategy for Infrastructure and Spatial Planning
SWRI	Soil and Water Resources Institute

TEK	Traditional Ecological Knowledge
U.S.	United States
UN	United Nations
UNEA	United Nations Environment Assembly
UNEP	United Nations Environment Programme
WB	World Bank
WEF	World Economic Forum

1. Introduction

In today's rapidly changing world, the pressing challenges of climate change, biodiversity loss, and pollution have become increasingly urgent and unavoidable. This has highlighted the urgent need for innovative and sustainable solutions. Nature-based solutions (NBS) are emerging as crucial and effective approaches to address these complex challenges. NBS leverage the power of nature to provide sustainable and cost-effective solutions for a wide range of societal, economic, and environmental issues. By harnessing the inherent resilience and functionality of natural ecosystems, NBS offer a promising pathway towards building a more sustainable, resilient, and harmonious relationship between human societies and the environment. From restoring wetlands and forests to implementing green infrastructure in urban areas, NBS are proving to be a transformative force in shaping a more sustainable and equitable future for our planet.

NBS have emerged as a key approach to addressing global challenges, including sustainable infrastructure development. By protecting and restoring ecosystems like wetlands, peatlands, and coastal areas, and sustainably managing marine environments, forests, and soils, NBS play a crucial role in reducing greenhouse gas emissions and adapting to climate change.[1] Specifically in the water sector, a focus of this project's scope and report, NBS offer vast possibilities to protect and to restore aquatic ecosystems and support the sustainability and circularity of water resources.[2] For instance, restoring wetlands and rivers reduces flood risks and provides recreational benefits, while natural coastal infrastructure (e.g. mangrove forests or oyster reefs) protects shorelines and mitigates sea-level rise impacts.[3]

As climate and biodiversity challenges intensify, the importance of NBS cannot be overstated. According to UNEP, managing, protecting, and restoring nature can address societal challenges, enhance well-being, and support biodiversity, potentially reducing emissions by up to 11.7 gigatons of carbon dioxide equivalent per year by 2030, being a significant support factor in limiting global warming.[4] In the water sector, NBS, such as riverbed or wetland restoration, help combat flooding, droughts, and water quality issues

[1] European Commission. (2021). EU biodiversity strategy for 2030. https://op.europa.eu/en/publication-detail/-/publication/31e4609f-b91e-11eb-8aca-01aa75ed71a1.
[2] Water4All. (2022). Strategic Research and Innovation Agenda (SRIA): 2022-2025. https://www.water4all-partnership.eu/sites/www.water4all-partnership.eu/files/2023-02/Water4All_SRIA-2022-2025_A4_2311_bd.pdf.
[3] IUCN. (2016). Nature-based solutions to address global societal challenges. https://portals.iucn.org/library/sites/library/files/documents/2016-036.pdf.
[4] United Nations Environment Programme. (2024). UNEP and nature-based solutions. https://www.unep.org/unep-and-nature-based-solutions.

while building resilience. NBS also complement grey infrastructure, offering added benefits for biodiversity, human health, and community resilience.[5]

There are various definitions when it comes to NBS.[6] In the international context, the fifth United Nations Environment Assembly (UNEA-5.2) established a multilaterally agreed definition in March 2022: "*Nature-based solutions are actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services, resilience and biodiversity benefits*."[7] This definition was formally agreed by governments worldwide, and among other resolutions adopted at UNEA-5.2, it aims at strengthening actions for nature to achieve the Sustainable Development Goals (SDGs). It is the definition the European Commission (EC) uses.

In the context of development cooperation, NBS play a vital role in promoting sustainable development and supporting the achievement of international climate and biodiversity goals. They are indispensable for achieving multiple SDGs[8], specifically SDG6 when focusing on the water sector. Also, in recent European Union (EU) policies, such as the EU Biodiversity Strategy[9], the essential value of NBS has been recognised. Through their ability to provide effective and adaptive solutions to complex challenges, NBS have the potential to significantly impact the lives of people around the world. By harnessing the knowledge and experience already existing in the EU and supporting the uptake of NBS globally, development cooperation efforts can not only enhance environmental sustainability but also contribute to the overall well-being and resilience of communities.

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[5] OECD. (2024). Nature-based solutions and climate-resilient infrastructure. https://www.oecd.org/en/topics/nature-based-solutions-and-climate-resilient-infrastructure.html; OECD. (2021). Scaling up Nature-based Solutions to Tackle Water-related Climate Risks: Insights from Mexico and the United Kingdom. https://doi.org/10.1787/736638c8-en.

[6] IUCN. (2020). Issues Brief: Ensuring effective nature-based solutions. https://iucn.org/sites/default/files/2022-02/iucn_issues_brief_-_nbs_standard_eng.pdf; IUCN. (2016). Nature-based solutions to address global societal challenges. https://portals.iucn.org/library/sites/library/files/documents/2016-036.pdf.

[7] United Nations Environment Programme. (2022). UNEP/EA.5/Res.5. – Nature-based Solutions for supporting sustainable development. https://wedocs.unep.org/bitstream/handle/20.500.11822/39864/NATURE-BASED%20SOLUTIONS%20FOR%20SUPPORTING%20SUSTAINABLE%20DEVELOPMENT.%20English.pdf?sequence=1&isAllowed=y.

[8] United Nations. (2024). Sustainable Development Goals. https://sdgs.un.org/goals.

[9] European Commission. (2021). EU Biodiversity Strategy for 2030 – Bringing nature back into our lives. https://op.europa.eu/en/publication-detail/-/publication/31e4609f-b91e-11eb-8aca-01aa75ed71a1.

1.1. NBS Implementation at EU Level

At the heart of the EU's promotion of NBS are several key policies, including the **European Green Deal**, the **Biodiversity Strategy for 2030**, the **Nature Restoration Regulation**, and the **EU Adaptation Strategy**, all of which emphasise the integration of NBS into urban planning, climate adaptation, and disaster risk reduction strategies, among others. These frameworks call for embedding NBS in national and regional policies, encouraging EU Member States to adopt solutions that not only protect and restore ecosystems but also enhance community resilience and contribute to climate mitigation.

To scale up the implementation of NBS, the EC has utilised various funding mechanisms that directly support the development and execution of NBS projects. The **LIFE Programme**, one of the EU's primary funding instruments for environmental and climate action, has financed numerous NBS initiatives focused on restoring ecosystems, enhancing water management, and building urban resilience.[10] Through this programme, the EU has mobilised **€ 52 million** in funding for climate change adaptation projects, many of which centre around NBS.[11]

Another key funding stream is the **European Regional Development Fund (ERDF)**, which promotes regional economic development by supporting green infrastructure, including NBS projects. By focusing on reducing disparities between regions, the ERDF enables regions to adopt NBS that are locally relevant yet aligned with EU-wide sustainability goals.

The EC has also significantly invested in **research and innovation to advance NBS,** particularly through the EU's framework programmes, **Horizon 2020** and **Horizon Europe**. By the end of 2024, the EU will have financed more than **83 NBS projects, representing a total investment exceeding € 726 million**. These projects bring together **1,500 partners from over 70 countries**, fostering collaboration across diverse regions and sectors. This extensive support highlights the EU's global thought leadership and experience in driving scalable and effective NBS for critical areas such as water management, urban planning, and climate resilience. Such efforts not only contribute to advancing sustainable development but also position the EU as a leading advocate for integrating nature into innovative solutions for global challenges.

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[10] European Commission. (2024). Nature-based solutions. Directorate-General for Research and Innovation. Retrieved December 6, 2024, from https://research-and-innovation.ec.europa.eu/research-area/environment/nature-based-solutions_en.

[11] European Commission. (2022, November 23). LIFE Programme: €380 million for 168 new green projects all around Europe. Press release. European Commission. Retrieved December 6, 2024, from https://ec.europa.eu/commission/presscorner/api/files/document/print/en/ip_22_6983/IP_22_6983_EN.pdf

Platforms such as **NetworkNature**[12] foster collaboration and knowledge exchange between policymakers, researchers, and practitioners to ensure NBS solutions are adaptable across regions. The NetworkNature European Roadmap to 2030 for Research and Innovation on Nature-based Solutions[13] further supports these efforts by setting strategic priorities, addressing knowledge gaps, and developing standardised tools to ensure NBS projects are sustainable and scalable globally.

In addition to research, the EC promotes collaboration through partnerships between EU Member States, local authorities, and international organisations. NetworkNature plays a pivotal role in this regard by providing resources, case studies, and policy guidance to disseminate best practices in NBS implementation. These collaborative and capacity-building efforts are essential for overcoming barriers such as technical expertise, financial constraints, and stakeholder management, particularly in large-scale projects, for instance, in the water management sector.

These initiatives align with the goals of this project, which seeks to identify best practices that can be scaled and adapted for EU and global application.

1.2. NBS Implementation in International Partnerships

The EC's International Partnerships' objective is to formulate and implement the EU's international partnership and development policies, with the goal of reducing poverty, ensuring sustainable development, and promoting democracy, human rights, and the rule of law worldwide.

Within this framework, the **Global Gateway** serves as a strategic initiative aimed at fostering sustainable and trusted connections as well as connectivity that benefit both people and the planet. It tackles some of the most pressing global challenges, including climate change, improving health systems, and enhancing the security and competitiveness of global supply chains. With a commitment to mobilising up **to € 300 billion by 2027**, **Global Gateway** focuses on key sectors such as climate resilience, energy, digital transformation, and transport. It aligns closely with the European Green Deal, the Paris Agreement and the Kunming-Montréal Global Biodiversity Framework, ensuring that infrastructure projects adhere to high environmental, social, and ethical standards.

[12] NetworkNature. (2024). https://networknature.eu/.
[13] El Harrak M. & Lemaitre F. (2023). European Roadmap to 2030 for Research and Innovation on Nature-based Solutions. NetworkNature. https://networknature.eu/sites/default/files/uploads/eu-ri-roadmapweb.pdf.

Aligned with the principles of being **green and clean**, the Global Gateway aspires to be a climate-neutral initiative that accelerates sustainable development and recovery, promotes inclusive economic growth and job creation, and supports the transition to a cleaner, circular global economy. It seeks to prioritise investments in infrastructure that are environmentally sustainable, climate-resilient, and compatible with net-zero emission pathways. All projects supported as part of this initiative are guided by the European Green Deal's commitment to "**do no harm**" by incorporating environmental impact assessments and strategic environmental evaluations.[14][15]

In this context, NBS play a crucial role, as they are often described as solutions that work with people and nature for the benefit of both.[16] NBS hold significant potential to address climate adaptation, mitigation, and biodiversity challenges, aligning with the Global Gateway's vision of sustainable and inclusive infrastructure. However, the use of NBS across the initiative's portfolio remains significantly below its potential. For instance, only two out of the 128 Global Gateway flagship projects **put in place for 2024 explicit references to nature as part of infrastructure or NBS** (coastal protection projects in Mozambique and in Togo).[17]

This underutilisation is striking given NBS enormous potential and cost-effectiveness. The Global Commission on Adaptation report emphasises that NBS, such as mangrove restoration and wetland conservation, can have a **high return on investment**. For example, mangroves prove a cost-effective alternative to seawalls, offering flood protection, carbon sequestration and fisheries support.[18] UNEP's Making Peace with Nature report similarly highlights that NBS, when properly designed and implemented, can **deliver economic benefits comparable to or greater than traditional infrastructure**, particularly in addressing climate adaptation challenges. Instead, common challenges, among others, lie in gaps in knowledge, financing, engagement, and

[14] European Commission & High Representative of the Union for Foreign Affairs and Security Policy. (2021). Joint communication to the European Parliament, the Council, the European Economic and Social Committee, the Committee of the Regions and the European Investment Bank: The Global Gateway (JOIN(2021) 30 final). Brussels. eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021JC0030
[15] European Commission. (2024). Global Gateway. https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/stronger-europe-world/global-gateway_en.
[16] For instance: U.S. Department of the Interior. (2024). Nature-based solutions. Retrieved December 3, 2024, from https://www.doi.gov/ppa/integrative/nature-based-solutions.
[17] Council of the European Union. (2023, November 21). List of Global Gateway Flagship Projects for 2024 (Document 15369/23 LIMITE). Presidency Note to the Permanent Representatives Committee (Part 2). Retrieved from https://data.consilium.europa.eu/doc/document/ST-15369-2023-INIT/en/pdf.
[18] Global Commission on Adaptation. (2019). Adapt now: A global call for leadership on climate resilience. Rotterdam and Washington, DC: Global Center on Adaptation and World Resources Institute. https://gca.org/wp-content/uploads/2019/09/GlobalCommission_Report_FINAL.pdf.

the integration of these solutions into policy frameworks (see Chapter 2).[19] A recent review of 87 studies[20] published between 2000 and 2021 found that **71% of these studies consistently demonstrated the cost-effectiveness of NBS in mitigating various hazards**. Moreover, **65% of these studies indicated that NBS were more effective than conventional engineering-based solutions in reducing risks**, highlighting their superior performance in many contexts.

These economic benefits also materialise for many non-disaster risk reduction NBS solutions creating public benefits such as clean air, the preservation of water quality and more, through which public and private entities can enable future cost-savings linked to

[19] United Nations Environment Programme. (2021). Making peace with nature: A scientific blueprint to tackle the climate, biodiversity and pollution emergencies. Nairobi: UNEP. https://www.unep.org/resources/making-peace-nature.

[20] First, 20,015 articles were reviewed to find out which were relevant and satisfied the inclusion criteria. After the preliminary screening, 260 articles were kept for full-text screening, which led to the exclusion of 105 articles. The remaining 155 articles underwent in-depth review. After the second round of review, the final number of articles satisfying the inclusion criteria and included in this study corresponded to 87. Each article was subject to an additional in-depth review.

the degradation of the environment.[21] Beyond cost savings, NBS offer a broad range of additional benefits, such as enhancing biodiversity, improving water quality, and fostering social cohesion.[22] The below text box provides an illustrative example of NBS cost-effectiveness and multiple co-benefits.

[21] Brasil-Leigh, A., Byrd R., Käfer, P., Miao, G., Ruiz-Serra, M., Vieira, A. & Wallock, W. (2024). Toolbox on Financing Nature-Based Solutions. https://www.climatepolicyinitiative.org/wp-content/uploads/2024/09/Report-Toolbox-on-Financing-Nature-Based-Solutions.pdf.

[22] Vicarelli, M., Sudmeier-Rieux, K., Alsadadi, A., Shrestha, A., Schütze, S., Kang, M. M., Leue, M., Wasielewski, D. & Mysiak, J. (2024). On the cost-effectiveness of nature-based solutions for reducing disaster risk. Science of The Total Environment, 947, 174524. https://doi.org/10.1016/j.scitotenv.2024.174524.

Cost-Effectiveness of NBS: New York City's Integrated Water Resource Management

Upstream: Watershed Protection

New York City (NYC) sources approximately 90% of its drinking water, serving 9.5 million people, from the **Catskill-Delaware Watershed**, the **largest unfiltered water supply system in the United States (US)**. To maintain high water quality without relying on **traditional filtration plants – which were estimated to cost US$ 6-8 billion in capital expenses and US$ 100-200 million annually in operating costs** – NYC implemented an **NBS strategy. Since 1997, NYC has invested US$ 2.7 billion in comprehensive watershed protection, including**:

- **Upgrading 42 Wastewater Treatment Pants**: Reducing pollution into reservoirs.
- **Land Acquisition**: Securing and preserving watershed areas to prevent development and pollution.
- **Stream Stabilisation**: Preventing erosion and sedimentation.
- **Forest and Wetland Restoration**: Enhancing natural filtration and biodiversity by protecting upstream forests, preventing erosion and sedimentation.
- **Agricultural Best Practices:** Collaborating with local dairy farmers to reduce nutrient and pathogen runoff and improve land use, reducing pollution.
- **Septic System Replacement:** Upgrading failing systems near reservoirs, particularly at Kensico Reservoir.

Downstream: Urban Stormwater Management

In addressing urban stormwater challenges exacerbated by climate change, NYC adopted a **green-grey infrastructure approach**, integrating natural and engineered systems to enhance resilience and cost-effectiveness. This integrated strategy has led to an **estimated US$ 1.5 billion in cost savings** compared to traditional infrastructure solutions, while effectively mitigating flood risks. Key components include:

- **Green Roofs**: Vegetated rooftops that absorb rainfall and reduce runoff.
- **Bioretention Areas**: Landscaped zones designed to capture and treat/filter stormwater.
- **Permeable Pavements**: Surfaces that allow water infiltration, decreasing surface runoff and flooding.
- **Green Corridors**: Networks of green spaces that facilitate water absorption, enhancing drainage, and provide recreational areas.
- **Subsurface Storage**: Underground tanks and tunnels to store excess stormwater during peak events, increasing stormwater retention capacity.

Additional Co-Benefits

Beyond direct cost savings and improved water resource management, these NBS initiatives offer a range of supplementary benefits that contribute to the overall well-being of NYC residents and enhance the city's resilience to environmental challenges.

- ➔ **Recreational and Aesthetic Enhancements:** Creation of green spaces that improve urban liveability, provide recreational opportunities, and improve quality of life.
- ➔ **Urban Cooling**: Trees and vegetation lower ambient temperatures by up to 2 degrees Celsius, enhancing comfort and reducing energy consumption, mitigating heat islands.
- ➔ **Air Quality Improvement**: Green spaces act as natural air filters, reducing pollutants, enhancing public health.
- ➔ **Biodiversity Conservation**: Supporting diverse plant and animal life within urban settings, through green corridors and protected watersheds.

Preparing for Future Challenges

While the watershed protection plan has been a remarkable success, NYC must adapt to new stressors posed by climate change:

- ❖ **Increased Storm Intensity**: More frequent and severe storms raise erosion and turbidity risks, which can interfere with ultraviolet disinfection.
- ❖ **Rising Temperatures**: Warmer waters and nutrient loads increase the risk of harmful algal blooms.
- ❖ **Infrastructure Needs**: Ensuring flexibility and redundancy through investments like the US$ 1.9 billion Kensico-Eastview Connection (KEC), a two-mile tunnel capable of carrying 2.6 billion gallons daily to the Catskill-Delaware Ultraviolet (CDUV) Disinfection Facility.

These projects ensure the continued reliability of NYC's water supply, complementing NBS with modern infrastructure to meet growing demands while maintaining cost-effectiveness. NYC's integrated approach - leveraging upstream watershed protection and downstream green-grey infrastructure - demonstrates the immense cost savings, resilience benefits, and environmental co-benefits of NBS at scale.

***Sources**:*

- *Pires, M. (2004). Watershed protection for a world city: The case of New York. Land Use Policy, 21(2), 161–175. https://doi.org/10.1016/j.landusepol.2003.08.001.*
- *World Bank. (2019). Integrating green and grey: Creating next-generation infrastructure. World Bank. https://doi.org/10.1596/978-1-4648-1430-3.*
- *Walton, B. (2020, March 3). After more than two decades, landmark New York City watershed protection plan is working. Circle of Blue. https://www.circleofblue.org/2020/world/after-more-than-two-decades-landmark-new-york-city-watershed-protection-plan-is-working/.*
- *National Academies of Sciences, Engineering, and Medicine. (2020). Review of the New York City Watershed Protection Program. The National Academies Press. https://doi.org/10.17226/25851.*
- *New York City Department of Environmental Protection. (2024, July 23).* New York City Department of Environmental Protection breaks ground on $1.9 billion water tunnel in Westchester County*. NYC.gov. Retrieved from https://www.nyc.gov/site/dep/news/24-027/new-york-city-department-environmental-protection-breaks-ground-1-9-billion-water-tunnel-in#/0.*

These findings underscore the significant untapped potential of NBS in delivering both environmental and socio-economic advantages, further reinforcing the case for their increased adoption in infrastructure projects. A more integrated approach to NBS is warranted, as opportunities exist to embed them across all sectors within the Global Gateway initiatives and supported projects. For example:

- **Renewable energy**: Incorporating green roofs beneath solar panels can enhance energy efficiency by cooling the panels, while surrounding solar farms with native vegetation supports local ecosystems and reduces maintenance costs.
- **Transport**: Using NBS along transport corridors, such as vegetated swales or permeable pavements, can manage stormwater runoff and reduce flood risks.
- **Urban development**: Urban green spaces and green walls not only mitigate urban heat islands but also improve air quality, water retention, and offer recreational opportunities.
- **Agriculture and food security**: Agroforestry and wetland restoration can enhance soil health and water availability while sequestering carbon and increasing resilience to climate variability.

In almost all Global Gateway flagship projects, there is vast untapped potential to exploit NBS further. To maximise the Global Gateway's impact, greater emphasis should be placed on systematically integrating NBS into planning, design, and implementation phases, thereby ensuring these solutions complement and enhance traditional infrastructure interventions.

For 2025, several Global Gateway flagship projects for 2025 have strong potential for implementing NBS. These projects focus on integrating sustainable practices, restoring ecosystems, and leveraging nature-driven approaches to address challenges like climate resilience and environmental preservation.[23] Some of the more evident examples include:

- **Promoting Sustainable Coastal Agricultural Practices in the Gulf of Tunis** (Project #4) - Enhances agricultural practices with wetland hydrology monitoring.
- **Sustainable Coffee Value Chain in Africa** (Project #7) - Promotes climate resilience and sustainable practices in agriculture.
- **Sustainable Cocoa Reforestation in Côte d'Ivoire** (Project #16) - Aims to transition from deforestation to reforestation.

[23] Council of the European Union. (2024). Draft proposal for a list of Global Gateway flagship projects for 2025 and for amending the lists of Global Gateway flagship projects for 2023 and 2024 (Document No. 15281/24).

- **Virunga Conservation and Development Initiative in the Democratic Republic of Congo** (Project #23) - Supports green corridors and conservation efforts.

Furthermore, there are also projects in the list with less obvious but nonetheless considerable NBS opportunities, including:

- **Senegal River Valley Development and Resilient Project in Mauritania (Project #5)** – May offer opportunities for NBS by employing wetland restoration and floodplain management to improve flood protection and agricultural productivity while promoting local ecosystem services.
- **Climate Resilient Infrastructure and TVET Centres in Pakistan (Project #8)** – Includes the construction and rehabilitation of hydropower and irrigation systems with opportunities for NBS, such as catchment area reforestation to reduce sediment loads, and the development of community-based initiatives to promote ecosystem resilience. This project also includes training centres to build local capacities, with a focus on youth and women, contributing to green job creation and climate adaptation.
- **Kpong Hydropower Dam Rehabilitation in Ghana (Project #24)** - While primarily a grey infrastructure project, it offers potential for NBS by for instance integrating upstream measures for sediment-load reduction through catchment reforestation and improved land-use practices, reducing reservoir siltation and enhancing biodiversity.

However, none of the projects explicitly reference NBS, while they may align with the principles of NBS, such as enhancing ecosystem services, improving agricultural sustainability, and supporting conservation efforts. Global Gateway infrastructures should incorporate NBS elements, putting emphasis on restoring and maintaining ecosystems and leveraging natural processes to achieve higher cost-effectiveness and reap the multiple additional benefits of public value provided by NBS vis-à-vis purely grey solutions.

The limited adoption of NBS within the Global Gateway projects highlights an **opportunity to further expand and scale up NBS**. Increasing the use of NBS could significantly enhance the sustainability and resilience of Global Gateway projects, while also contributing to the long-term environmental goals of Europe's international partners while at the same time supporting their economic development.

It is worth noting that the **360-degree approach**, a cornerstone of the EU's Global Gateway strategy, provides a holistic framework for achieving these objectives. This approach emphasises the systematic application of six key principles: **democratic values and high standards, good governance and transparency, equal partnerships, green and clean infrastructure, security-focused investments, and catalysing private sector involvement**. By promoting **high environmental, social and governance (ESG) standards**, the 360-degree approach aims to create an enabling

environment for sustainable and quality investments. Through its integration of diverse implementation modalities, such as **budgetary guarantees, blending, grants, and technical assistance**, the 360-degree approach facilitates the incorporation of NBS into infrastructure projects. Its emphasis on **inclusivity - engaging civil society actors and local authorities** - ensures that NBS address community-specific needs while contributing to broader goals like climate neutrality and the green transition. Scaling the deployment and finance of NBS in Global Gateway would underscore the EU's commitment to creating sustainable, high-impact infrastructure investments that deliver benefits for both people and the planet.[24]

1.3. The 2024 JPP INTPA Project

INTPA.F2 is currently developing an **Action** that is intended to help deliver on the Global Gateway's green and clean principles[25] in line with the 360-degree approach. The action focuses on integrating NBS into infrastructure or hybrid infrastructure projects. This initiative aims to unlock significant investment opportunities to meet global climate and biodiversity targets.

Specifically, the Action will centre on **knowledge and capacity building**, tailored country support, and technical assistance to develop a robust pipeline of NBS projects. The goal is to facilitate the transmission of critical information and technical skills to stakeholders, driving **catalytic change** by scaling up green and clean infrastructure initiatives that contribute to biodiversity and climate adaptation targets.[26] These projects, with an envisioned **minimum budget of the NBS component of € 10 million**, will be aligned with the Global Gateway's broader goals of addressing climate mitigation, adaptation, and biodiversity challenges.

Several barriers are commonly identified as limiting the scaling up of NBS, despite their clear potential for climate resilience and sustainability. The **2023 report** on the **state of play on NBS investments in Europe**, conducted by the EC and the European Investment Bank (EIB), highlights that of more than **1,300 NBS projects** surveyed across the EU and the United Kingdom **72%** cover less than **1 km²**, and **81%** have investment costs below **€ 10 million (44% reported costs below € 1 million)**.

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[24] European Commission. (2024). Note for the Attention of INTPA Directors: Global Gateway 360-degree approach. (intpa.g.dir(2024)8800503).
[25] European Commission. (2024). Global Gateway: Overview. International Partnerships. Retrieved December 3, 2024, from https://international-partnerships.ec.europa.eu/policies/global-gateway/global-gateway-overview_en.
[26] European Commission. (2024). Global Gateway. https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/stronger-europe-world/global-gateway_en.

The **small-scale nature of NBS projects** can pose a financial barrier. According to the EIB report, the average size of NBS projects in the EU (ranging from € 1 million to € 10 million) may contribute to their limited appeal for financial institutions, as such projects often fail to generate returns that adequately compensate for perceived risks. Additionally, the **public nature of many NBS initiatives** - centred on stakeholder engagement, ecosystem restoration, and land management - may make them more suitable for public sector implementation, where benefits like social and environmental externalities are prioritised over direct financial returns. Against this backdrop, it should come as no surprise that public funding continues to dominate NBS financing, with **only 3% of NBS projects managing to attract private sector investment covering more than 50% of total project costs**.[27]

However, it is worth noting that low private sector investment may also stem from other factors, including the **difficulty of monetising the diverse benefits of NBS, the lack of standardised metrics to measure returns, and the often fragmented or experimental nature of NBS approaches**. For instance, the prevalence of pilot-oriented or research-driven initiatives in publicly funded NBS projects highlights a lack of pathways to long-term scalability. These projects often focus on testing and innovation but may not transition to larger-scale, wider implementation-ready solutions, further reinforcing the reliance on public funding. These challenges suggest that scaling up NBS investment will require innovative and sustainable financing mechanisms, including levies, payment for ecosystem services, and other models that ensure long-term funding beyond annual budgets.

However, while it is instinctive to focus on increasing private sector investment, it should not be seen as the only lever for success. **Clearer frameworks for valuing ecosystem services and establishing partnerships among public, private, and community stakeholders** will be key to managing ecosystems more effectively. Rather than relying solely on private sector involvement, the emphasis should be on fostering collaborations that align diverse interests and deliver solutions valued by all parties. Some of these best practices and recommendations, identified through this project's research, interviews, and case studies, are explored further in this report (see Chapter 2). Scaling pilot projects into mature, investable initiatives, whether implemented by public or private actors, will further contribute to unlocking the full potential of NBS while ensuring financial sustainability.

[27] European Investment Bank. (2023). Investing in nature-based solutions: State-of-play and way forward for public and private financial measures in Europe. https://www.eib.org/attachments/lucalli/20230095_investing_in_nature_based_solutions_en.pdf.

In addition to the EIB report, the **2024 EU Water Facility report**[28]**,** commissioned by the EC, also identifies several critical barriers preventing NBS initiatives from reaching their full potential. These barriers can be categorised as follows:

- **Governance challenges**: Implementing large-scale NBS projects often requires long-term planning, cross-sectoral coordination, and clear regulatory frameworks. However, many countries lack comprehensive policies to integrate NBS into national infrastructure strategies. For example, **only 20% of EU Member States have fully integrated NBS into their national climate strategies**, leading to bureaucratic complexity and siloed approaches that hinder implementation. Political resistance - particularly a preference for traditional grey infrastructure - further complicates efforts to mainstream NBS.
- **Knowledge and capacity gaps**: A shortage of technical expertise and standardised guidelines hampers the design and implementation of NBS. The EU Water Facility report found that **nearly 60% of stakeholders reported insufficient technical capacity to implement NBS effectively**. Engineering firms and local authorities often struggle with the **absence of reliable data to assess the performance of NBS compared to grey infrastructure**. Moreover, **inadequate monitoring frameworks** make it difficult to track the long-term impact and sustainability of these projects, with **less than 30% of NBS projects having established performance metrics**.
- **Financial barriers**: Securing funding for NBS projects remains a major challenge, particularly due to the perception that grey infrastructure is a safer investment. According to the EU Water Facility report, **traditional grey infrastructure continues to receive the majority of investment**. Financial mechanisms that account for the broader social and environmental benefits of NBS are still underdeveloped, and there is a scarcity of financial tools that quantify their economic value. Additionally, the **higher operational and maintenance costs (OPEX) of some NBS projects can deter potential investors**, particularly from the private sector. Moreover, without **appropriate governance structures**, these financial barriers can undermine the long-term sustainability of NBS infrastructure.

Against this backdrop, the 2024 Junior Professionals Programme project sponsored by INTPA intended to address the gap for NBS potential and scale-up by **identifying and promoting best practices from existing large-scale NBS initiatives across Europe**. By examining successful case studies, particularly in water-related sectors such as flood prevention and coastal protection, the project aimed to develop actionable

[28] Water Facility. (2024). Concept Paper: Nature-based Solutions for Infrastructure development – Pathways to overcome barriers for upscaling the use of nature as infrastructure.

recommendations for scaling up NBS. These efforts are to provide practical solutions for climate adaptation while enhancing the integration of NBS into broader development agendas. Ultimately, the project will contribute to achieving the EU's climate adaptation, mitigation, and biodiversity goals, as well as supporting the objectives of the Neighbourhood, Development, and International Cooperation Instrument (NDICI).

The purpose of this project was **to identify best practices and lessons learnt within the EC and the EU Member States that could help facilitate a greater uptake of NBS**, particularly in the context of substituting or complementing grey infrastructure with green infrastructure. The work carried out built on the findings of the above-mentioned Water Facility report by shifting the focus from identifying barriers to solutions to overcome these barriers and facilitate the use of NBS. By concentrating on the success factors of medium- to large-scale NBS projects in Europe, particularly in the water sector, the aim was to uncover strategies to **address governance, knowledge, financial, and stakeholder challenges**.

Through analysing eight select case studies across Europe, this report provides actionable recommendations to support the long-term success and scalability of NBS. These insights are intended to inform INTPA's efforts to integrate NBS into its development cooperation strategies, ensuring that these projects deliver sustainable and resilient infrastructure.

Moreover, initial consultations with other EC services have underscored the importance of considering the overlap between areas with significant biodiversity and Indigenous Peoples'-held or -owned territories and community land. It was deemed essential that the aforementioned Action, as well as the research carried out under this project, considers the need to increase the voices of Indigenous Peoples, and local communities in participatory planning and governance, as well as in knowledge-sharing and capacity-building.

This emphasis aligns with key outcomes from the sixteenth UN Biodiversity Conference (COP16) held in Cali, Colombia, where the establishment of a new permanent subsidiary body on traditional knowledge, innovations, and practices of Indigenous Peoples, and local communities was celebrated as a historic decision. This body will operate on par with other CBD subsidiary bodies, further strengthening the inclusion of Indigenous Peoples, and local communities in biodiversity conservation efforts. Additionally, COP16 adopted a decision on Digital Sequence Information (DSI) mandating large companies benefiting from DSI to contribute financially to a newly created "Cali Fund", ensuring more equitable benefit-sharing with developing countries and Indigenous Peoples. These developments reflect the growing recognition of the critical roles of Indigenous Peoples, and local communities in achieving global biodiversity goals.

The primary research question for the project was:

1. In the selected NBS projects, what best practices, gaps, and synergies can be identified, and how have common challenges been overcome?

A secondary research question was the following:

2. What tools, knowledge, and governance structures do stakeholders need to effectively replace grey infrastructure with NBS, and how have existing initiatives addressed gaps and challenges in this process?

1.4. Methodology

The project was conducted by using a mixed-method approach, combining literature review and qualitative interviews. The target was to gain knowledge of successful medium- and large-scale NBS projects in the water sector in Europe, for which certain best-practice case studies were identified. The interviewees were chosen based on the respective case studies and their availability.

The first phase of the work involved a review of existing literature on NBS, with an additional focus on specific tools that would facilitate the implementation of NBS projects. Furthermore, consultations with other EC services that deal with NBS in their daily work (RTD, ENV, CLIMA, NEAR) were conducted to obtain guidance and gather relevant insights on the research, as well as to contribute to the mapping of knowledge and case studies in Europe. In addition to gaining a deeper understanding of the EC's priorities and current initiatives in NBS, liaising with various services was also useful to foster collaboration and facilitate internal sharing of knowledge on NBS within the EC.

The second phase was to identify relevant NBS projects as case studies in line with INTPA.F2's focus. However, identifying sufficiently large projects in Europe proved challenging, and in many instances, the scale of the projects was smaller than initially anticipated. Nevertheless, across both larger and smaller projects, the findings demonstrated consistent patterns, indicating that the results remain valid and relevant despite the smaller size of some of the projects.

To gain in-depth insights into the chosen NBS projects, semi-structured interviews were conducted with key stakeholders. The interviewees included project coordinators, researchers, and advisers, as well as representatives of Indigenous Peoples, and local communities. The discussions focused on gathering practical knowledge about the implementation, challenges, and solutions to overcome barriers of NBS projects.

The interviews were conducted via video calls or in-person, following ethical guidelines. All interviewees were informed about the study's purpose, and consent was obtained prior to conducting interviews. Notes were taken from the discussions, which were then used

for further analysis. Responses were categorised based on key themes that arose from the interviewees' narration.

With the literature as a guiding resource to the interpretation, the responses were then analysed identifying patterns and meaningful insights. In this process, recurring themes, challenges, and best practices across various NBS projects were recognised. The findings from the literature review and interviews were integrated to showcase the most important factors for the success of NBS projects, as well as to draw broader conclusions about the scalability of NBS.

The selected case studies present a diverse range of projects, with interdisciplinary approaches, but mostly focusing on NBS in the context of water management. The projects assessed are **mostly located in Europe** (the Netherlands, United Kingdom, Hungary, Greece, Norway, Spain, amongst others), but **also in the European neighbourhood**, such as in the case of AQUACYCLE which is being implemented in Tunisia and Lebanon. This diversity underscores the multifaceted nature of NBS, which can be applied in areas such as wastewater treatment, coastal management, urban planning, and agriculture. The projects have varying timeframes, with durations from one to five years, and their budgets differ drastically, but **mostly falling under the range of € 10 million** – due to the previously mentioned challenges in identifying large-scale NBS projects in Europe. It is worth to note that the projects of over € 10 million are often consortiums of projects spreading across multiple countries.

Find below a non-comprehensive description of the selected projects – more information can be found in Annex A and B.

1.4.1. PHUSICOS

This project implemented NBS in rural and mountainous areas to reduce the risk of natural hazards such as landslides and floods. The project had demonstrator sites in Norway, the Pyrenees and Italy, and two concept cases in Austria and Germany. It has a total budget of over € 9 million.

1.4.2. AQUACYCLE

This project aims to implement an eco-innovative wastewater treatment system for Mediterranean communities, combining anaerobic digestion, constructed wetlands, and solar treatment to achieve cost-effective wastewater treatment with minimal operational costs and significant environmental benefits. The project is being implemented in Greece, Spain, Malta, Lebanon and Tunisia. Its total budget is just over € 2 million.

1.4.3. MARA-MEDITERRA

This project is aimed at addressing the low uptake of NBS in agro-ecosystems, with five locations of land and water degradation as case studies, located in Turkey, Greece, Egypt, Algeria and Lebanon. It has a budget of just over € 2 million.

1.4.4. REST-COAST

This project aims to implement large-scale restoration of coastal systems to enhance the resilience against climate change impacts such as sea-level rise and extreme weather events. It is led by different institutions, and spans nine pilot sites across eleven countries - nine European countries, as well as Israel and Turkey. It has a total budget of over € 18 million.

1.4.5. WATERLANDS

This project contributes to the restoration of Europe's wetlands, going beyond the traditional restoration by integrating ecological, financial and community knowledge to create scalable and resistant restoration strategies. The project cooperates with 32 partners from 14 countries. It has six action sites in Bulgaria, Estonia, Ireland, Italy, Netherlands and the United Kingdom, and 15 knowledge sites all over Europe. It has a total budget of over € 23 million.

1.4.6. MERLIN

This project draws on successful freshwater restoration projects across Europe and co-develops win-win solutions through collaboration with local communities and key economies. The project spans from 18 best-practice case-study demonstrators in 15 countries in the EU and beyond. It has a total budget of over € 22 million.

1.4.7. NATURVATION

This project was a four-year research project involving 14 institutions across Europe, in the fields of urban development, geography, innovation studies and economies. It sought to develop the understanding of the potential of NBS in cities. Its total budget was of € 7.8 million.

1.4.8. SAND MOTOR

This project, initially a pilot project, consists of an artificial sand bank created following the principles of building with nature: ocean currents, winds and waves, gradually spreading mega sand nourishments along the coast and into the dunes. The aim is to reinforce the coastline in the long term and create an attractive area for leisure and nature. The total cost of the pilot project was € 50-70 million.

As part of the present project, the following additional interviews with relevant stakeholders were conducted:

- A representative from the Ministry of Public Administration and Regional Development of Hungary, interviewed for the experience in fostering awareness of NBS for local and regional authorities in Hungary. The representative referred to the **NBS4LOCAL** Interreg project, which aims to contribute to the integration of NBS into national or regional policy instruments.
- Representatives from the **Wayapa Wuurkk** community, which unlike other interviews did not focus on technical issues but contributed a cultural and spiritual lens from Indigenous Peoples', and local communities' perspectives to the broader discussion of NBS.

The project's findings are further foreseen to be presented in a workshop with INTPA colleagues and in a separate e-talk for the EC's NBS Community (facilitated by RTD) after the Junior Professional Programme's showcase in February or March of 2025.

2. Discussion of Findings

This chapter builds on the interviews conducted and case studies analysed, as detailed in the previous chapter. It discusses the key barriers and opportunities identified in advancing NBS, focusing on three critical dimensions. The first section addresses gaps in knowledge and capacity, examining how fragmented expertise and limited resources constrain effective implementation, and how these challenges can be overcome. The second explores governance and stakeholder engagement, emphasising the need for inclusive decision-making and collaboration to enhance legitimacy and ownership. The third and final section delves into financing mechanisms, highlighting innovative approaches to overcoming funding challenges and scaling NBS. Together, these findings offer actionable insights into addressing systemic barriers and unlocking the full potential of NBS.

2.1. Knowledge and Capacity Building

Knowledge and capacity building play a vital role in the successful implementation of NBS. However, several barriers related to knowledge and capacity have been identified in the literature that hinder the full potential of NBS projects.

The Water Facility report[29] describes six specific barriers on knowledge and capacities related to NBS and green infrastructure:

1. Knowledge and data gap to advocate, justify and counter misinformation on NBS applications;
2. Lack of standardised guidelines on NBS to specify performance levels;
3. Inadequate cost-benefit analysis on NBS options;
4. Lack of knowledge for engineering companies and consultancies to design NBS solutions;
5. Poor understanding of procurement and tendering process;
6. Inadequate monitoring frameworks and indicators to measure NBS impact and sustainability.

Some of these barriers were also mentioned in the interviews, such as the lack of standardised guidelines and tools (MARA-MEDITERRA) and lack of specific knowledge and limited expertise in NBS (PHUSICOS). Also, additional barriers were identified, such as lack of interdisciplinary collaboration (PHUSICOS), limited capacity for knowledge

[29] Water Facility. (2024). Concept paper: Nature-based solutions for infrastructure development – Pathways to overcome barriers for upscaling the use of nature as infrastructure.

transfer (PHUSICOS, AQUACYCLE), insufficient training and capacity building (AQUACYCLE, MARA-MEDITERRA), limited access to information and resources (MARA-MEDITERRA), and limited capacity for long-term planning (MARA-MEDITERRA, Wayapa Wuurrk).

While a great amount of general knowledge on NBS exists, the lack of expertise and specific knowledge, especially on the local level, is a widespread issue in the NBS community. In the literature it is the most mentioned barrier, which limits the capacity to carry out successful NBS projects.[30] Especially, the limited understanding of the effectiveness of NBS and the benefits they can deliver has been described as a key barrier.[31] This can even be seen as one of the major hindrances to scaling investment in NBS for climate resilience. In addition, many project developers lack the necessary tools and knowledge – such as valuation techniques, assessment and evaluation tools, or knowledge of available funding mechanisms – to properly assess the value of NBS as alternatives or supplements to grey infrastructure.[32]

These findings are reflected in the interviews, according to which many stakeholders, including local municipalities, often **lack the necessary understanding of NBS concepts**, principles, and practices. This knowledge gap is intensified by the complexity of NBS projects, which require interdisciplinary approaches and involve multiple stakeholders. The consequences of this knowledge gap are far-reaching, including:

- Inadequate project planning and implementation, leading to reduced effectiveness and efficiency;
- Insufficient stakeholder engagement and participation, resulting in decreased ownership and increased opposition;
- Inability to navigate complex funding mechanisms and secure long-term financing;
- Limited capacity to adapt to changing environmental conditions and emerging challenges.

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[30] Linnerooth-Bayer, J., Scolobig, A., Aguilera Rodríguez, J., Fresolone-Caparrós, A. F, Olsen, S.G., Hoffstad Reutz, E., Martin, J. & Solheim, A. (2023). Tackling policy barriers to nature-based solutions. IIASA Policy Brief. Laxenburg, Austria: PB-39.

[31] Linnerooth-Bayer, J., Martin, J., Fresolone-Caparrós, A., Scolobig, A., Rodriguez, J.A., Solheim, A., Olsen, S.G. & Reutz, E.H. (2023). Learning from NBS implementation barriers. Deliverable 5.4 of the PHUSICOS project; Van Zanten, B. T., Gutierrez Goizueta, G., Brander, L. M., Gonzalez Reguero, B., Griffin, R., Macleod, K. K., Alves Beloqui, A. I., Midgley, A., Herrera Garcia, L. D. & Jongman, B. (2023). Assessing the benefits and costs of nature-based solutions for climate resilience: A guideline for project developers. World Bank. http://hdl.handle.net/10986/39811.

[32] Van Zanten, B. T., Gutierrez Goizueta, G., Brander, L. M., Gonzalez Reguero, B., Griffin, R., Macleod, K. K., Alves Beloqui, A. I., Midgley, A., Herrera Garcia, L. D. & Jongman, B. (2023). Assessing the benefits and costs of nature-based solutions for climate resilience: A guideline for project developers. World Bank. http://hdl.handle.net/10986/39811.

The implications of this knowledge gap are significant. If not addressed, they can lead to ineffective implementation and failure of NBS projects. This may also undermine public confidence and trust in the effectiveness of NBS as a strategy for addressing environmental challenges.

In the following sub-chapters, the report delves deeper into the need for the accessibility of knowledge, for leveraging existing networks and promoting knowledge exchange, and building local capacity and knowledge transfer. The below will present best practices and provide practical recommendations for overcoming the knowledge and capacity barrier in order to ensure the successful implementation and uptake of NBS projects.

2.1.1. The Need for Accessible Knowledge and Promoting Knowledge Exchange

Limited and fragmented knowledge can hinder the application of NBS, often preventing efficient implementation and limiting the replicability of successful projects. The interviews conducted reveal that, while knowledge about NBS is available, there are persistent challenges, namely the lack of standardised guidelines, and technical expertise, and the limited awareness on the multiple benefits of these solutions, as aforementioned. This chapter hence explores how the accessibility, dissemination and exchange of knowledge can mitigate the fragmentation of NBS knowledge to overcome this barrier.

➔ *Knowledge Barriers to NBS Implementation*

The discussions held with project managers and researchers reveal that while knowledge is well available, **the fragmentation of knowledge** about implementing, monitoring, and replicating NBS projects remains a barrier to scaling up these solutions effectively. Without **centralised, standardised, interoperable, and accessible information**, project managers, municipalities and practitioners must invest significant time and resources in finding or replicating knowledge that might already exist. This knowledge gap has the potential to particularly hinder smaller or more remote regions, with lesser access to knowledge – which is the case of local municipalities in Hungary and Tunisia, as stated in the interviews with the AQUACYCLE and NBS4Local projects.

Terminology inconsistency further exacerbates knowledge fragmentation and accessibility, particularly amongst stakeholders such as policymakers and practitioners**.** The multiplicity of terms including “ecosystem-based approaches” and “green infrastructure” leads to a lack of understanding of the NBS concept, creating confusion among stakeholders, and hence hindering the potential for upscaling. The MARA-

MEDITERRA project conducted a survey[33] targeted to local stakeholders in the localities of the project (in Algeria, Egypt, Greece, Turkey and Lebanon). From the 467 respondents, MARA-MEDITERRA found that less than 20% understood NBS concepts clearly. Although this is a barrier that must also be tackled at policy level, projects such as AQUACYCLE and NBS4local have aimed to address it by providing workshops to decision-makers on the concept of NBS. This demonstrates that centralising knowledge is not only about availability of resources but also about **establishing a common language**.

At the project implementation level, **the absence of standardised guidelines on NBS** spanning from technical assessments, regulatory compliance, performance indicators and monitoring practices remains an obstacle. Multiple projects, including PHUSICOS, SAND MOTOR and NbS4LOCAL, reveal that it complicates consistent application and hinders scalability. SAND MOTOR, for example, illustrates the challenges of working without established guidelines for large-scale sand nourishment and coastal management. Instead, the project opted for an adaptive management approach as it gathered necessary knowledge in real time.

Standardising guidelines and evaluation metrics could enhance cross-site comparison and build broader acceptance of NBS. One potential framework is the **International Union for Conservation of Nature's (IUCN) Global Standard for Nature-based Solutions**[34] which offers guidelines, indicators and criteria for designing, implementing, and monitoring NBS. Through its participation in the **ENACT partnership**, the EC has already committed to supporting this framework. ENACT which focuses on accelerating the adoption of NBS promotes cross-convention policy development and collaboration among governments and non-state actors.[35] The IUCN standardised framework can serve as a model providing transparency and establishing measurable metrics that other regions can adopt thereby improving global NBS scalability.

While the Water Facility report[36] highlights the considerable availability of knowledge on the benefits of NBS, the stakeholders interviewed pointed to the **limited awareness**

[33] Arampatzis, G. & Takavakoglou, V. (2023). SWOT analysis of local governance framework: WP5 policy recommendations and action plans (Deliverable 5.1). Edited by SWRI, with contributions from AMENHYD, DEU-DESUM, ECU, IRMCo, UL, UNIFI, and TENSOR. MARA-MEDITERRA Project, PRIMA Programme. Funded by the European Union.

[34] Cohen-Shacham, E., Andrade, A., Karangwa, C. & Maginnis, S. (2024). Proposing an IUCN Global Standard for Nature-Based Solutions: Main Operational Guidelines. International Union for Conservation of Nature. Retrieved from https://iucn.org/resources/information-brief/proposing-iucn-global-standard-nature-based-solutions-main-operational.

[35] IUCN. (2024). ENACT – Enhancing Nature-based Solutions. International Union for Conservation of Nature. Retrieved December 19, 2024, from https://iucn.org/our-work/topic/nature-based-solutions-climate/our-work/enact-enhancing-nature-based-solutions.

[36] Water Facility. (2024). Concept paper: Nature-based solutions for infrastructure development – Pathways to overcome barriers for upscaling the use of nature as infrastructure.

about the broader social, economic, and environmental advantages that NBS can offer. Often, the environmental benefits of NBS are recognised. However, projects such as WATERLANDS emphasised the need for greater awareness regarding ecosystem restoration's social and economic advantages as well as potential trade-offs. For instance, changes in agricultural practices may diminish land productivity in some cases.

Tellingly, PHUSICOS dedicated a project deliverable (Deliverable 5.4. Learning from NBS Implementation Barriers) to demonstrate that this lack of awareness undermines public support, as public and private decision-makers need to justify investments in NBS as an alternative to grey infrastructure.[37] In the case of SAND MOTOR, while its recreational and ecological benefits are significant - such as new habitats, development of tourism and leisure activities -, the early resistance from local communities highlighted a lack of understanding of the broader NBS benefits, and communication proved to be critical in building support for the project. Hence, **increasing the awareness of the multiple benefits of NBS through effective communication** proved essential to increase local acceptance and further incentivise private sector involvement.

➔ *Best Practices for Improving Knowledge Accessibility, Interoperability and Fostering Collaboration in NBS*

As previously noted, the fragmentation of knowledge about NBS presents significant challenges to its implementation and acceptance. Projects commonly advocate for **increased consistency and centralisation to improve knowledge accessibility**. However, the issue is more multifaceted than simply centralising information. The interviews revealed that **knowledge generation**, **exchange**, and **transfer** are each critical processes that need to be addressed in distinct but interconnected ways.

Centralisation of knowledge can play a key role in overcoming fragmentation by consolidating scattered information into accessible and organised repositories. This approach can reduce redundancy, promote efficiency, and ensure that valuable data is not lost or overlooked. Centralised knowledge systems can serve as a go-to source for best practices, research findings, and lessons learned from a wide range of NBS projects. For example, a global platform or database that collects case studies, scientific research, and technical guidelines has the potential to significantly improve accessibility for stakeholders seeking evidence-based solutions. Furthermore, centralisation can facilitate collaboration across regions and sectors by providing a common reference point for project teams, policymakers, and researchers.

[37] Linnerooth-Bayer, J., Martin, J., Fresolone-Caparrós, A., Scolobig, A., Rodriguez, J.A., Solheim, A., Olsen, S.G. & Reutz, E.H. (2023). Learning from NBS implementation barriers. Deliverable 5.4 of the PHUSICOS project.

That being said, the concept of centralisation is not without its limitations. Centralising knowledge requires considerable **resources for maintenance and updates**, and there are challenges in **ensuring that such systems remain relevant and responsive to evolving local contexts**. Additionally, as the project interviews showed, centralisation alone does not address all the complexities of NBS knowledge sharing. It is crucial to also consider the **interoperability** of different knowledge systems, ensuring that diverse platforms or tools can work together seamlessly, as well as **standardisation** to ensure consistency across projects. These factors are just as important for ensuring effective knowledge management and sharing.

It is as important to consider various phases linked to knowledge throughout the NBS project lifecycle:

- **Knowledge Generation** involves the creation of new insights or data through research, experimentation, or local observation. For example, projects such as SAND MOTOR conduct field studies on local coastal protection and ecosystem restoration, generating new data that can be valuable for similar initiatives elsewhere.
- **Knowledge Exchange** refers to the sharing of insights between various stakeholders, including researchers, practitioners, and local communities. Regional platforms or networks, such as those seen in projects like WATERLANDS, facilitate the exchange of successful NBS solutions for common challenges like flood management allowing stakeholders to learn from one another's experiences.
- **Knowledge Transfer** is the process of disseminating knowledge from one group or context to another, often through formal workshops or training. For instance, in the MERLIN project, knowledge on ecosystem services is transferred to local policymakers and practitioners to ensure effective implementation in diverse settings.

Hence, centralising knowledge is not the sole solution. The **interoperability** of different knowledge systems is equally crucial and ensures that diverse platforms or tools can work together seamlessly. For example, integrating various software systems that manage environmental data, as seen in the PHUSICOS project, can enhance collaboration and ensure that information flows effectively between stakeholders, project lifecycle phases, projects and entire regions.

Another challenge involves **standardisation** or the creation of uniform formats and protocols to ensure consistency across projects. Standardising reporting formats for NBS projects allows for better comparison and sharing of outcomes across different regions, as exemplified by platforms used by several NBS-focused initiatives.

However, these processes will only be successful if the knowledge remains **accessible**. This means ensuring that information is understandable and usable by a wide range of

stakeholders, including those with limited technical expertise. In practice, this could involve using non-technical language in reports or making knowledge repositories available in multiple languages to reach local communities.

The interviewed projects such as WaterLANDS, MERLIN, PHUSICOS, and SAND MOTOR showcased best practices that are replicable and mitigate the effects of knowledge fragmentation. These include forming **multidisciplinary teams** that integrate ecologists, hydrologists, policy experts, and social scientists to tackle the complex and interconnected challenges of NBS. For instance, the SAND MOTOR project employed a collaborative team from the Dutch Ministry, the Province of South Holland, Deltares, and multiple universities. Their combined expertise helped address various aspects of the project, from coastal protection and recreational space development to ecological benefits.[38]

In conclusion, while centralisation of knowledge is in itself a worthwhile goal when it comes to accelerating the implementation and scaling of NBS, it is equally clear that a combination of strategies - such as improving accessibility, interoperability, and standardisation - alongside fostering local and regional knowledge exchange, will be key to overcoming the barriers to NBS implementation.

➔ *Creation and Promotion of NBS Knowledge Hubs and Living Labs*

The projects MERLIN, MARA-MEDITERRA, WATERLANDS and SAND MOTOR have developed **Knowledge Hubs and Living Labs** as part of their strategies for centralising, disseminating and exchanging knowledge on NBS.

- **Knowledge Hubs** are centralised platforms that serve as "one-stop resources" designed to guide stakeholders through the process of implementing and monitoring NBS. They provide access to tools, guidelines, and case studies to support decision-makers and practitioners. For example, the *Nature-based Solutions Hub in the UK*, which was only launched in February 2024,[39] offers resources such as funding programmes, best practice guides, and case studies to help stakeholders specifically in the UK overcome barriers to scaling NBS projects, though it is stated on the hub website that “much of the guidance would also be applicable in other locations.”[40] Similarly, **NetworkNature**, an initiative funded by Horizon Europe to facilitate

[38] EcoShape. (2017). Sand Motor: Science and international opportunities take centre stage at NatureCoast Symposium. Retrieved from https://www.ecoshape.org/en/sand-motor-science-international-opportunities-centre-stage-naturecoast-symposium/.
[39] Nature-based Solutions Initiative. (2024, February 29). Collaboration for Nature: Launch of UK NbS Knowledge Hub. Retrieved from https://www.naturebasedsolutionsinitiative.org/news/nbs-knowledge-hub.
[40] Nature-based Solutions Initiative. (n.d.). UK NBS Knowledge Hub. Retrieved December 19, 2024, from https://nbshub.naturebasedsolutionsinitiative.org/.

exchange of insights, best practices, and capacity building across Europe, is supporting its members in establishing local and regional hubs.

- A **Living Lab** is an innovation ecosystem that uses real-life settings for co-creation and testing. It involves end-users, researchers, public and private sectors working together to address local challenges and develop sustainable solutions. Originating in digital technology the approach has since expanded to fields like sustainable energy and landscape planning. The core goal is to foster participation and collaboration with end-users shaping the solutions themselves. Typically, Living Labs follow a stepwise process involving problem identification, solution development, testing, and evaluation, to ensure effectiveness and relevance in the community.[41] The MARA-MEDITERRA project, for instance, used a Living Lab approach to engage stakeholders in the Mediterranean region to co-design and implement NBS projects for sustainable water management.[42] Due to the initial pilot nature of the SAND MOTOR project, it was conceived as and established as a Living Lab - "a unique laboratory for coastline maintenance"[43], enabling real-time learning for researchers and practitioners to adjust and refine their methods. In addition, the project collaborated with Delft and Utrecht Universities to study the various aspects of the SAND MOTOR's impact. It established research programmes with doctorate and post-doctorate researchers, such as NatureCoast and NeMo (Nearshore Monitoring and Modelling) which allow for comprehensive research and knowledge sharing on the project.

Both concepts ensure that NBS knowledge is accessible and continuously updated, benefiting both local stakeholders and the scientific community.

In addition, there are also research projects such as NATURVATION, offering resources for NBS implementation, which contribute to the accessibility of knowledge. The MERLIN project developed the **MERLIN Academy**, with the aim of creating an informative environment to facilitate knowledge sharing and capacity building, providing users with tools to advance their understanding of freshwater ecosystem and wetland restoration, as well as of NBS. The resources include learning modules, webinars, and podcasts. The Academy also includes a "Knowledge Centre" containing a collection of resources such as scientific publications, manuals, and guidance documents. In addition, it provides links to datasets, tools and websites relating to planning, implementation, and financing of NBS.

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[41] Lupp, G., Zingraff-Hamed, A., Huang, J. J., Oen, A. & Pauleit, S. (2021). Living Labs-A concept for co-designing nature-based solutions. Sustainability, 13(1), 188. https://doi.org/10.3390/su13010188.

[42] Yahya, F., El Samrani, A., Khalil, M., Abdin, A. E.-D., El-Kholy, R., Embaby, M., Negm, M., De Ketelaere, D., Spiteri, A., Pana, E. & Takavakoglou, V. (2023). Decentralized wetland-aquaponics addressing environmental degradation and food security challenges in disadvantaged rural areas: A nature-based solution driven by Mediterranean living labs. Sustainability, 15(20), 15024. https://doi.org/10.3390/su152015024.

[43] Taal, M. D., Löffler, M. A. M., Vertegaal, C. T. M., Wijsman, J. W. M., Van der Valk, L. & Tonnon, P. K. (2016). Brochure: Development of the Sand Motor. Deltares.

Furthermore, the project offers the **MERLIN Marketplace**, a website that connects suppliers and users of solutions, listing products and services for freshwater ecosystem restoration.

The WATERLANDS project, in turn, identified 15 “Knowledge Sites” which represent areas where successful restoration work has been completed. These sites facilitate the exchange of lessons and strategies that can be applied to current and future wetland restoration projects. At the same time, WATERLANDS provided tailored financial solutions and resources for several “Action Sites” functioning as best practice examples of restoration.

➔ *Participation in Project and Knowledge Networks*

Participation in project and knowledge networks is a valuable avenue for knowledge exchange and collaborative capacity building. Several of the projects assessed, including WATERLANDS, MERLIN and PHUSICOS, are connected through networks such as the aforementioned **NetworkNature**. The initiative enables dialogue and cooperation through “Thematic Task Forces”, which produce outputs like publications, tools, and workshops. By collaborating through this network, projects can reduce overlap and combine their expertise in new projects. As a result, NetworkNature not only fosters cooperation, but also serves as a reliable platform for disseminating knowledge.

Meanwhile, MERLIN and REST-COAST are “sister projects”, participating in collaborating under the **EU Green Deal Call 7.1 Cluster**, which focuses on ecosystem restoration and biodiversity across various landscapes. This collaboration facilitates exchanges on shared goals, methodologies, and particularly on finance, governance, and stakeholder engagement. It also allows for on-site collaboration, with the example of WATERLANDS and REST-COAST collaborating in the Ems-Dollard Estuary in the Netherlands, and at the Venice Lagoon; and of WATERLANDS and MERLIN cooperating in sites at the Danube River. The Cluster also provided scientific support and knowledge for the proposed EU Nature Restoration Law at the time of its negotiation, informing policy development. Lastly, the participation by AQUACYCLE in another project’s best practice database - the NCQ Best Practices Inventory by the MEDWAYCAP project, which focuses on knowledge dissemination and upscaling - is an example of another opportunity for cross-project collaboration and best practices sharing.

2.1.2. Building Local Capacity and Knowledge Transfer

NBS require the involvement and collaboration of various stakeholders, including local communities, governments, and technical experts. However, the planning and implementation of NBS can be hindered by inadequate capacity and knowledge transfer. The need for knowledge and capacity development is reflected in the Water Facility

report[44], and similarly, the interviews highlighted the importance of building local capacity and knowledge transfer, with many respondents emphasising the need for more effective training and support for local stakeholders.

➔ *Barriers to Building Local Capacity and Knowledge Transfer*

Based on the interviews and literature review, several challenges were identified which impede the effective building of local capacity and knowledge transfer. One major issue is the lack of technical understanding and expertise in NBS among local authorities and technical experts. This is partly due to the limited availability of hands-on training and workshops, as highlighted in the MARA-MEDITERRA case study.

Furthermore, as discussed in the previous section, the lack of consistent terminology and guidelines on NBS creates confusion among stakeholders leading to a lack of understanding of the NBS concept. This issue is exacerbated by the dispersed nature of NBS knowledge making it difficult for local communities to access relevant information.

Another issue is the lack of knowledge exchange between local communities and external experts. This can lead to a reliance on external expertise, undermining local ownership and decision-making which can also result in a lack of sustainability and long-term viability of NBS projects. The ENACT Partnership[45] emphasises in their NBS discussion paper[46] the importance of leveraging local knowledge, particularly that held by Indigenous Peoples, and local communities, to ensure that NBS projects are tailored to local contexts and needs.

The implications of limited local capacity and knowledge transfer are far-reaching. Without adequate capacity and knowledge NBS projects are more likely to fail. Possible negative consequences include inefficient use of resources since projects may duplicate efforts or waste resources on redundant activities, or limited scalability.

Various possible solutions and best practices were identified to address the challenge of limited local capacity and knowledge transfer: capacity building programmes, hands-on training and workshops, and stakeholder engagement and cooperation.

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[44] Water Facility. (2024). Concept paper: Nature-based solutions for infrastructure development – Pathways to overcome barriers for upscaling the use of nature as infrastructure.
[45] Enhancing Nature-based Solutions for Accelerated Climate Transformation (ENACT) Partnership, launched at COP27 by the Egyptian COP Presidency in collaboration with the Government of Germany and IUCN. IUCN hosts ENACT's Secretariat, which leads the implementation of the Partnership.
[46] Bertram, M. & Griswold, D. (2024). ENACT 2024: Nature-based solutions discussion paper. International Union for Conservation of Nature (IUCN).

➔ *Development of Targeted Capacity Building Programmes*

Effective capacity building is vital for the successful adoption and implementation of NBS. This involves equipping individuals, organisations, and communities with the necessary knowledge, skills, and resources to adopt and sustain NBS. As a few interviewees pointed out, local municipalities, in particular, require training and support to navigate complex projects and funding mechanisms. This includes providing frameworks and tools for selecting and implementing the right NBS.[47]

The NATURVATION project emphasises the importance of having a "champion" to drive NBS projects forward and ensure they remain aligned with local needs. In this context, a champion can be seen as a key individual or entity that provides leadership, advocacy, and access to resources, facilitating the success and legitimacy of the project. To address these needs, targeted capacity building programmes should be developed for local authorities.

When local communities and stakeholders are adequately equipped with the right skills and knowledge, they can actively engage in planning, implementing, and maintaining NBS projects. Moreover, adequate capacity building and transfer of knowledge ensures that the NBS projects are sustainable, context-specific, and widely accepted.

➔ *Implementing Hands-On Training and Workshops*

To ensure the long-term success of NBS, it is essential to develop the technical competence of local stakeholders to operate and maintain NBS infrastructure. This requires an adaptive management approach that empowers individuals and organisations to cope with new ways of working or thinking. Hands-on training and workshops can facilitate this transition. Especially training in change resilience, leadership, and communication skills should be provided. Allocating human and financial resources, such as funding and supporting structures, is necessary to support the uptake process and institutionalising these resources through integration into existing systems, policies, and practices that can help ensure their sustainability.[48]

As mentioned in the previous section, the MERLIN Academy developed educational modules to train local actors in the steps required for large-scale freshwater restoration. This programme not only addressed technical skills but also fostered understanding of the broader ecological impacts allowing communities to actively participate in restoration efforts. Similarly, the AQUACYCLE project in Tunisia provided training to municipal workers and local farmers on wastewater reuse in agriculture aiming to overcome resistance by building local expertise and trust in innovative water management

[47] Catalano, C., Campiotti, A. & Baldacchini, C. (2024). Report: Possible ways to foster the uptake Nature-based Solutions. Biodiversa.
[48] Ibid.

approaches. The project's targeted workshops were instrumental in equipping local decision-makers with knowledge on NBS, ultimately promoting community acceptance and skilful project management.

The PHUSICOS project established a training programme and used workshops, living labs, and stakeholder involvement to facilitate the exchange of knowledge between local stakeholders, contractors, and end-users. The MARA-MEDITERRA project provided targeted training for local authorities and technical experts. This enabled them to develop a deeper understanding of NBS concepts and principles, empowering them to drive NBS projects forward. These approaches can help build trust and reduce uncertainty, as demonstrated by the REST-COAST project's use of pilots to demonstrate the efficacy of NBS.

The WATERLANDS project also highlighted the importance of stakeholder mapping and training programmes. Facilitators guided community stakeholders in mapping local challenges and planning adaptive measures, allowing them to understand and manage NBS interventions over multiple years. Through co-creation and hands-on workshops, WATERLANDS empowered communities to take leadership roles, ensuring resilience and continuity in NBS management.

2.2. Governance and Stakeholder Engagement

For the purpose of this report, "governance" in NBS projects refers to the structures and processes that direct how decisions are made regarding people and nature impacting project success or failure. Furthermore, a key component of governance is engagement of varied stakeholders. If inclusive and collaborative, the right governance model can support decision-making for every stakeholder involved to deliver multi-benefit outcomes for nature and people fostering long-term environmental and socio-economic benefits.[49] Building local capacity and knowledge, as discussed in the previous chapter, plays a crucial role in informing and strengthening governance frameworks ensuring that the needs and perspectives of all stakeholders are considered throughout the decision-making process.

[49] Nature-based Solutions Initiative. (2024). Governance. Nature-based Solutions Knowledge Hub. University of Oxford. Retrieved December 6, 2024, from https://nbshub.naturebasedsolutionsinitiative.org/governance/; Battisti, L., Cuomo, F. & Manganelli, A. (2024). Collaborative governance arrangements: what makes nature-based solutions endure? Territory, Politics, Governance, 1–21. https://doi.org/10.1080/21622671.2024.2355317; Sekulova, F. & Anguelovski, I. (2017). The governance and politics of nature-based solutions (Deliverable 1.3: Part VII). NATURVATION project. Retrieved from https://naturvation.eu/sites/default/files/news/files/naturvation_the_governance_and_politics_of_nature-based_solutions.pdf.

It is possible to categorise various governance models by the predominant actors driving NBS initiatives whether public authorities, private entities, civil society, academia, or grassroots movements. Purely public or private governance examples are rare; instead, **most NBS projects involve a blend of actors, with possibly one taking a primary role**.

If not taken seriously, governance and stakeholder engagement challenges have the potential to affect project timelines, community trust and long-term sustainability. Concretely, unresolved issues in these areas can lead to limited community buy-in, delays, financial losses as well as missed opportunities for integrating diverse, beneficial perspectives, including Indigenous Peoples', and local communities' knowledge.

The below table lists relevant barriers identified in the Water Facility Report.[50]

Governance barriers	**Stakeholder engagement barriers**
Limited acceptance and mainstreaming of NBS	Knowledge gaps among engineering firms and consultants
Lack of tracking of NBS type investments in international development cooperation	Absence of standard guidelines for NBS
Lack of political willingness in countries	Need for local adaptation and community inclusion
Bottlenecks at the EU level for action in partner countries on NBS	Challenges in multi-sectoral coordination
Regulatory gaps within countries	
Ambiguous legal status to enable initiatives for long-term land use for NBS	

The following aims to highlight solutions to the above-listed challenges from the interviews and projects examined as part of this project. Note that aspects related to knowledge and capacity of stakeholders as well as financing of projects are treated in separate chapters.

2.2.1. Governance

Implementing and scaling NBS projects involve a complex set of governance-related challenges. These projects typically require substantial upfront investment, long-term planning, and extensive cross-sectoral coordination, often at large scales, such as city-wide or landscape levels. Traditional governance structures are often insufficient for addressing these demands. Furthermore, the governance challenges for NBS projects span multiple levels, from international financing and regulatory frameworks to local policy integration and cross-sectoral coordination. Addressing these barriers is essential to support NBS initiatives and ensure their scalability and sustainability.

[50] Water Facility. (2024). Concept Paper: Nature-based Solutions for Infrastructure development – Pathways to overcome barriers for upscaling the use of nature as infrastructure.

➔ *Regulatory Incentives*

A key challenge facing NBS is variable **political commitment**. Interviews with stakeholders in REST-COAST and MARA-MEDITERRA underscored how national and regional policies tend to favour traditional grey infrastructure, leaving NBS as a secondary consideration. Political will is often shaped by competing agendas. In some regions, the push for economic growth, poverty alleviation, and short-term gains eclipses support for green initiatives. This tendency is especially noticeable in lower-income contexts, where NBS is sometimes viewed as a lower priority compared to immediate socio-economic needs. However, it is important to note that there is no inherent trade-off between socio-economic development and NBS as demonstrated in the Introduction Chapter.

A promising approach to build political support is to **align NBS with broader socio-economic and development goals**. As seen in WATERLANDS or MARA-MEDITERRA, engaging local policymakers early on, sometimes years in advance of project implementation, and framing NBS as part of sustainable development and economic resilience, can build a more substantial and enduring political commitment or alliance. By linking NBS to national development goals and the SDGs, policymakers can better appreciate NBS's socio-economic benefits, promoting its integration into broader policy frameworks.

A powerful example of a conducive regulatory environment is provided by the case of **the Netherlands**. For both, the SAND MOTOR and REST-COAST projects, which are being implemented at the Dutch coast, the policy framework proved an enabler for the project implementation. The Dutch Water Act, National Water Plan (NWP), and National Policy Strategy for Infrastructure and Spatial Planning (SVIR) are worth mentioning in this regard.[51] These frameworks prioritise maintaining coastal safety, promoting soft solutions like sand nourishment over hard infrastructure, and fostering adaptive measures to cope with sea-level rise. The NWP specifically supports maintaining sediment stocks and sand nourishment making it instrumental in justifying the SAND MOTOR's large-scale, NBS approach to coastal reinforcement.

The same can be said of the REST-COAST Wadden Sea project. For well over a decade, significant efforts have been directed towards the coastal development and protection of the province of Groningen. A new strategy for coastal protection was developed focusing on NBS as an alternative to traditional methods that rely heavily on asphalt, concrete, and hard infrastructure. Interviews with the project managers made it clear that several factors aligned to create a "perfect storm" in favour of the project's advancement. Specifically, it was noted that the Netherlands undergoes major dike reinforcement planning every fifty

[51] Rijkswaterstaat. (2024). Legal policy framework. Noordzeeloket. Retrieved December 6, 2024, from https://www.noordzeeloket.nl/en/policy/policy-framework/legal/.

years and with the current cycle up for review, it was imperative to act. This **long-term planning horizon is crucial for securing the necessary investments and political will** to realise NBS projects.

Nonetheless, both projects also encountered regulatory challenges mostly pertaining to **Natura 2000** areas. Natura 2000 regulations are primarily protective and do not adequately account for positive developments such as the creation of new habitats. The Natura 2000 framework mainly focuses on protecting existing habitats and species, often emphasising restrictions to prevent degradation. While this is vital for conservation, it leaves limited room for addressing or incentivising positive ecological developments, such as creating new habitats or enhancing biodiversity.

More concretely, one issue is that Natura 2000's regulatory provisions, particularly under Article 6 of the Habitats Directive, **emphasise preventing deterioration and mitigating adverse impacts but do not explicitly facilitate the integration of proactive habitat creation or restoration into development planning**. This can lead to delays or conflicts in implementing innovative projects that aim to enhance biodiversity but still require extensive permitting and environmental impact assessment processes. For example, projects creating new habitats as part of NBS might face hurdles due to the focus on avoiding impacts rather than enabling net ecological gains. Additionally, developers and stakeholders may struggle with administrative burdens because the framework was originally designed to safeguard existing natural values, not necessarily to account for dynamic landscape changes or new habitats introduced outside designated Natura 2000 sites. The complexity of these assessments can discourage projects that could align with conservation goals but require reinterpretation of current rules.[52][53]

Interviewees emphasised the need for a shift in **thinking that recognises the value of ecosystem connectivity and dynamic habitat development**. For instance, the SAND MOTOR project managers emphasised the need for "**flexibility clauses**" within Natura 2000 and similar regulations. These clauses would allow NBS to demonstrate their potential to enhance biodiversity over time, even if they initially deviate from traditional conservation measures. For example, temporary disturbance of a protected area (e.g., sediment deposition) might be permissible if evidence shows it will lead to long-term improvements in ecosystem health, such as increased species diversity or habitat resilience. An example of a flexibility clause would be *Article 6(4)* of the Habitats Directive (92/43/EEC), which permits projects to proceed in Natura 2000 areas despite potential

[52] European Commission. (2021). Natura 2000: Protecting Europe's biodiversity. Retrieved from https://ec.europa.eu/environment/nature/natura2000/.
[53] Lomba, A., Pellissier, L., Randin, C., Vicente, J., Moreira, F., Honrado, J. & Araújo, M. B. (2019). Challenges for Natura 2000 sites in a changing climate: Lessons from the continental, Mediterranean, and Atlantic biogeographical regions. Journal of Environmental Management, 232, 58–66. https://doi.org/10.1016/j.jenvman.2018.11.030.

adverse effects, provided there are overriding public interests, no feasible alternatives, and appropriate compensatory measures to ensure the coherence of the Natura 2000 network. Such derogations and compensatory measures are already applied in practice for the development of offshore wind farms which have been permitted under these clauses when paired with compensatory actions like creating new habitats or improving existing ones to offset potential impacts.[54] This kind of flexibility could be adapted to allow innovative, time-sensitive projects and others like the SAND MOTOR to prove their biodiversity benefits while complying with conservation goals.

Another important aspect that was repeatedly mentioned in the interviews as fundamental to implementing large-scale NBS is the matter of **land tenure**, yet many regions face unclear land rights and tenure issues, especially as urbanisation and agricultural pressures grow. The REST-COAST and MARA-MEDITERRA projects both encountered land-use conflicts, often due to ambiguities over ownership and competing interests among stakeholders. As REST-COAST stakeholders observed, uncertainty over land tenure delayed the project advancement and led to disputes, complicating implementation, and creating additional financial risks.

In this regard, the importance of **establishing clear legal frameworks to support land-based partnerships** is evident. Policies that facilitate **public-private land partnerships** could improve accessibility for NBS initiatives. Establishing a **clear and consistent policy framework within the EU - one that clarifies definitions, roles, and objectives for NBS** – was highlighted in interviews as a key factor in reducing project delays and fostering scalability. For example, the MARA-MEDITERRA project demonstrated the value of **integrating NBS terminology and eco-schemes in the EU's Common Agricultural Policy (CAP),** promoting alignment and coherence across agricultural initiatives. **Enhancing cross-ministry collaboration - particularly between environmental, agricultural, and urban planning authorities** - was also cited as a method to create cohesive land-use policies that support NBS.

However, it is important to recognise that the prevailing approach within EU policymaking emphasises mainstreaming NBS across sector-specific legislation and policies rather than creating a standalone policy for NBS. Given the diverse applications for NBS - from flood mitigation to urban heat reduction - this integration into relevant directives, such as the Floods Directive and urban greening plans, ensures tailored, context-specific implementation. Combining these perspectives underscores the need for both

[54] European Commission (2024). Managing and protecting Natura 2000 sites. https://environment.ec.europa.eu/topics/nature-and-biodiversity/natura-2000/managing-and-protecting-natura-2000-sites_en.

standardised definitions to enhance alignment and sectoral integration to address the diverse scope of NBS effectively.

Beyond the national and local contexts, **aligning NBS with existing global frameworks** is essential to enhance impact and create a unified approach to NBS adoption. This includes leveraging synergies across EU policies, such as the European Green Deal, Climate Adaptation Strategy, and the Convention on Biological Diversity's Global Biodiversity Framework, to reinforce NBS on a global scale. This alignment facilitates **international dialogue, shared standards, and potentially co-funded projects** that advance global environmental goals. An additional benefit of this is that NBS projects can gain coherence and visibility, which are crucial for scaling, as well as participation in international standards development and collaborative projects, as demonstrated by REST-COAST, SAND MOTOR and WATERLANDS, all of which benefitted from cross-border cooperation. Take the example of the SAND MOTOR: Today, the Sand Motor is no longer a pilot project, and the challenge is now to mainstream its proven approaches into policy. This is why the project is now part of the EU co-funded INTERREG North Sea Programme project MAinstreaming NAture BAsed Solutions through COASTal systems (MANABAS COAST).[55] MANABAS COAST aims to develop an accessible and evidence-based framework for widescale implementation of NBS in coastal areas, based on experiences made in several partner projects, including the SAND MOTOR.

➔ *Adaptive Governance*

Following from the above, in the implementation of NBS, **adaptive and flexible governance frameworks** play a critical role by enabling iterative feedback and regular adjustments in response to evolving needs and monitoring outcomes. These frameworks facilitate collaboration, allow stakeholders to respond effectively to evolving conditions, and help align the interests of various parties by incorporating ongoing monitoring, stakeholder engagement, and feedback mechanisms to adjust project activities as needed. In NBS, where ecosystems and socio-political landscapes are dynamic, such flexibility is essential for maintaining ecological integrity while addressing stakeholder concerns.

The SAND MOTOR project exemplifies a governance model that integrates **interactive feedback through structured monitoring and stakeholder engagement**. The project's governance framework included a **multi-tiered steering group that met semi-annually to evaluate ecological, social, and recreational outcomes based on continuous data collection**. This approach allowed stakeholders to address issues promptly, such as balancing dune preservation with increasing demands from recreational activities like

[55] Interreg North Sea Region. (2024). MANABAS COAST. Retrieved December 6, 2024, from https://www.interregnorthsea.eu/manabas-coast.

kitesurfing. Furthermore, partnerships with academic institutions like Delft and Utrecht University as well as the knowledge institute Deltares enabled informed decision-making, ensuring that any interventions were backed by scientific data. This model underscores the advantage of adaptive frameworks in reconciling diverse stakeholder interests while maintaining project goals.

In the WATERLANDS project, community engagement was prioritised through **"deliberation sessions," where stakeholders collaborated to tailor NBS to local needs**. These sessions, which took place over two to three years, provided a platform for **iterative feedback, helping to integrate local values with ecological goals**. By involving skilled facilitators, WATERLANDS fostered **co-creation and empowered community members** to shape the project according to evolving social and environmental conditions. This approach demonstrates the effectiveness of adaptive governance in building local support and ensuring that NBS reflects both ecological and socio-economic needs.

REST-COAST, which aimed to implement NBS in Natura 2000-protected areas, faced challenges with restrictive regulations that typically limit NBS flexibility, as explained above. The project team navigated these restrictions by advocating for regulatory reforms to permit ecosystem enhancements within protected zones, **adjusting the regulatory framework to align with the principles of adaptive governance**. Furthermore, **regular meetings and pilot projects provided continuous feedback**, gradually shifting stakeholder attitudes from a reliance on grey infrastructure to embracing NBS.

The PHUSICOS project leveraged a **bottom-up approach, engaging local stakeholders early** to build a sense of ownership and commitment to NBS interventions. A steering committee was responsible for mapping and coordinating stakeholders which allowed the project to adapt NBS interventions to regional contexts. This model facilitated a flexible approach to zoning restrictions in areas with high biodiversity priorities enabling the project to meet regulatory requirements without compromising on NBS goals. The PHUSICOS example shows how adaptive frameworks that prioritise local engagement can overcome regulatory and ecological challenges by making early adjustments to project designs.

These examples illustrate that adaptive frameworks can also be a powerful tool to strengthen the **inclusivity** of NBS projects by integrating diverse stakeholders throughout the project lifecycle. This inclusivity is not only valuable for gaining local support but also fosters long-term commitment and resilience by addressing potential conflicts early and adapting the project accordingly.

As mentioned above, political changes and inconsistent policy support can destabilise NBS projects, particularly in certain countries, where frequent government shifts may have contributed to short-term thinking. This political volatility undermines the continuity

of NBS efforts and complicates long-term planning and funding for projects. To address this, some projects, for instance, SAND MOTOR, rely on **formalised governance agreements, to provide continuity across political cycles and clearly define stakeholder roles and responsibilities**. This can significantly contribute to reducing conflicts and enhancing accountability among stakeholders involved.

One such example are Belgium's **Blue Deal** Action Plan and respective agreements. The "Blue Deal" in Belgium refers to an initiative launched in 2020 led by the Flemish government aimed at tackling water scarcity and drought.[56] This comprehensive programme combines various measures to enhance water management, ecological restoration, and resilience to extreme weather events. Key elements include **financial incentives** for water-saving projects, improving groundwater levels, and investments in flood and drought prevention measures. Funding is available for local authorities, industries, agricultural sectors, and research institutes. Blue Deal projects are financed through the European Recovery Plan's Facility for Recovery and Resilience and the Flemish Recovery Plan "Flemish Resilience." For financing, € 75 million was allocated for the first year, with an additional € 343 million to increase resilience post-COVID 19. In Flanders, the Blue Deal funding is provided through various **project calls and subsidy channels**.[57] One component of the Blue Deal involves promoting sustainable water use through ecological restoration projects, infrastructure improvements, and technologies like controlled drainage systems. Starting in 2024, **municipalities must have a rainwater and drought plan aligned with the Blue Deal's goals to be eligible for water-related subsidies**. This approach encourages municipalities to proactively manage water challenges and contribute to the Blue Deal's environmental objectives.[58]

These efforts aim to ensure long-term sustainability in water resources management while addressing the increasing risks posed by climate change. The **Blue Deal decree** was passed in the Flemish Parliament on 29 February 2024. This legislative step ensures the long-term continuation of investments in climate resilience, particularly focusing on water retention and the fight against droughts and floods. The decree guarantees that future Flemish governments will be required to **draft a new Blue Deal with specific**

[56] De Potter, B. (Publisher). (2024, January 25). Blue Deal – Drie Luiken [PDF]. EU Water Conference, March 12, 2024. Flanders Environmental Agency. https://en.vmm.be/events/presentations/eu-waterconference-march-12th-2024/2024-01-25_bluedeal_drieluika4-lr.pdf.
[57] Blue Deal. (2024). *About Blue Deal*. Integraal Waterbeheer. Retrieved December 19, 2024, from https://bluedeal.integraalwaterbeleid.be/about-blue-deal.
[58] Interlace Hub. (2024). Blue Deal Flanders. Retrieved December 19, 2024, from https://interlace-hub.com/blue-deal-flanders.

objectives and investments within a year of taking office. **This formalises the commitment to tackling water scarcity and flood risks in Flanders**.[59]

At its core, the Blue Deal initiative allows for the establishment of **collaborative frameworks** for improving water resilience and addressing drought risk. These **agreements, tailored to specific sectors** such as agriculture, industry, and municipalities, **outline commitments and actions for each participant**. By fostering partnerships and aligning objectives under **a clear yet adaptable framework**, the Blue Deal enables stakeholders to co-create solutions while ensuring that NBS are implemented effectively. This approach minimises the risk of misalignment, particularly in regions where competing interests could otherwise hinder sustainable water management.[60]

➔ *Inclusive, Poly-Centric Governance*

Inclusive governance models for NBS are increasingly recognised for their role in fostering collaboration, resilience, and adaptability across complex environmental projects. In contrast to traditional centralised governance models, inclusive approaches often employ **polycentric and co-governance structures that actively engage multiple stakeholders**, including local governments, civil society organisations, private sector entities, and local communities. These models aim to **harness diverse perspectives, share decision-making power, and ensure that the implementation of NBS aligns with the needs and values of various actors, particularly those at the local level**.[61]

For example, one interviewee referred to the Isar River restoration project in Munich which exemplifies the success of polycentric governance. By engaging city planners, local authorities, and civil society groups in the planning and implementation process, the project fostered trust and ensured that diverse stakeholder perspectives were integrated into decision-making. This collaborative approach was instrumental in addressing the complex challenges of river restoration, including maintaining ecological health while enhancing recreational spaces for the community.

Polycentric governance structures, which involve **multiple, overlapping centres of decision-making, provide flexibility and adaptability critical to NBS**. By distributing

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[59] Walker, L. (2024, February 29). The Blue Deal: A new tool in Flanders to fight drought and floods. The Brussels Times. https://www.brusselstimes.com/945403/the-blue-deal-a-new-tool-in-flanders-to-fight-drought-and-floods.

[60] European Environment Agency. (n.d.). (2024). The Blue Deal: A mission story. Climate-ADAPT. Retrieved November 23, 2024, from https://climate-adapt.eea.europa.eu/en/mission/solutions/mission-stories/the-blue-deal-mission-story12.

[61] European Commission. Directorate-General for Research and Innovation. (2023). Guidelines for co-creation and co-governance of nature-based solutions: Insights from EU-funded projects (Publication No. KI-05-23-300-EN-N). Publications Office of the European Union. https://doi.org/10.2777/157060.

authority across different actors and levels, these structures **enable localised responses to environmental challenges, promote innovation, and enhance resilience**. In particular, **co-governance** - where diverse stakeholders collaborate in shared decision-making - empowers local actors and builds ownership which is essential for the sustainability of NBS interventions.[62]

For instance, the REST-COAST project demonstrated the effectiveness of a "**coalition of the willing**," a co-governance structure that brought together non-governmental organisations (NGOs), local communities, and government bodies to align diverse objectives. Through shared governance, these stakeholders established a unified approach to managing coastal and marine resources, ensuring that NBS efforts were tailored to meet both environmental and social needs. It is worth noting that other key tenets of the project also contribute to ensuring continuous and positive engagement with the "non-willing". The REST-COAST project emphasises collaboration between NGOs, local communities and government bodies, and utilised several strategies to convince stakeholders of their cause, including direct engagement (i.e., one-on-one conversations with sceptical farmers, see also Chapter 1.2.2. on stakeholder engagement) to clarify misconceptions and build trust, showcasing the long-term benefits as well as building shared understanding through co-governance and frequent dialogue to better understand and address stakeholders' specific needs and concerns.

The SAND MOTOR project also used collaborative, poly-centric approaches, including **knowledge-sharing workshops and monitoring and data-sharing, to engage stakeholders** and ensure successful project implementation. The main purpose of these workshops was to familiarise the local community with the project's goals and its experimental nature. For example, **during the construction phase, regular management and user meetings** were organised to inform the stakeholders. To ensure swimmer and beach safety, the lifeguards were closely involved. **Feedback from these sessions** had a direct impact on safety measures, such as improved signage and the presence of a lifeguard at certain sections of the SAND MOTOR and times. **Continuous community engagement and public updates** helped build broader support over time, and safety apps for visitors became a unique way to integrate local input into daily management practices. This inclusive approach helped the SAND MOTOR achieve a balance between innovation in coastal management, environmental stewardship, and community value.

Nonetheless, the complexity of coordinating multiple stakeholders with varying interests, capacities, and knowledge of NBS can also present an obstacle to project success. The

[62] European Commission. Directorate-General for Research and Innovation. (2023). Guidelines for co-creation and co-governance of nature-based solutions: Insights from EU-funded projects (Publication No. KI-05-23-300-EN-N). Publications Office of the European Union. https://doi.org/10.2777/157060.

Hungarian NBS4LOCAL project highlighted this issue. In an interview with the responsible Hungarian Ministry, it was noted that in particular local governments often lack the resources and expertise to manage complex, multi-stakeholder projects. This can also make upscaling the approach costly and unfeasible. Therefore, national authorities' **facilitative role** is critical, and a more centralised governance structure may often be more realistic, particularly from the perspective of local authorities.

2.2.2. Stakeholder Engagement

For any NBS project, **stakeholder engagement** represents a critical challenge – no matter the envisioned governance structure or model. NBS projects are unique in their need for **diverse stakeholder cooperation across public, private, and community spheres**. Furthermore, effective NBS implementation requires not only **scientific and technical input but also a nuanced understanding of local conditions, cultural contexts, and socio-economic factors**. Additionally, conventional engagement models often fail to bridge cultural divides, knowledge disparities, and competing interests among stakeholders. Addressing these gaps is essential to building trust, fostering collaboration, and enhancing project success.

➔ *Early and Continuous Participatory Involvement of Stakeholders*

Early and sustained involvement of stakeholders is fundamental to fostering ownership and commitment in NBS projects. **Engaging stakeholders from the planning stage** helps to align project goals with community values, encouraging shared responsibility and long-term support.

For the MARA-MEDITERRA project, one of the first project deliverables consisted of a **stakeholder mapping** and a strengths, weaknesses, threats and opportunities (SWOT) analysis which formed the basis of the project's emphasis on **participatory decision-making**. The MARA-MEDITERRA project used the SWOT analysis to assess governance challenges impacting the adoption of NBS across its five Mediterranean target countries: Algeria, Egypt, Greece, Lebanon, and Turkey. The analysis combined environmental governance reviews, stakeholder surveys with over 460 responses and insights from interviews with policymakers and local actors. These efforts highlighted key governance strengths and barriers, revealing possible pathways for aligning stakeholder perspectives with policy recommendations to improve NBS mainstreaming and address societal challenges in rural areas.[63]

Furthermore, the project employed a **consultative process involving workshops and roundtable discussions in the project's design phase**. This allowed diverse

[63] MARA-MEDITERRA Consortium. (2023). SWOT analysis of local governance framework (Deliverable 5.1, WP5 Policy Recommendations and Action Plans). Edited by SWRI, with contributions from AMENHYD, DEU-DESUM, ECU, IRMCo, UL, UNIFI, and TENSOR.

stakeholders, including local authorities, NGOs, and community members, to contribute to the project's proposal, addressing local concerns while promoting sustainable practices. **Continued, regular engagement** helped stakeholders see the project as a mutual endeavour, ultimately leading to greater community buy-in and participation. Similarly, the SAND MOTOR project in the Netherlands involved **semi-annual meetings with diverse stakeholders** to address concerns about coastal protection and recreation, ensuring that environmental safety and community use remained balanced.

The WATERLANDS project also demonstrated the value of early engagement by **organising extensive deliberations with local communities before implementing restoration actions**. **Community facilitators gathered feedback over several years, incorporating local values and concerns into project planning**, which increased the project's acceptance and long-term viability. Interviews emphasised that this **co-creation model** helped to integrate the community's perspectives with the project's environmental objectives, providing a foundation for sustainable NBS management.

Another significant challenge is fostering trust among stakeholders, especially in contexts where historical grievances or power imbalances exist. For instance, in the Netherlands, past industrial developments that displaced local communities created lasting mistrust, making it challenging to engage these communities in new initiatives. In response, project leaders in the REST-COAST project **employed direct, transparent communication and one-on-one consultations** to rebuild trust and ensure that local concerns were prioritised.

By **focusing on sustainability and long-term viability**, the REST-COAST Wadden Sea/Ems Dollard pilot successfully garnered buy-in specifically from the agricultural community. Farmers' initial scepticism stemmed from various concerns about, for the risk of contamination from dredged material used for land elevation, potential disruptions to farming practices, and uncertainty about the long-term benefits of NBS compared to traditional infrastructure. However, a **targeted engagement strategy** addressed these concerns, demonstrating how NBS could align with farmers' priorities and deliver both environmental and economic value.

Farmers' primary concerns revolved around three key issues:

- **Contamination Risks**: Concerns about the safety of dredged material for raising low-lying farmland were prominent.
- **Land Productivity**: Farmers feared that interventions like salt marsh creation or seagrass restoration might reduce arable land or interfere with farming operations.
- **Cost-Benefit Alignment**: While farmers were not directly responsible for funding the interventions, they were wary of adopting measures that might not deliver equivalent or better outcomes than grey infrastructure.

The REST-COAST project team tackled these concerns through a combination of **science-backed assurances, direct communication and co-creation approaches**. For example:

1) **Safety Assurance:** Project leaders conducted thorough testing of dredged material and transparently shared the results reassuring farmers about contamination risks.
2) **Engagement Sessions:** Through one-on-one meetings with up to thirty farmers per region, project leaders provided tailored explanations of how NBS could mitigate flooding and soil erosion while improving land productivity over time, benefiting each farmer individually.
3) **Demonstrating Long-Term Benefits:** Farmers were shown cost-benefit analyses that highlighted how NBS, such as salt marsh creation, deliver flood protection with lower maintenance costs and additional ecological benefits compared to grey infrastructure.[64]

An additional factor in securing farmer support was the **recognition that agricultural land in the region was losing value and productivity due to environmental degradation**, including soil erosion, salinisation, and increased flooding risks. This tangible challenge reframed farmers' priorities making them more open to solutions that could secure the future viability of their land. NBS emerged in this sense as a pragmatic response by addressing both immediate and long-term needs, by offering:

- **Flood Protection:** Salt marshes and reinforced dikes with natural materials provided equivalent or superior flood protection compared to grey infrastructure.
- **Ecosystem Services:** Interventions such as seagrass restoration offered added benefits like carbon sequestration, erosion control, and biodiversity enhancement, which aligned with regulatory goals under Natura 2000 and increased resilience to climate change.

It is worth noting that the relative openness of Dutch stakeholders to NBS may also be rooted to an extent in the shared awareness and perception of importance of the Netherlands' urgent need for flood protection. This understanding has a long history and is exacerbated by continued sea-level rise, sinking of land, and extreme weather events, including flash floods, driven by climate change. Over recent decades, Dutch stakeholders' perspectives have shifted in the pursuit of solutions to these challenges. Given growing evidence that NBS deliver better value for money by providing flood protection alongside additional benefits for ecosystems and communities, support for

[64] REST-COAST Project. (2022). Wadden Sea pilot factsheet. Retrieved from https://rest-coast.eu/storage/app/media/pilots/Wadden%20Sea_2022.pdf.

them has grown. At the level of policy, too, as mentioned in previous chapters, there is more acceptance in the Netherlands for (re-)allocating funding earmarked for traditional dike reinforcement to NBS, indicating an increasing recognition of NBS' cost-effectiveness and multifunctionality.

Nonetheless, the REST-COAST pilot exemplifies how **careful alignment of stakeholder priorities, combined with transparent communication and evidence-based advocacy**, can overcome resistance and foster broad support for innovative approaches like NBS. By addressing farmers' specific concerns and highlighting the economic and ecological advantages of NBS, the project successfully built consensus and unlocked substantial funding for interventions that promise long-term sustainability.

Similarly, the PHUSICOS project in Norway and Italy **engaged local farmers and landowners in decision-making processes**. By involving end users as implementers, PHUSICOS facilitated a **bottom-up approach**, **where local stakeholders became both decision-makers and caretakers of the NBS initiatives**, fostering a strong sense of **ownership**.

Such strong and enduring engagement can also be supported by **financing models that align economic incentives with environmental goals**. For example, **EU CAP eco-schemes** can provide financial incentives for farmers to adopt sustainable practices that contribute to NBS outcomes, such as soil restoration, flood management, and biodiversity enhancement.[65] Additionally, **payment for ecosystem services (PES)** can offer viable mechanisms to reward landowners for the ecosystem services their land provides, such as carbon sequestration and water quality improvement.[66][67] By linking financial incentives to the environmental and social benefits of NBS, such approaches can create a structure that motivates stakeholders to actively participate in and sustain NBS initiatives. Furthermore, as further explored in the chapter on finance, these mechanisms may prove critical to ensuring the sustained funding and financing of NBS projects, helping to align the economic interests of stakeholders with long-term environmental goals.

Engaging stakeholders and fostering cooperation are critical components of NBS - not only during the planning and implementation phases, but also for ensuring the long-term maintenance and sustainability of the project. The local municipalities play a significant role in implementing NBS projects, and thus it is important to engage with them for

[65] European Commission. (2023). The Common Agricultural Policy at a glance. https://ec.europa.eu/info/food-farming-fisheries/key-policies/common-agricultural-policy_en
[66] Engel, S., Pagiola, S. & Wunder, S. (2008). Designing payments for environmental services in theory and practice: An overview of the issues. Ecological Economics, 65(4), 663-674. https://doi.org/10.1016/j.ecolecon.2008.03.011.
[67] Wunder, S. (2005). Payment for environmental services: Some nuts and bolts. CIFOR Occasional Paper No. 42. Center for International Forestry Research. https://www.cifor.org/publications/pdf_files/OccPapers/OP-42.pdf.

mutually beneficial outcomes and better cooperation. The recently published ENACT discussion paper[68] encourages to develop **formal channels with stakeholders for regular consultation and feedback, and to offer capacity-building resources to ensure effective and informed engagement of all participants**.

➔ *Engaging Indigenous Peoples, and Local Communities*

Achieving true inclusivity in NBS project governance and implementation requires a **long-term commitment to engaging Indigenous Peoples, and local communities** in continuous consultation and decision-making. Indigenous Peoples, who safeguard around 80% of the world's biodiversity on their lands, have been engaged in sustainable land and resource management for centuries.[69] However, the integration of Indigenous Peoples' perspectives and traditional ecological knowledge (TEK) into conventional governance frameworks and NBS project governance structures remains a challenge in today's complex environmental and social landscapes.

In addition, Indigenous Peoples, and local communities are increasingly vocal about the risks associated with NBS initiatives. Concerns include the phenomenon of "parachute science" (where outsiders extract knowledge without community involvement), the commodification of natural resources, and the exclusion of local expertise. The need for more **respectful, inclusive NBS approaches that genuinely value Indigenous Peoples', and local communities' knowledge and cultural practices** can thus not be understated.[707172] Resulting disconnects can be particularly evident in the context of large-scale projects, such as those related to energy production, mining, and

[68] Bertram, M. & Griswold, D. (2024). ENACT 2024: Nature-based solutions discussion paper. International Union for Conservation of Nature (IUCN).
[69] United Nations Department of Public Information. (n.d.). (2018). Indigenous peoples' collective rights to lands, territories and resources. United Nations Permanent Forum on Indigenous Issues. https://www.un.org/development/desa/indigenouspeoples/wp-content/uploads/sites/19/2018/04/Indigenous-Peoples-Collective-Rights-to-Lands-Territories-Resources.pdf.
[70] Jang, N. (2024, August 7). For nature-based solutions to be effective, we need to work with Indigenous peoples and local communities. International Institute for Sustainable Development. https://www.iisd.org/articles/insight/nature-based-solutions-indigenous-peoples.
[71] Dawson, N. M., B. Coolsaet, E. J. Sterling, R. Loveridge, N. D. Gross-Camp, S. Wongbusarakum, K. K. Sangha, L. M. Scherl, H. Phuong Phan, N. Zafra-Calvo, W. G. Lavey, P. Byakagaba, C. J. Idrobo, A. Chenet, N. J. Bennett, S. Mansourian & F. J. Rosado-May. (2021). The role of Indigenous peoples and local communities in effective and equitable conservation. Ecology and Society 26(3):19. https://doi.org/10.5751/ES-12625-260319.
[72] Brondízio, E. S., Aumeeruddy-Thomas, Y., Bates, P., Carino, J., Fernández-Llamazares, Á., Ferrari, M. F., Galvin, K., Reyes-García, V., McElwee, P., Molnár, Z., Samakov, A. & Shrestha, U. B. (2021). Locally based, regionally manifested, and globally relevant: Indigenous and local knowledge, values, and practices for nature. Annual Review of Environment and Resources, 46(1), 481–509. https://doi.org/10.1146/annurev-environ-012220-012127.

infrastructure development, which often involve Indigenous Peoples' lands and communities.[73]

Consider the following example: In recent years, concerns about exploitation, lack of consultation, and harmful consequences have led some Indigenous Peoples to reject carbon credit schemes. Investigations have shown that over 70% of carbon-offset projects cause harm to Indigenous Peoples, and local communities.[74] For instance, Cambodia's Southern Cardamom Reducing Emissions from Deforestation and Forest Degradation (REDD+) project[75] egregiously violated the rights of the Chong people[76] through forced evictions and arrests, implemented without meaningful consultation or equitable benefit-sharing arrangements.[77][78] This pattern extends globally. In the Amazon alone, 20 documented cases highlight forced displacement and land appropriation, including the planting of palm oil on Indigenous Peoples' graves. In Africa, tree-planting initiatives displaced families in the Republic of Congo, while in Borneo, secret deals sold 2 million hectares of Indigenous Peoples' land without consent. These actions have fuelled deep mistrust, with Indigenous Peoples, and local communities fearing loss of autonomy and cultural heritage.[79]

The scale of these injustices underscores broader issues of inequity and opacity in carbon offset schemes. Nearly half of the world's remaining intact ecosystems are on Indigenous Peoples-held lands, yet their stewards - 6% of the global population - are marginalised in decision-making. Addressing these challenges requires **inclusive, rights-respecting**

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[73] Bainton, N. (2020, July 30). Mining and Indigenous Peoples. Oxford Research Encyclopedia of Anthropology. Retrieved 9 Nov. 2024, from https://oxfordre.com/anthropology/view/10.1093/acrefore/9780190854584.001.0001/acrefore-9780190854584-e-121.

[74] Dunne, D. & Quiroz, Y. (2023, September 26). Mapped: The impacts of carbon-offset projects around the world. Carbon Brief. https://interactive.carbonbrief.org/carbon-offsets-2023/mapped.html.

[75] The **Southern Cardamom REDD+ Project** is an initiative in Cambodia aimed at preserving one of Southeast Asia's largest remaining tropical rainforests. By combining advanced forest protection techniques and community engagement, the project aims to tackle deforestation and supports biodiversity conservation. It has implemented measures such as training enforcement teams, building solar-powered water wells for local communities, and promoting sustainable agriculture. The area provides critical habitat for endangered species like the Asian elephant and Siamese crocodile, with notable successes in boosting wildlife populations.

[76] The **Chong people** are an Indigenous ethnic group primarily found in parts of **Cambodia** and **Thailand**, particularly in the southeastern provinces near the border of the two countries. They are one of the Indigenous hill tribes in the region and are closely related to other Mon-Khmer speaking groups.

[77] Human Rights Watch. (2024, February 28). Cambodia: Carbon offsetting project violates Indigenous group's rights. Human Rights Watch. https://www.hrw.org/news/2024/02/28/cambodia-carbon-offsetting-project-violates-indigenous-groups-rights.

[78] Otis, L. (2024, April 2). More harm, more foul: Carbon crediting project exposes widespread human rights violations. Carbon Market Watch. https://carbonmarketwatch.org/2024/04/02/more-harm-more-foul-carbon-crediting-project-exposes-widespread-human-rights-violations/.

[79] Dunne, D. & Quiroz, Y. (2023, September 26). Mapped: The impacts of carbon-offset projects around the world. Carbon Brief. https://interactive.carbonbrief.org/carbon-offsets-2023/mapped.html.

frameworks that position Indigenous Peoples as central stakeholders. Without such reforms, NBS projects at large risk perpetuating environmental and social harm rather than delivering equitable climate solutions.[80]

In the context of the present report, interviews with the SAND MOTOR, Wayapa Wuurrk, and AQUACYCLE project managers highlighted the prevalence of governance structures that prioritise hierarchical decision-making, inadvertently limiting local communities' voices. At times, even the terminology used in project communication can lead to exclusion of stakeholder groups not familiar with these terms. For example, practitioners of Wayapa Wuurrk, pointed to how terms used in NBS discourse feel detached from Indigenous Peoples' ways of knowing and doing, resulting in a perception of exclusion among traditional knowledge holders. As a result, Indigenous Peoples' perspectives are often at risk of remaining underrepresented in decision-making processes, with few mechanisms to bridge these cultural and conceptual gaps.

A sustainable and respectful approach to NBS projects requires shifting from integration to **active inclusion of TEK holders in decision-making processes**. Experts advocate for **community-based, adaptive resource management, where TEK holders have direct involvement and authority**. This approach aligns with principles of adaptive management discussed previously, which **prioritise local knowledge, feedback loops, and flexible decision-making that responds to changes in environmental and social conditions**. For infrastructure projects, this could mean **forming adaptive management teams that include Indigenous Peoples' representatives as decision-makers**, not merely consultants or as the consulted. Such arrangements enable Indigenous Peoples, and local communities to maintain stewardship over their lands and resources, **leveraging their ecological knowledge in a way that respects and upholds their cultural practices**.

Establishing continuous and accessible feedback mechanisms can allow Indigenous Peoples, and local communities to provide knowledge to inform both initial project development and adjustments as needed. Projects like NATURVATION underscored the importance of creating governance structures tailored to specific local and cultural contexts. Inversely, fostering long-term relationships with Indigenous Peoples', and local communities is essential in ensuring that their knowledge informs project decisions and evolution over time. This requires ongoing consultation and feedback mechanisms, which enable stakeholders to learn from each other's perspectives and co-develop mutually beneficial solutions.

[80] Cabello, J. & Hartlief, I. (2024, October 24). Carbon offsets often disenfranchise communities. SOMO. https://www.somo.nl/carbon-offsets-often-disenfranchise-communities/.

Furthermore, NBS projects could **adopt participatory research methods** that centre Indigenous Peoples' voices in defining, researching, and applying TEK. This would ensure that Indigenous Peoples, and local communities have control over how their knowledge is shared, interpreted, and applied. Furthermore, **using methods that preserve the oral and cultural context of TEK, such as video documentation, could help retain the integrity of Indigenous Peoples' knowledge**.

A powerful example of integrative approach that blends Indigenous Peoples' and conventional perspectives is encapsulated in the concept of **Living Labs**, as highlighted in several of this report's examined NBS projects and introduced in an earlier chapter.[81] Living Labs have been particularly effective in enabling co-creation environments where TEK and scientific expertise converge. They create **collaborative spaces that allow for mutual learning among stakeholders**, including Indigenous Peoples, and local communities, scientists, and policymakers. For example, the PHUSICOS project employed Living Labs to provide local stakeholders with hands-on engagement, effectively allowing them to interact directly with the natural landscape and offer cultural insights into its management. Less formalised but equally as effective, the AQUACYCLE project introduced workshops and training sessions targeted at local communities, decision-makers, and farmers to unearth and apply TEK on sustainable water usage. The workshops both educated participants about the benefits of NBS and encouraged **local adaptation of ecological practices within culturally relevant frameworks**.

Measures that **prioritise Indigenous Peoples; and local leadership** can further enhance inclusivity. An example of such initiatives are Indigenous Peoples-led workshops, which are critical in fostering a deeper understanding of Indigenous Peoples' knowledge and its relevance to conventional governance frameworks. These workshops provide a space for knowledge sharing, skill development, and dialogue, enabling participants to develop a greater appreciation for the complexities involved in integrating Indigenous Peoples' knowledge into project design and management.

The Wayapa Wuurrk initiative is a prime example of a **co-creation approach** that integrates Indigenous Peoples' knowledge into conventional governance frameworks. This initiative, led by Indigenous Australians, uses digital platforms and workshops to share Indigenous People's knowledge globally and facilitate a reciprocal relationship with nature. Wayapa Wuurrk has enabled Indigenous Australians to share their TEK with a broader audience, promoting a deeper understanding of the importance of Indigenous Peoples' knowledge in managing natural resources.

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[81] European Commission. Directorate-General for Research and Innovation. (2023). Guidelines for co-creation and co-governance of nature-based solutions: Insights from EU-funded projects (Publication No. KI-05-23-300-EN-N). Publications Office of the European Union. https://doi.org/10.2777/157060.

Interviews with Wayapa Wuurrk representatives also shed light on ways in which Indigenous Peoples' customs can be incorporated into project planning. For instance, "**yarning circles**" as a method of stakeholder engagement can foster more inclusive dialogue. Yarning circles facilitate **reciprocal communication, where Indigenous Peoples' and other perspectives are shared in a non-hierarchical format**, making decision-making more inclusive. Informed by Indigenous Peoples' wisdom, this model aligns well with NBS goals by emphasising collective responsibility for ecosystem stewardship.

2.3. Financing NBS in Europe and Beyond: Addressing the Funding Gap and Mobilising Private Investment

As mentioned in the Introduction Chapter, NBS are increasingly recognised for their long-term economic benefits and effectiveness in addressing pressing environmental challenges. These findings align with insights from stakeholder interviews conducted for this analysis, which underscore the potential of NBS as cost-effective alternatives to conventional infrastructure once initial investments are secured.

Despite their economic advantages, mobilising private investment in NBS remains a significant challenge. While the inherent cost-effectiveness of many NBS might suggest a natural alignment with private capital markets, barriers such as **the economic quantification of benefits** and **delayed financial returns for investors** hinder their scalability. While NBS usually provide substantial public goods, including improved public health, biodiversity conservation, and climate resilience, besides the infrastructure services they deliver, some of these benefits are difficult to translate into direct financial returns for private investors due to their complex and often intangible nature.

Moreover, the **often-longer regeneration cycles of natural systems** compared to grey infrastructure further delay revenue realisation, making NBS less attractive to conventional investment models. These hurdles necessitate innovative financial mechanisms, particularly those that **blend public and private funding**, to mitigate risks and incentivise private capital flows.

Drawing on qualitative interviews with stakeholders, this chapter analyses these challenges and evaluates two financial models and their potential for scaling NBS from pilot initiatives to the comprehensive delivery of NBS infrastructure. While general interviewee feedback on financial aspects was limited and did not provide concrete insights into innovative financial models, this analysis is supplemented with insights from secondary literature research to provide an assessment of the related challenges and opportunities.

2.3.1. The Gap: Scope and Scale

The financial landscape remains unfavourable, with approximately € 1.7 trillion[82][83] in global subsidies supporting environmentally harmful activities, compared to only US$ 133 billion that were allocated to NBS between 2020 and 2021, mostly from public sources.[84]

To meet the ambitious targets set by global frameworks like the **Kunming-Montréal Global Diversity Framework** and its **Target 19** on financial resource mobilisation**,** international organisations and institutions as well as research institutions have provided **varying estimates** on the **financing gap** for NBS worldwide. UNEP calls for a threefold increase in NBS investments by 2030, which would require an annual investment of € 355 billion to address climate change, biodiversity loss, and land degradation.[85] Meanwhile, the World Economic Forum (WEF) estimates that cumulative investment in NBS must reach approximately € 7.7 trillion by 2050, which translates to an annual requirement of € 508 billion.[86] The highest financing gap estimate comes from the Paulson Institute, the Nature Conservancy, and the Cornell Atkinson Centre for Sustainability at Cornell University, which identifies an average annual gap of € 674 billion between 2019 and 2030.[87] These figures highlight both the scale of the financing shortfall and the urgent need to secure additional capital from both public and private sources.

The EU faces challenges in closing this financing gap, also due to its reliance on **public financing**. While public funds have been crucial, they alone are insufficient to meet Europe's growing NBS demands. The G20, which includes the EU and 19 of the world's largest economies, accounts for 92% of global NBS investments, spending over EUR 120 billion annually.[88] Within Europe, public financing represents approximately 91% of total NBS financing, with private investments covering only 3% in some areas.[89]

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[82] While data availability on the scale of these subsidies varies widely across sectors and countries, even based on incomplete estimates they measure at least US$ 1.8 trillion a year or about 2 percent of global GDP.
[83] Koplow, D. & Steenblik, R. (2022). Protecting Nature by Reforming Environmentally Harmful Subsidies. https://www.earthtrack.net/sites/default/files/documents/EHS_Reform_Background_Report_fin.pdf.
[84] Brasil-Leigh, A., Byrd R., Käfer, P., Miao, G., Ruiz-Serra, M., Vieira, A. & Wallock, W. (2024). Toolbox on Financing Nature-Based Solutions, p.8. https://www.climatepolicyinitiative.org/wp-content/uploads/2024/09/Report-Toolbox-on-Financing-Nature-Based-Solutions.pdf.
[85] Water Facility. (2024). Concept paper: Nature-based solutions for infrastructure development – Pathways to overcome barriers for upscaling the use of nature as infrastructure, p. 17.
[86] Ibid.
[87] Paulson Institute. (2019). Financing Nature: Closing the Global Biodiversity Financing Gap. https://www.paulsoninstitute.org/conservation/financing-nature-report/.
[88] Water Facility. (2024). Concept paper: Nature-based solutions for infrastructure development – Pathways to overcome barriers for upscaling the use of nature as infrastructure, p. 17.
[89] European Investment Bank. (2023). Investing in nature-based solutions: State-of-play and way forward for public and private financial measures in Europe, p. 50. https://www.eib.org/attachments/lucalli/20230095_investing_in_nature_based_solutions_en.pdf.

The disparity between existing and required financing for NBS reflects a broader, global challenge in the shift toward sustainable finance. In recent years, organisations such as UNEP, the EIB, and the WEF have emphasised the necessity of redirecting capital away from environmentally harmful activities toward sustainable initiatives like NBS.[90] Nevertheless, this gap persists, partly due to the limited capacity of public funds to meet growing demands for large-scale NBS projects and partly due to systemic financial barriers that discourage private sector investments. These challenges will be further explored in the following section.

Bridging the NBS financing gap will require not **only increased public investment but also a coordinated effort to attract private capital**. Achieving the objectives of the EC's European Green Deal and Biodiversity Strategy 2030 will depend on developing innovative financial instruments that can engage private sector interest and unlock new financing sources. Understanding the specific obstacles that prevent private companies from investing in NBS is essential in designing and applying financial mechanisms capable of mobilising private investments.

2.3.2. Financial Challenges in Upscaling NBS: Insights from Stakeholder Interviews

Interviews with stakeholders from various NBS projects in Europe reveal significant financial challenges that impact the scalability of NBS, specifically:

1) **Economically quantifying and monetising ecosystem services**, and
2) **high upfront costs due to delayed revenue realisation.**

These central issues restrict private investment, limiting the potential for scaling NBS. While this chapter will focus on these two primary challenges, other financial barriers emerged during the interviews which will also be identified below. Stakeholders also proposed several innovative financial mechanisms and solutions to address these issues which will be further explored and elaborated in more detail in the last section of this chapter.

➔ *The Challenge of Economically Quantifying and Monetising Ecosystem Services*

Quantifying ecosystem services remains a major obstacle to private investment in NBS. In the PHUSICOS project, for instance, the project coordinator emphasised that, translating the monetisable benefits of community resilience against natural hazards into a financial metrics appealing to investors remains challenging.

[90] Water Facility. (2024). Concept paper: Nature-based solutions for infrastructure development – Pathways to overcome barriers for upscaling the use of nature as infrastructure, p. 17-18.

A similar challenge was encountered by the MERLIN project, which focuses on freshwater ecosystem restoration. According to the interview, although NBS offer substantial public benefits, such as flood risk reduction and water management, these do not produce immediate financial returns, making it difficult to find private investors who see a clear business case in NBS. While MERLIN continues to investigate ways to demonstrate the long-term benefits of NBS to potential investors, **the economic value of these public goods is difficult to quantify, which limits private sector engagement**.

The root issue, as illustrated by these examples, is that **many natural benefits, such as clean air, are public goods freely available to all stakeholders in society – they are non-rival and non-excludable**. These positive externalities should be factored in, a quantifiable value put to them. For some NBS one or several of these public goods provided by NBS may already suffice to make a business case that is favourable to that of grey infrastructure, meaning that cost-effectiveness is achieved and can be reaped by a single or numerous entities (as seen, for example, in the reduced capital expenditure (CAPEX) and OPEX cost of NYC's drinking water described in the Introduction Chapter). In these cases, the hypothesis is that these NBS will increasingly materialise – regardless of public, private, or mixed ownership - as the limiting factors described in the above chapters are overcome.

Another way of valorising these benefits is by **attributing a value to the cost avoided or the risk alleviated**, which is again true for public as well as private entities. In the case of public entities and urban planning, a sponge city, for example, can provide the grey-equivalent infrastructure services (e.g., grey drainage systems) while providing multiple public good benefits that can reduce costs in other public services. For example, sponge cities can significantly reduce temperature levels and clean the air, resulting in lower health bills. It will also reduce flooding risks, hence improving insurance performance, and improving companies risk profiles favouring their development and access to finance.

In the case of private entities, a company that is reliant on sufficient water availability of a certain quality may incur increasing costs for its production in the long run. In the case of Coca-Cola, the company has engaged in a natural capital assessment of seven water projects by developing a standardised methodology based on the ecosystem they provide in order to counter the risk of increased contaminated water supplies.[91] The result being that Coca-Cola and its bottling partners have invested in projects that promote watershed health while supporting NBS such as reforestation, wetland and meadow restoration and

[91] We value nature. (2019). Coca-Cola's Natural Capital Story on valuing the impact of their water replenishment programs. https://wevaluenature.eu/sites/default/files/2021-04/WVN Natural Capital Journey - Coca Cola.pdf.

irrigation system improvements.[92] The example of Coca-Cola demonstrates how raising awareness for the reliance of companies' business models on well-preserved ecosystems can translate into market-driven private investments in them. However, many companies (as well as public entities at all levels) are still widely unaware of these risks or may not be able to quantify them (and reversely the potential cost savings) adequately, leading to the mentioned market failure of significant under-investments into the ecosystems we rely on.[93][94]

➔ *The High Upfront Costs and Delayed Revenue Realisation in NBS*

A second major barrier to NBS, according to the interviewees, lies in the **high upfront costs associated with their implementation**. High upfront costs can thereby include the CAPEX but also the feasibility and pre-feasibility study, remedying knowledge gaps, stakeholder engagement and capacity building (see previous chapters). This can be a considerable financial burden for small stakeholders and project managers, especially if they are reliant on private investments to enable the financing for their projects.

This is further coupled with **the delayed timeline for realising revenue rooted in the longer duration of regenerating ecosystems and ecosystem benefits** which is often regarded as too late for private investors. This delay in economic returns limits private sector interest, as investors typically seek quicker returns on investment. For instance, the REST-COAST project, focusing on large-scale coastal ecosystem restoration, requires approximately 25% more investment than its grey infrastructure equivalent within the project timeframe between 2021-2026. However, when considering a longer time horizon, the project offers savings through reduced maintenance costs; thus, achieving a higher cost-effectiveness than their grey equivalent.

An example for the long-term cost-effectiveness of NBS infrastructures can also be seen in the context of the AQUACYCLE project which incurs **high initial costs due to regulatory burdens and the existence of knowledge gaps**. The project integrates cheaper eco-innovative wastewater treatment technologies and technically runs on low operational costs due to the reliance on solar energy for photocatalytic processes which make it suitable for regions with limited financial resources. Nevertheless, the interview highlighted regulatory burdens in the case of Tunisia which lacks comprehensive policies

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[92] The Coca-Cola Company. (2024). 4 ways the Coca-Cola system is contributing to the UN SDGs. Retrieved December 20, 2024, from https://www.coca-colacompany.com/media-center/4-ways-the-coca-cola-system-is-contributing-to-the-un-sdgs.

[93] Brasil-Leigh, A., Byrd R., Käfer, P., Miao, G., Ruiz-Serra, M., Vieira, A. & Wallock, W. (2024). Toolbox on Financing Nature-Based Solutions, p. 10. https://www.climatepolicyinitiative.org/wp-content/uploads/2024/09/Report-Toolbox-on-Financing-Nature-Based-Solutions.pdf.

[94] Morgan Stanley. (2024). Sustainable Signals: Understanding Individual Investors' Interests and Priorities. https://www.morganstanley.com/content/dam/msdotcom/en/assets/pdfs/MSInstituteforSustainableInvesting-SustainableSignals-Individuals-2024.pdf.

for wastewater management in rural areas which complicates the scaling up of NBS initiatives like AQUACYCLE. Furthermore, this case has demonstrated that state utility services in potential partnership countries, such as the National Sanitation Utility in Tunisia, might not be adequately equipped for its operation in rural areas and are dependent on receiving additional funding. This can ultimately increase short-term and medium-term costs even if in the long-term costs could be saved.

In addition to these immediate financial challenges, other barriers complicate NBS funding, including **high land acquisition costs**, particularly in urban and competitive settings. As shown in projects like MERLIN, financing land acquisition by private and non-profit entities is essential for restoration, as land is often the core investment asset or designated within commercial strategies due to the higher need for land in NBS vis-à-vis their grey equivalents. High land prices present significant obstacles to affordable land acquisition. **In the EU, land acquisition is the preferred strategy for conservation and restoration, despite its tendency to escalate prices and generate friction over land use**. **Voluntary agreements can offer a more cost-effective approach**, but often at the expense of long-term control, which remains critical for sustainable project outcomes. Ownership provides security, while alternative strategies like **repurposing publicly owned land may help lower costs**.[95]

Capacity and knowledge gaps add yet another layer of difficulty. Limited technical knowledge within public institutions and private entities complicates both NBS financing and execution. For example, the WATERLANDS project emphasises the need for capacity-building initiatives to enhance local understanding of NBS financing, as well as technical training to ensure effective project implementation. Stakeholders buy-in, capacity building, and training for effective NBS implementation represent additional costs that must not be overlooked.

In addition to identifying financial challenges, our interviewees highlighted a range of innovative solutions, underscoring the need for public-private financing models. Two prominent approaches emerged from these discussions: **blended finance** - mentioned by stakeholders in AQUACYCLE and MERLIN - which combines public and private investments. This could allow for **combining grants, subsidies and private investment**. Secondly, many projects, such as WATERLANDS and REST-COAST, mentioned **carbon and biodiversity credits** which can help monetise the long-term ecosystem benefits of NBS and thereby attract greater private sector engagement. These credits could generate income by quantifying and selling the environmental benefits produced by NBS. For example, public funding might support initial stakeholder engagement and

[95] European Investment Bank. (2023). Investing in nature-based solutions: State-of-play and way forward for public and private financial measures in Europe, p. 118. https://www.eib.org/attachments/lucalli/20230095_investing_in_nature_based_solutions_en.pdf.

capacity building, while biodiversity or carbon credits could generate longer-term revenue streams from restored habitats or carbon dioxide captured in trees.

As we have seen in the example of Coca-Cola, an **analysis of natural resource dependence and disclosure of associated nature-related risks of companies may further unlock additional private funding into NBS**. The **Taskforce on Nature-Related Financial Disclosures (TNFD)**, launched in 2021, facilitates this process, following the success story of climate risk accountability and transparency. The TNFD has developed a set of disclosure recommendations and guidance that aim to encourage and enable businesses to assess, report and act on their nature-related dependencies, impacts, risks and opportunities.[96] The **Carbon Disclosure Project** has also facilitated water risks disclosure: 3,163 companies disclosed through CDP in 2023. One in five companies report supply chain water risks which could have a significant impact on their business.[97]

The public sector can strategically incentivise the acceleration of this process. The **EU Corporate Sustainability Reporting Directive (CSRD)** is a case in point. It requires all large companies and all listed companies to disclose information on the risks and opportunities arising from social and environmental issues, and on the impact of their activities on people and the environment.[98] This helps investors, civil society, consumers, and other stakeholders to evaluate the sustainability performance of companies. This has been changing the perception of the water risk by companies and a recent study by Morgan Stanley showed that "*momentum is growing around investing in the water sect*or. *"Water solutions" now rank number one globally in both the US and Europe*." [99] This trend has the potential to unlock demand and private capital for NBS.

Lastly, the **public sector and/or development banks may also incentivise nature-positive investments through tax incentives or preferential conditions**.[100]

Stakeholder insights revealed that while these mechanisms do not resolve all financial hurdles - especially those related to high land costs and capacity gaps - they contribute

[96] Taskforce on Nature-related Financial Disclosures (2021-2024). (2024). https://tnfd.global/.
[97] Le Sève, M.D. & de Souza, E. (2024). Stewardship at the Source: Driving water action across supply chains. https://www.cdp.net/en/research/global-reports/global-water-report-2023.
[98] European Commission. (2023). Corporate sustainability reporting. https://finance.ec.europa.eu/capital-markets-union-and-financial-markets/company-reporting-and-auditing/company-reporting/corporate-sustainability-reporting_en.
[99] Morgan Stanley. (2024). Sustainable Signals: Understanding Individual Investors' Interests and Priorities. https://www.morganstanley.com/content/dam/msdotcom/en/assets/pdfs/MSInstituteforSustainableInvesting-SustainableSignals-Individuals-2024.pdf.
[100] European Commission. (2023). Corporate sustainability reporting. https://finance.ec.europa.eu/capital-markets-union-and-financial-markets/company-reporting-and-auditing/company-reporting/corporate-sustainability-reporting_en.

to a more supportive environment for scaling NBS, ultimately helping to translate the intrinsic value of nature into a tangible and investable business model.

2.3.3. Financial Instruments to Tackle NBS Funding Challenges

Insights from stakeholder interviews underscore that overcoming the obstacles analysed in the previous sub-chapter requires **innovative financial instruments that can diversify revenue streams and reduce investment risk**. This section explores two promising financial strategies of public-private financing: **Environmental Impact Bonds (EIBs)** and **concessional funding**. The following will outline how these two financial instruments provide mechanisms for (a) concretely monetising and economising ecological benefits by generating attractive investment returns for private investors at pre-agreed varying rates and (b) raising investments to enable the financing of upfront costs needed for the implementation of NBS solutions.

➔ *Environmental Impact Bonds (EIBs)*

EIBs are innovative financial tools that fund projects delivering significant environmental benefits while sharing risks and rewards between stakeholders. They are structured using **pay-for-success (PFS) contracts, where investor returns depend on achieving specific environmental outcomes**. These can, for example, be urban green infrastructures that lead to a more cost-effective storm water management or solutions improving water quality. The better the results, the higher the returns for investors.

In an EIB structure, private investors provide upfront capital by purchasing the bond, while public or private entities - such as governments, environmental agencies, companies implementing the project - agree to repay investors at varying rates based on the project's success. If the project achieves or exceeds its environmental goals, investors receive higher returns. If the project only partially succeeds or underperforms, repayments are reduced.

EIBs operate similarly to traditional bonds, with set repayment schedules and interest rates. However, repayments are directly linked to the project's actual performance, aligning financial outcomes with measurable environmental benefits. This structure encourages investment in NBS by enabling investors to share both the financial burdens and the rewards.

When a project succeeds, the bond issuers repay the investors. The funding for these repayments can come from:

- **Cost Savings:** Projects like ecosystem restoration reduce costs for infrastructure, disaster prevention, or water treatment, and these savings are used to pay investors.

- **Revenue Generation:** Some projects generate revenue, such as through carbon credits, taxes on increased land value, levies on water use or incomes deriving from an increased hydroelectricity production, which can supplement repayments.
- **Future Benefits:** Repayments may also be tied to long-term financial savings achieved through improved environmental conditions.
- Public Finances: Simply to reap the additional (partly non-monetisable) benefits associated with NBS.

In some cases, contractual terms may allow for lower or negative interest rates when supplementary income streams, such as carbon credits, are available. This flexibility makes EIBs particularly attractive to impact investors and philanthropic entities willing to take risks for environmental gains.[101]

Case Study: Forest Resilience Bond (FRB) for Wildfire Management

The **Forest Resilience Bond (FRB)**, developed by Blue Forest Conservation, is an innovative financial model designed to mitigate wildfire risk in the western US. By **leveraging private capital from impact funds, insurance companies, and philanthropic organisations**, the FRB finances large-scale forest restoration projects that exceed the capacity of public funding alone. The North Yuba pilot, requiring approximately **€ 3.8 million** in financing, successfully demonstrated the bond's ability to reduce wildfire risks, enhance water yield, and improve biodiversity while providing measurable financial returns through a **4% interest rate return**. This approach not only delivered ecological and economic benefits but also reduced the financial burden on public agencies, highlighting the potential for scalable investments NBS.

The FRB achieves this by **assigning financial value to ecosystem services such as fire risk reduction, water quality improvement, and hydropower benefits**. Through **PFS contracts**, public and private beneficiaries - like the US Forest Service, non-profits, and local utilities - **reimburse investors upon successful project completion**. **Payments are based on measurable outcomes, such as increased water volumes or reduced sedimentation and firefighting costs**. This co-financing model shares upfront costs among stakeholders, enabling immediate action while aligning financial incentives with ecological performance. By monetising the indirect benefits of forest restoration, the FRB makes ecosystem services financially viable for investors.

Source: Tobin-de la Puente, J. & Mitchell, A.W. (eds.). (2021). The Little Book of Investing in Nature, Global Canopy. https://globalcanopy.org/wpcontent/uploads/2021/07/LBIN_2020_RGB_ENG.pdf.

[101] Tobin-de la Puente, J. & Mitchell, A.W. (eds.). (2021). The Little Book of Investing in Nature, Global Canopy, p. 177. https://globalcanopy.org/wp-content/uploads/2021/07/LBIN_2020_RGB_ENG.pdf.

➔ *Blended Finance Models through Concessional Capital*

Blended finance models combine public and private capital to fund high-risk environmental projects, making them more attractive to private investors by reducing financial risks. This approach can **integrate concessional financing - offered at below-market terms by public institutions - with private investment** to support initiatives that address public goods, such as marine conservation or climate resilience. By addressing the upfront costs and delayed financial returns often associated with NBS, blended finance models make it possible to mobilise resources for projects that might otherwise struggle to secure funding.[102]

Concessional loans, a key element of blended finance, **provide borrowers with affordable financing options characterised by low interest rates, favourable repayment terms, and, in some cases, conversion to grants**. These loans are particularly valuable for conservation projects that lack immediate revenue generation, enabling them to access funding earlier than would be possible through commercial debt alone. By reducing the total financial burden and (perceived) risks for lenders, concessional debt also encourages private credit providers to participate in financing ecosystem-friendly activities. Moreover, these loans can be structured to **link to specific ecological outcomes, such as biodiversity conservation or the delivery of ecosystem services**, effectively incentivising sustainability in nascent markets for natural capital.

The returns in blended finance models and concessional loans are typically paid by the beneficiaries of the financed project. These beneficiaries can include public entities, such as governments or multilateral organisations, and private stakeholders, like businesses or utility companies that are part of the project implementation. Similarly to EIBs, the funding for these repayments can come from cost savings, revenue generations and future benefits. In case of conversions to grants repayments are not required.

[102] Ibid., p. 52.

Case Study: Seychelles Blue Bond as a Blended Finance Model

The **Seychelles Blue Bond**, issued in 2018, is an example of a **blended finance approach** aimed at supporting marine conservation and strengthening the blue economy. This **sovereign bond** raised approximately **€ 14.4 million** to finance Seychelles' marine conservation strategy, focusing on sustainable fisheries and the creation of marine protected areas. By leveraging **concessional finance and risk-mitigation tools, the bond reduced public borrowing costs**, making it possible for private investors to contribute to conservation efforts. The initiative successfully mobilised critical funds, directing resources toward ecosystem protection while supporting sustainable economic activities such as fisheries and aquaculture. This approach has inspired similar projects in Belize, Indonesia, and Ecuador, demonstrating its scalability for marine-focused NBS.

To make the bond attractive to investors, two key financial enhancements were included: **a € 4.7 million partial guarantee from the World Bank's International Bank for Reconstruction and Development (IBRD), reducing borrowing costs by approximately 2% annually, and a € 4.7 million concessional loan from the Global Environment Facility (GEF), which lowered the bond's effective interest rate from 6.5% to 2.8%.** The two credit enhancement mechanisms allowed the Seychelles Conservation and Climate Adaptation trust (SeyCCAT) to raise **€ 14.4 million** that were allocated to two funds: the **Blue Grants Fund**, managed by Seychelles Conservation and Climate Adaptation Trust (SeyCCAT), providing **€ 2.8 million** in grants for marine conservation projects, and the **Blue Investment Fund**, managed by the **Development Bank of Seychelles**, which used **€ 11.3 million** to offer concessional loans for sustainable businesses. This setup ensured marine conservation was both quantifiable and economically viable, channelling funds into profitable sustainable enterprises through the funding of cold storage facilities and fish processing plants while preserving aquamarine ecosystems. It unlocked investments of **€ 190,000 per year** for conservation activities.

Source: Brasil-Leigh, A., Byrd R., Käfer, P., Miao, G., Ruiz-Serra, M., Vieira, A. & Wallock, W. (2024). Toolbox on Financing Nature-Based Solutions. https://www.climatepolicyinitiative.org/wp-content/uploads/2024/09/Report-Toolbox-on-Financing-Nature-Based-Solutions.pdf.

Together, blended finance mechanisms and concessional loans provide a scalable framework for supporting ecological transitions, unlocking capital for conservation projects that deliver long-term environmental and social benefits.[103] The are suited to projects that face high upfront costs and long-term returns, particularly in emerging markets for biodiversity and ecosystem services. By bridging the gap between public and private investments, these mechanisms provide critical financial support for ecological

[103] Tobin-de la Puente, J. & Mitchell, A.W. (eds.). (2021). The Little Book of Investing in Nature, Global Canopy, p. 109. https://globalcanopy.org/wp-content/uploads/2021/07/LBIN_2020_RGB_ENG.pdf.

transitions, enabling countries and organisations to fund conservation projects that might not easily attract sufficient commercial investment.[104]

[104] Brasil-Leigh, A., Byrd R., Käfer, P., Miao, G., Ruiz-Serra, M., Vieira, A. & Wallock, W. (2024). Toolbox on Financing Nature-Based Solutions, p. 54. https://www.climatepolicyinitiative.org/wp-content/uploads/2024/09/Report-Toolbox-on-Financing-Nature-Based-Solutions.pdf.

3. Conclusions

This project and assessment of the case studies presented as part of this report have demonstrated that the EC has played a pivotal role in driving the implementation, scaling up, and further development of NBS projects, not only within the EU but also globally. Through its strategic policies, substantial funding mechanisms, and investments in research and innovation, the EC has positioned the EU as a leader in promoting NBS as integral solutions for tackling climate change, enhancing resilience, and achieving sustainable development.

While the EC's efforts have laid a strong foundation for the implementation of NBS and continues its mainstreaming of NBS, significant challenges and opportunities remain. Despite their proven benefits, NBS often remain small-scale and localised, with limited examples of large-scale, high-investment projects. This is further compounded by a substantial financing gap, which continues to hinder the broader adoption and integration of NBS. For instance, the Introduction Chapter noted that despite its green and clean principles, the Global Gateway's incorporation of NBS into infrastructure projects has been minimal.

To bridge this gap, initiatives like INTPA.F2's advancement of a dedicated Action to integrate NBS into infrastructure projects are critical. This report aimed to present best practices for the uptake of NBS, with a focus on the major challenges commonly identified to upscaling: knowledge and capacity, stakeholder engagement and governance, and finally, financing. By analysing eight NBS projects, interviewing project stakeholders and discussing with several more, including EC services, the two research questions set by INTPA.F2 were answered.

The primary research question aimed to identify best practices, gaps, and synergies in NBS projects, and to understand how common challenges have been overcome. The secondary research question aimed to identify the tools and knowledge that the various projects and stakeholders need to replace grey infrastructure with NBS. The following summarises the project's findings briefly, which can be read in conjunction with the complementary deliverables in the Annexes.

3.1. Summary of Findings

Firstly, this report highlights the role of **knowledge and capacity** building in the successful implementation of NBS. Several barriers have been presented in this report, identified both in the literature and by the interviewed cases studies. The lack of standardised guidelines on NBS, the limited awareness on the multiple benefits of NBS, and the limited capacity for knowledge transfer and capacity building exemplify some of the barriers discussed in the report. This knowledge gap is intensified by the complexity

of NBS projects, which require interdisciplinary approaches and multiple stakeholders. Hence, if not addressed, the knowledge and capacity gap on NBS has the potential to hinder its successful implementation. The findings of this report underscore the need to **improve NBS knowledge accessibility, interoperability** to **promote knowledge exchange**, and to **successfully build local capacity**.

Discussions with project managers and researchers demonstrate that knowledge on NBS implementation, monitoring and replication is well-available but **fragmented in its sources**. The research has found that this leads to an increase in the investment in time and resources in finding or replicating knowledge, which particularly hinders significantly smaller or more remote regions, as denounced by AQUACYCLE and NBS4LOCAL. **Terminology inconsistency** further exacerbates knowledge accessibility, and practitioners pointed to the often lack of understanding of the NBS concept which often creates confusion amongst stakeholders. Furthermore, the **lack of standardised guidelines** spanning from technical assessment to regulatory compliance hinders consistent application and scalability, as pointed by PHUSICOS and SAND MOTOR. In addition, interviewed stakeholders highlighted the **limited awareness about the broader social, economic, and environmental benefits of NBS** which can undermine support and lead to resistance in local communities. Effective communication proves hence to be critical.

Projects interviewed have tackled the fragmentation of knowledge by developing **Knowledge Hubs** and **Living Labs**, for which the MERLIN Academy is an example, aiming to facilitate knowledge sharing and resources. One must highlight also the **SAND MOTOR**, built as a **Living Lab**, enabling for real time learning for researchers in collaboration with universities in Delft and Utrecht. Projects interviews not only focus on building knowledge but also on **knowledge exchange within project networks**. For example, MERLIN, WATERLANDS and PHUSICOS are connected via Network Nature, and WATERLANDS and REST-COAST collaborate on the same sites.

In order to build local capacity and facilitate knowledge transfer, **capacity building programmes** are essential for equipping local stakeholders with the skills needed for successful NBS implementation. Projects such as NATURVATION, MERLIN, and AQUACYCLE have demonstrated the value of providing frameworks, training modules, and practical tools to empower communities and stakeholders to adopt and sustain NBS initiatives. Additionally, **hands-on training and workshops** play a critical role in building technical competence and fostering adaptive management practices. By involving local communities in practical learning experiences, programmes like PHUSICOS and WATERLANDS ensure that stakeholders gain confidence and knowledge to engage in NBS projects. These initiatives also promote trust and acceptance through collaborative approaches which address local concerns and build resilience.

Secondly, this report underscores the critical role of **inclusive and adaptive governance and stakeholder engagement** in the success of NBS projects. Effective governance frameworks are identified as those that embrace collaboration across public, private, and community actors, fostering adaptive and flexible models capable of addressing dynamic socio-environmental conditions. By integrating iterative feedback mechanisms and multi-sectoral coordination these frameworks ensure long-term ecological, social, and economic sustainability.

A key challenge lies in limited political will often compounded by gaps in regulatory frameworks and unclear land tenure arrangements. Evidence from projects like REST-COAST and the SAND MOTOR demonstrates that **aligning NBS initiatives with broader socio-economic goals and development priorities** can enhance political commitment and secure funding. Moreover, **adaptive governance models**, exemplified by **structured monitoring and stakeholder engagement processes**, allow projects to respond to evolving conditions, fostering resilience and inclusivity.

Stakeholder engagement emerges as a foundational element for NBS project success. Early and continuous involvement of diverse stakeholders, including Indigenous Peoples, and local communities builds trust, fosters ownership, and aligns project goals with community values. Projects such as WATERLANDS and PHUSICOS highlight the success of **co-creation approaches** where stakeholders actively shape project outcomes through deliberative processes. Financial incentives, such as eco-schemes and PES, can further support stakeholder participation and align economic interests with environmental goals.

However, challenges persist, particularly in ensuring the integration of TEK from Indigenous Peoples and other local knowledge holders. Indigenous Peoples often act as custodians of biodiversity, safeguarding critical ecosystems and providing invaluable TEK. However, ensuring meaningful inclusion requires **addressing systemic barriers, such as inequitable governance frameworks and limited recognition of Indigenous Peoples' knowledge systems**. **Co-creation models**, as seen in the PHUSICOS and Wayapa Wuurrk projects, provide effective pathways for integrating Indigenous Peoples' wisdom with scientific approaches, ensuring that NBS are contextually relevant and equitable. This report emphasises the need for active inclusion, leveraging **culturally sensitive approaches like Living Labs and yarning circles** to blend Indigenous Peoples' wisdom with scientific frameworks. This not only enriches project design but also promotes **equitable decision-making** and sustainable outcomes.

The findings of this report further highlight the critical need to **align NBS with global frameworks and strategies** to bolster their scalability and sustainability. Initiatives like the European Green Deal, the Climate Adaptation Strategy, and the Global Biodiversity Framework provide valuable opportunities for anchoring NBS within international action

plans fostering **shared standards, cross-border collaboration, and access to co-funding mechanisms**. Linking NBS to these global efforts not only amplifies their impact but also strengthens their political legitimacy making them less susceptible to destabilising factors like political changes and short-term policymaking.

As previously noted, inconsistent policy support and frequent government shifts in certain regions can undermine the continuity of NBS projects. Such instability often fosters a focus on short-term priorities over long-term environmental sustainability. To mitigate these risks, **formalising governance agreements** that transcend political cycles and integrating NBS into broader national development and biodiversity strategies is essential. For example, initiatives such as Belgium's Blue Deal, today formalised for long-term effectiveness in a decree, demonstrate how strategic alignment with climate and biodiversity goals can foster resilience and ensure the sustained implementation of NBS.

Moreover, the capacity of governments to monitor and manage biodiversity forms the foundation for successful NBS implementation. Without a clear understanding of the current state of ecosystems, including the **identification of biodiversity hotspots and ecological corridors**, poorly planned interventions risk causing unintended harm. Strengthening government capacity to assess, monitor and map biodiversity is thus a critical prerequisite for NBS planning. By leveraging advanced tools such as **Geographic Information Systems (GIS) and integrating local TEK** governments can make informed decisions that maximise ecological benefits and minimise adverse impacts. In addition, there is a need to better understand the carbon and water content and dynamics in the ecosystems in question so that the **services provided can be adequately quantified, with agreed scientific models and methodologies**.

Lastly, this report underscores the **critical role of private investments in closing the financial investment gap into NBS and advocates for innovative financial instruments** for the successful implementation and scaling of NBS. While NBS are increasingly recognised for their long-term economic benefits and effectiveness in addressing pressing environmental challenges, including the cost avoidance of natural hazards, this potential remains largely unrealised.

As the findings of our report show these barriers cannot be overcome by only directing financial measures to closing the knowledge and capacity gap or by enabling effective and coherent governance models. Instead, it is vital to also address two specific challenges related to leveraging private investments: the difficulty of economically quantifying ecosystem services and generating short-term financial returns for investors, and concurrently, the high upfront costs perceived by project implementors, and the delayed financial returns associated with NBS implementation due to longer regeneration times. Addressing these barriers is essential to unlock the necessary capital to scale NBS and align their benefits with private sector investment. To address these challenges, this

report identifies **public private financing models** as a critical mechanism to bridge the NBS funding gap. These finance models combine public and private capital, enabling the distribution of risk while incentivising private sector participation.

Environmental Impact Bonds (EIBs) stand out as a promising financing tool for NBS due to their ability to align financial returns with ecological success. By linking investor returns to measurable environmental outcomes, they effectively attract private capital for NBS projects that generate both environmental and economic value. Their scalability and focus on monetising ecosystem services make them especially suitable for initiatives with tangible and time-bound benefits, such as water quality improvement or carbon sequestration. Moreover, EIBs reduce financial risks for public entities while incentivising innovation, enabling long-term sustainability through mechanisms like carbon credits and ecological benchmarks. This combination of financial innovation and ecological accountability positions EIBs as a transformative solution for bridging fundings gaps in NBS projects.

Concessional financing blends public and private capital to lower the financial risks and costs of NBS projects. Using public guarantees, low-interest loans, or grants, these models reduce borrowing costs and de-risk investments, making them more appealing to private investors. By leveraging public funds, concessional financing supports large-scale NBS initiatives, such as ecosystem restoration or climate resilience, that require high upfront investments but generate long-term benefits. This approach ensures financial sustainability while enabling broader participation from the private sector, fostering scalable and impactful NBS solutions.

In addition to these financial instruments, this report emphasises the need to strengthen the institutional and policy frameworks that underpin NBS financing. Moreover, capacity-building initiatives are essential to equip local stakeholders with the technical and financial expertise needed to develop, implement, and manage NBS projects effectively.

Ultimately, by leveraging innovative financial instruments such as EIBs and blended finance models, alongside capacity-building and stakeholder engagement efforts, NBS can increasingly transition from isolated pilot projects to large-scale infrastructure solutions of first choice. These mechanisms not only attract private capital but also align private financial interests with environmental outcomes ensuring a global scalability of NBS.

3.2. Limitations and Future Research

While this report provides valuable insights into NBS projects, several limitations must be acknowledged to contextualise the findings and ensure transparency.

Firstly, the research was conducted under time and resource constraints, which limited the scope and depth of the study. The findings largely rely on interviews with a small number of project managers from selected NBS initiatives. These projects were identified through a somewhat ad-hoc process rather than a systematic sampling approach, with several being rather small-scale or localised in nature. Consequently, the study cannot claim to be representative of the broader landscape of NBS projects, and the findings should be interpreted cautiously and not generalised across contexts.

Secondly, the reliance on self-reported data from interviews introduces the potential for bias. While the perspectives shared by project managers offer rich, first-hand insights, they may reflect subjective experiences or priorities specific to the projects discussed. Furthermore, this approach may not always capture the full range of challenges, practices, and perspectives from other stakeholders, such as policymakers, local community members, or private sector actors, who could not be interviewed given the resource constraints mentioned.

Another limitation stems from the focus of the study itself. The project's explicit focus was to be on identifying best practices that could inform development cooperation with third countries. However, the research predominantly examined NBS initiatives within the EU context. Given the socio-economic, political, and environmental differences between the EU and many third countries, it must be noted that the findings may not be fully replicable or directly transferable. In fact, several interviewees cautioned against simplistic replication of NBS models or solutions, emphasising the importance of tailoring solutions to local conditions, ecosystems, capacities, and governance structures.

Finally, it is important to recognise the inherent complexity of NBS projects, which involve dynamic ecosystems, diverse stakeholders, and varying regulatory environments. While the report highlights key lessons and promising practices, it cannot claim to capture all the nuances or long-term outcomes of these initiatives, some of which are still in progress.

These limitations highlight the need for further research to expand the scope and robustness of the findings. Future work should aim to include a more diverse range of projects, stakeholders, and contexts, ideally through a systematic, comparative approach. Additionally, more comprehensive data collection methods, such as longitudinal studies and cross-regional analyses, could provide deeper insights into the scalability and adaptability of NBS practices.

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Annexes

List of annexes included in this document:

- **Annex A** includes two-pagers for each case study analysed providing a brief description of the project and summarising key takeaways from the interviews.
- **Annex B** consists of a one-pager summarising the high-level recommendations for NBS projects derived from this project.

Annex A – Two-Pagers of Case Studies

PHUSICOS

Project Name: PHUSICOS – "According to nature" in Greek

Project Description: PHUSICOS implements nature-based solutions in rural and mountainous areas to reduce the risk of natural hazards such as landslides and floods. Its objective is to demonstrate that NBS are technically viable, socially acceptable, cost-effective and implementable at the regional scale. It also aims to show that the benefits of NBS are inclusive by increasing the ecological, social and economic resilience of local communities. PHUSICOS implements NBS in five case study sites, which comprise three large-scale demonstrator sites (Norway, Spain-France (Pyrenees) and Italy) and two supporting concept cases (Austria and Germany). It cooperates with a consortium of 15 partners with wide expertise and long experience coming from public authorities, research institutes and universities.

Key Objectives:

- Engage a diverse range of stakeholders through a Living Labs approach to co-design solutions for natural hazards.
- Design a comprehensive framework to assess NBS performance in risk reduction, costs, sustainability, and social acceptance.
- Explore ways to enhance the inclusiveness, fairness and effectiveness of the co-design and implementation of NBS.
- Create a knowledge co-generation platform using learning arena innovation, such as serious gaming, to share knowledge and train local decision-makers on NBS implementation.
- Establish a comprehensive evidence-base and data platform for NBS, providing a set of tools and best practices suitable for replication, up-scaling and future implementation.

Valley of Gudbrandsdalen, Norway

Serchio River Basin, Italy

Duration: 1 May 2018 - 30 April 2023

Budget: € 9 645 857, of which € 9 472 200 EU contribution under Horizon 2020[1]. Over 45% of the total budget dedicated to the NBS component[2].

[1] European Commission, Cordis, https://cordis.europa.eu/project/id/776681.
[2] PHUSICOS (2023), According to nature: Deliverable D2.4 – Nature-based solutions implemented in PHUSICOS, Ares(2023)3047469.

Key takeaways:

Knowledge and capacity

- **Interdisciplinary approach:** Both the interviewees highlighted the importance of interdisciplinary collaborations. PHUSICOS involved the integration of diverse fields, from environmental sciences to disaster risk reduction.
- **Capacity building:** Training and sharing of knowledge between local stakeholders, contractors and end users were key components. Both interviewees emphasised that many contractors and stakeholders are unfamiliar with NBS, making capacity building essential. In PHUSICOS, workshops, living labs and stakeholder involvement helped facilitate this exchange, ensuring that local actors had the knowledge to maintain the interventions post-project.
- **Scaling and Standards:** Gap in standardised tools and guidelines for contractors, which limits the scalability of NBS. The lack of widely accepted frameworks means that each project must tailor solutions to local contexts, complicating broader adoption and implementation.

Policies and governance

- **Stakeholder engagement:** Bottom-up approaches were highlighted as a central aspect of the project's success. In both Norway and Italy, stakeholders, including local farmers and landowners, were actively involved in decision-making processes, which created a sense of ownership and long-term commitment to the maintenance and success of the NBS interventions.
- **Governance Structures:** Both interviews stressed the need for inclusive and participatory governance structures. For all five major cases, a "living-lab" was created to include all the stakeholders, in order to design the project.
- **Regulatory challenges:** While there were no major regulatory barriers to implementing NBS at the policy level, the interviewees mentioned that zoning issues and national park statuses posed challenges in some regions, particularly when attempting to implement interventions in areas of high biodiversity value.

Funding

- **Private sector involvement:** Both interviewees noted the limited interest from the private sector in financing NBS projects. One of the main challenges is the lack of immediate financial returns from NBS, which are considered public goods. Insurers and private investors are hesitant due to the long-term nature of the benefits, such as reduced risk premiums over time.
- **Financial Incentives and Compensation**: To incentivise stakeholder participation, particularly landowners and farmers, financial compensation or co-benefits were necessary. For instance, in Norway, farmers were compensated by municipalities for lost crop production, which helped balance the economic impacts of NBS interventions.

AQUACYCLE

Project name: Towards Sustainable Treatment and Reuse of Wastewater in the Mediterranean Region

Project description:
AQUACYCLE aimed to bring an eco-innovative wastewater treatment technology that will consist of anaerobic digestion, constructed wetlands and solar treatment for the cost-effective treatment of urban wastewater with minimal costs of operation and maximum environmental benefits. The system aimed to treat urban wastewater efficiently with minimal operational costs and significant environmental benefits. The system used solar panels for energy, produced biogas and fertilisers, and the constructed wetlands will allow biodiversity to thrive and be a tourist attraction.

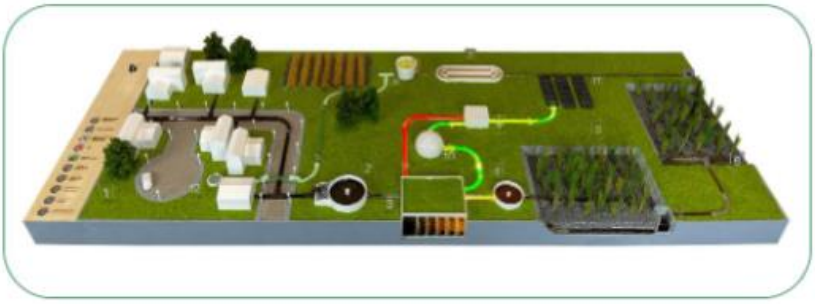
Key Objectives:

- Adapting an eco-innovative wastewater treatment technology to the Mediterranean region.
- Providing a specific system of low-cost operation and maintenance for the Mediterranean region by using solar panels for energy, produces biogas and fertilisers.
- Providing an economised biodiversity hub to be a tourist attraction.

Locations: Greece, Spain, Malta, Lebanon, Tunisia.

Duration: September 2019 – October 2023.

Budget: €2.8 million, with a €2.5 million EU contribution.



Miniature replica of AQUACYCLE's eco-innovative wastewater treatment system.

Key takeaways:

Knowledge and capacity

- **Innovative approach (APOC):** The AQUACYCLE project implemented a novel eco-innovative wastewater treatment technology, APOC, which integrates **Anaerobic Digestion**, **Photocatalytic Oxidation**, and **Constructed Wetlands**. The system aimed to treat urban wastewater efficiently with minimal operational costs and significant environmental benefits.
- **Knowledge transfer:** A key aspect of the project was the transfer of specialized knowledge to local communities, decision-makers, and stakeholders through workshops. This included training programs designed to educate local farmers and the general public on the benefits of treated wastewater reuse. Convincing local farmers was particularly challenging due to their concerns about consumer perceptions regarding crops irrigated with treated wastewater.
- **Capacity challenges:** In rural Tunisia, a lack of technical expertise and existing infrastructure remains a major obstacle to implementing such innovative systems. The lack of knowledge was namely in government agencies. The project worked closely with universities and research centres/universities. Additionally, the project contributed to a **Best Practice Database** compiled by another project (MEDWAYCAP), that solely focus on knowledge dissemination and upscaling.

Policies and governance

- **Regulatory gaps:** Tunisia lacks comprehensive policies for wastewater management in rural areas, which complicates the scaling up of NBS initiatives like AQUACYCLE. The National Sanitation Utility (ONAS) is responsible for managing wastewater projects, but its operation in rural areas is dependent on receiving sufficient funding. This creates inefficiencies in project management and execution, especially in small communities.
- **Municipality involvement:** One potential solution would be to transfer responsibility for rural sites to municipalities. However, these municipalities currently lack the necessary expertise and resources to effectively manage such projects. The interview suggested that creating a separate rural-focused agency, potentially involving private sector partnerships, could address this gap, provided there is regulatory certainty and strong governance.

Financing

- **Cost-effective solutions:** The APOC system was designed to provide a cost-effective wastewater treatment option for small and medium-sized rural communities. The system's low operational costs and reliance on solar energy for photocatalytic processes make it particularly suitable for regions with limited infrastructure and financial resources.
- **Incentives to the Private Sector:** For successful private sector engagement, financial incentives and a regulatory framework are essential.

MARA-MEDITERRA

Project Name: MARA-MEDITERRA: Safeguarding the livelihood of rural communities and the environment in the Mediterranean through NBS

Project Description: MARA-MEDITERRA is aimed at addressing the hitherto low uptake of NBS in agro-ecosystems, with 5 “hotspots” of land and water as case studies in Algeria, Egypt, Greece, Lebanon and Turkey. The selected localities are impacted by pollution, salinisation, desertification and wetland degradation. An array of already proven NBS will be co-tested, taken up into action plans and ultimately integrated with new business models and policy improvement initiatives based on the value of water and land. The project aims to introduce an effective awareness and decision-making environment through tools of diagnostic assessment and decision support and on the holistic green business development by exploring investment approaches at the international, national, and local levels.

Key Objectives:

- Promote **participatory decision-making**.
- Create **new markets**.
- Foster a more robust culture of **green entrepreneurship** and the rural economy.
- Use of **Living Labs** approach through the creation of **user-centred, open innovation eco-systems** based on a systematic **user co-creation in public-private-people partnerships.**
- **Integrating research and innovation processes in real-life communities and settings**.

Duration: 2022 - 2025

Budget: € 2 549 850

Aquaponics Green House at the Egyptian-Chinese University

Organic agriculture testimonies implemented in Malta

Key takeaways:

Knowledge and capacity

- **Centralising Knowledge:** While there is a substantial amount of information on NBS available, accessing and navigating it can be challenging, as it remains dispersed. The interviewee called for the establishment of centralised information hub for NBS resources, including guidelines, case studies, policy documents, and best practice examples.
- **Consistent Terminology:** The use of differing terms (i.e., ecosystem-based approaches, green infrastructure, natural water retention measures) create confusion and erode understanding of NBS. The project conducted a survey which showed that less than 20% of respondents grasped what NBS entails.

Policies and governance

- **Policy Integration:** The interviewee called for an improved integration of NBS into larger frameworks, i.e., the EU's Common Agricultural Policy (CAP). For instance, CAP eco-schemes exist, but NBS are not explicitly recognised or incorporated into these measures. There is a need to better align and embed NBS in existing policy frameworks at both national and EU levels. In this regard, regulatory barriers were also mentioned as an obstacle, i.e. obtaining permits, and ensuring compliance with environmental regulations.
- **Stakeholder Engagement and Capacity Building:** Throughout the entire project lifecycle, stakeholder participation is key. Implementing a Living Labs approach, the project conducted consultations with political decisionmakers and other key stakeholders through roundtables to discuss the practical aspects of implementation and output. In addition, a focus was on training knowledge multipliers in local communities and stakeholder groups. The project also put a lot of emphasis on cross-border sharing of best practices with other projects in the region and real-life community testing of NBS. The interview recommended the issuance of guidelines on how to effectively engage stakeholders, including marginalised groups, and in gender-inclusive ways.

Financing

- **Cost-Benefit Analysis:** The interviewee highlighted the importance of convincing decision-makers of the societal benefits of NBS, including quantifying the economic contributions NBS projects can make to local economies, such as through tourism, improved agriculture, and ecosystem services. Standardised indicators to measure societal involvement and the impact of NBS projects would be beneficial.
- **Case-Specific Solutions:** In Egypt, created wetlands will be commercially exploited (i.e., eco-tourism, sustainable harvesting of resources). In Algeria, the project intends to reclaim water and sludge to make the desert green again which will benefit the local economy. In Turkey, the aim is to implement measures to ensure long-term water availability, which is critical for local ecosystems and communities.
- **Private-Sector Participation:** The interview underlined the importance of engaging the private sector by creating demand for NBS with a bottom-up approach. This could be facilitated by offering financial incentives, such as credit systems (i.e., carbon credits), to encourage private sector participation in NBS initiatives.

REST-COAST

Project name: Large-Scale **Rest**oration of **Coast**al Ecosystems Through Rivers to Sea Connectivity

Brief description of the project

REST-COAST aims to implement large-scale restoration of coastal ecosystems to enhance resilience against climate change impacts such as sea-level rise and extreme weather events.

Key objectives include:

- Developing restoration techniques and tools to upscale efforts.
- Generate **new tools and data to assess risk reduction** at different climate change levels to provide consistent risk estimates.
- Design **innovative financial arrangements and bankable business plans** that support restoration upscaling.
- Develop a scalable plan for coastal adaptation through large scale restoration.
- Co-design **innovative governance arrangements and policies** to overcome present barriers to large scale restoration.
- Support the EU Green Deal social transformation and engagement.
- Engage with project stakeholders, EU Green Deal officers and international organisations **to transfer REST-COAST restoration tools, data, and expertise,** and to ensure their uptake.

The project contains 9 work packages led by different institutions.

The project spans 9 pilot sites across **11 countries (9 European countries, Israel and Turkey)**, involves 37 partner organisations, and is funded by Horizon Europe 2020 with **€17.8 million**.

Type of NBS: Coastal Wetland Restoration, River-to-Coast Connectivity.

Wadden Sea - North Sea, Core Pilot

Photo retrieved from the REST-COAST Website

Duration: October 2021 – March 2026

Budget: € 18 482 592,50, with EU contribution of € 17 823 755,75.

Key takeaways:

Knowledge and capacity

- **Capacity Building and Knowledge Transfer:** Both interviews stressed the importance of long-term collaboration and knowledge sharing. In the Wadden Sea project, stability among stakeholders and experts has been key to maintaining momentum. The interviews highlighted the disconnect between policy development and practical knowledge, and need for both bottom up and top-down approaches. The interviewees emphasised engaging stakeholders through direct communication and education, which are critical for managing the complexities of NBS.
- **Practical Lessons:** Piloting NBS before full-scale implementation has proven essential. Demonstrating the efficacy of NBS through smaller pilots has been a strategy to build trust and reduce uncertainty.

Policies and governance

- **Governance:** Effective governance in the Wadden Sea project involves a coalition of stakeholders including NGOs, local communities, and various governmental bodies.
- **Stakeholder engagement and trust building:** The strategy to connect multiple stakeholders involved direct one-on-one communication with farmers, addressing concerns about land use, particularly around issues like the potential contamination of dredged sludge used for land elevation. The approach emphasises transparency, tailored engagement, and ensuring that local communities see the mutual benefits of the project.
- **Regulatory Barriers:** Both interviews touched on the regulatory challenges posed by Natura 2000 protections, which make it difficult to implement NBS in designated conservation areas. The interviewees advocated for a shift in regulations to better account for positive habitat creation and ecosystem connectivity, which are core benefits of NBS.

Financing

- **Project funding:** The interviewees noted that NBS, while initially more expensive (requiring about 25% more investment than traditional grey infrastructure), proves to be cost-effective in the long run due to reduced maintenance costs and other long-term benefits.
- **Private and public investment:** Both interviews highlighted that much of the funding comes from public sources, However, the emphasis remains on demonstrating the long-term financial benefits of NBS to secure sustained investment. It was suggested that more quantitative evidence of the cost-effectiveness of NBS over time is needed to convince the central government to prioritise these solutions over traditional methods.

WATERLANDS

Project Name: WaterLANDS, water-based solutions for carbon storage, people and wilderness

Project Description: WaterLANDS project contributes to the restoration of Europe's wetlands, which are vital for biodiversity and ecosystem services but have heavily degraded, with 50% lost over the last century because of human activity. It goes beyond traditional restoration by integrating ecological, governance, financial, and community knowledge to create scalable and resilient restoration strategies. It also lays the foundations for scalable protection across wide areas. The project combines Action Sites for upscaled restoration efforts (Bulgaria, Estonia, Ireland, Italy, Netherlands, UK) and Knowledge Sites as sources of best practices (Austria, Bulgaria, Estonia, Finland, France, Germany, Ireland, Italy, Netherlands, Poland, Spain, Sweden, UK) to overcome challenges like socio-economic barriers, insufficient funding, and stakeholder engagement.

Key Objectives:

- Demonstrate large-scale wetland restoration.
- Identify barriers to the upscaling of restoration and how to overcome these.
- Provide integrated, co-designed solutions through multidisciplinary collaboration with a common aim of informing restoration at identified 'Action Sites'.
- Apply a community-led paradigm of stakeholder engagement and co-design or co-creation.
- Inform restoration with knowledge learned from former or existing projects and 'Knowledge Sites'.
- Provide tailored restoration and financial plans for each restoration site.
- Communicate results and create a legacy through guidelines, tools, information, knowledge, and facilities to support restoration at a continental scale.

Duration: 1 December 2021 - 30 November 2026 (in progress)

Budget: € 23 631 575, of which € 23 068 483 EU contribution under Horizon 2020[3].

Restoring the salt marsh in Venice Lagoon (Action Site)

Saltmarsh in Delfzijl, Ems-Dollard estuary (Action Site)

[3] European Commission, Cordis, https://cordis.europa.eu/project/id/101036484.

Key takeaways:

Knowledge and capacity

- **Multidisciplinary Approach**: The interviewee emphasised the need for a multidisciplinary perspective, where ecologists, hydrologists, governance experts, and public engagement specialists collaborate. He pointed out that this collaboration is not always common, and the project dedicates a **specific work package** to promote integration across different disciplines.

Policies and governance

- **Governance Challenges:** Governance remains a key challenge, particularly in contexts where national or local governments may be resistant to environmental restoration. For example, in Ireland, the Department of Agriculture was initially resistant to NBS but has been pushed by the EU to adopt new environmental payment schemes. The interviewee emphasised the importance of communicating the benefits of NBS to policymakers, both at the national and local levels.
- **Stakeholder Engagement:** One of the critical success factors in the WaterLANDS project is engaging with local communities early in the process. The interviewee discussed the use of "deliberation" with local communities, where facilitators gather feedback on what resident's value in their environment and help align this with the project's goals. This **co-creation approach** ensures that communities not only contribute to the design of NBS but are also involved in maintaining the projects.
- **Policy Implications:** The interviewee pointed out that existing policies, such as the CAP, can sometimes hinder the adoption of NBS. Convincing politicians to support NBS often requires demonstrating both environmental and economic benefits. He also highlighted the role of the Nature Restoration Law, which provides a legislative framework that encourages member states to prioritise environmental restoration.

Financing

- **Private Sector Interest:** The interviewee mentioned that private investors, particularly in the carbon and water sectors, are becoming increasingly interested in NBS. For example, tech companies with high water usage are exploring NBS to ensure long-term water supply. Additionally, private investment could be attracted through bundling carbon and water credits, which would provide a financial incentive for businesses to invest in restoration projects.
- **Economic benefits of NBS:** One of the project's key messages is that **NBS can be more cost-effective than traditional grey infrastructure.** For example, restoring a peatland might negate the need to build a large reservoir, providing significant cost savings. Demonstrating these long-term economic benefits is essential for attracting both public and private funding.

MERLIN

Project name: **M**ainstreaming **E**cological **R**estoration of freshwater-related ecosystems in a **L**andscape context: **IN**novation, upscaling and transformation

Brief description of the project

The MERLIN project commits to transformative ecosystem restoration, mainstreaming NBS for the urgent systemic change of our society. The project draws on successful freshwater restoration projects across Europe and co-develops win-win solutions through collaboration with local communities and key economies.

Key objectives include:

- **Demonstrating best-practice restoration, with 17 flagship restoration projects.**
- **Upscaling into broader landscapes.**
- **Engaging with investors and economic sectors.**
- **Win-win solutions to mainstream restoration, by closely collaborating with local communities and key economic sectors such as agriculture, water supply and the insurance industry.**
- **MERLIN Marketplace and Academy, which connects restoration actors.**

The project spans from **18 best-practice case-study** demonstrators in **15 countries** EU (Denmark, Spain, Sweden, the Netherlands, Poland, Austria, Hungary, Romania, Germany, Portugal, Finland, Belgium) and beyond (Bosnia-Herzegovina, Scotland, Israel).

Type of NBS: Fresh-water restoration through various solutions, such as reintroduction of beavers to restore the forest landscape in Sweden, to biological invasion control and restoration of the floodplain forest in Portugal.

Duration: October 2021 – March 2026

Budget: € 22 097 115,57, with EU contribution of € 21 245 938,88

Beaver re-introduction case study in Sweden

Danube floodplain Hungary case study

Key takeaways:

Knowledge and capacity

- **Capacity Building and Knowledge Sharing:** The project includes the **MERLIN Academy**, which provides educational modules to help restoration actors acquire the skills and resources needed to implement NBS. The Academy aims to become a central hub for fresh-water restoration knowledge dissemination. MERLIN also features a **marketplace,** where service providers can offer innovative solutions related to fresh water.
- **Challenges in Communication:** A major barrier to the success of NBS projects is poor communication and coordination between different disciplines and stakeholders. The success of NBS projects is closely linked to effective communication, multidisciplinary collaboration, and dedicated coordination.

Policies and governance

- **Stakeholder Engagement:** MERLIN places significant emphasis on engagement through **Communities of Practice**. These communities involve economic sectors such as agriculture, navigation, insurance, and water supply. The project has organised multiple rounds of stakeholder consultations, beginning with discussions on what NBS entails and concluding with creating agendas to upscale NBS across sectors. Stakeholder mapping is an important tool for ensuring that all relevant actors are involved in the decision-making process.
    - One of the project's key challenges is engaging landowners, who are often reluctant to change their practices.
    - Co-creation with local citizens is less emphasised in this context, as the focus is more on economic sectors and land management.
- **Nature Directives as Incentives:** MERLIN has found that Directives such as Natura 2000 act as incentives for restoration projects. These directives help drive the restoration of ecosystems that do not yet meet their desired status, and the benefits of NBS are often visible in this context.

Financing

- **Private Sector Engagement:** While the private sector shows some interest in NBS, particularly for water and carbon credits, private investment is still far from meeting the project's needs. The interviewee mentioned that finding private investors who see a clear business case in NBS is challenging. The project continues to explore how to demonstrate the long-term benefits of NBS to potential investors. It was also noted that while there is interest from some private sector actors, such as Coca-Cola and Intel, securing private funding for NBS remains difficult.
- **Economic Benefits and Cost-Benefit Analysis:** The project has highlighted the economic benefits of NBS, especially in terms of public benefits like flood mitigation and water management. However, in some cases, such as in the Netherlands, the high cost of land can reduce the financial attractiveness of NBS compared to other options. MERLIN emphasises the need to balance public benefits with financial feasibility when considering NBS.

NATURVATION

Project name: NAT-ure based Urban innovation.

Brief description of the project:

Nature-based Urban innovation was a 4-year project, funded by the European Commission and involving 14 institutions across Europe in the fields of urban development, geography, innovation studies and economics**.** It sought to develop our understanding of what nature-based solutions can achieve in cities, examine how innovation can be fostered in this domain, and contribute to realising the potential of nature-based solutions for responding to urban sustainability challenges by working with communities and stakeholders.

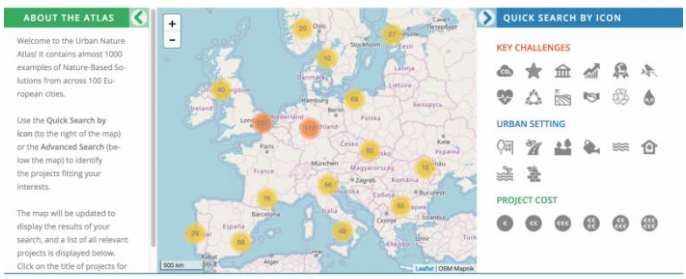
One of the outputs of the Naturvation project was the Urban Nature Atlas, which sought to collect evidence on NBS in order to provide a basis for the analysis of socio-economic and innovation patterns in Europe. It also sought to provide an interactive platform via which inspiring cases of NBS could be showcased and accessed.

Key Objectives:

- Establishment of urban-regional partnerships and best practice exchanges with strategic urban government, business and civil society organisations in six cities (Barcelona, Utrecht, Leipzig, Malmö, Gyor, and Newcastle).
- Creation of a knowledge-hub through the 'Urban Nature Navigator' to assess potential contributions of NBS to meet various urban sustainability challenges.
- Launch of a Massive Open Online Course (MOOC) on urban NBS, including the release of podcasts, films and blogposts.
- Publishing of reports with comparative analyses on NBS implementation across the diverse national contexts in the Netherlands, Sweden, the UK, Spain, Germany, Hungary and the EU – these include analyses as to how factors vary from across the regulatory, financial and urban development domains.

Duration: November 2016 – May 2021.

Budget: € 7 797 877,50 funded by the EU.



Urban Nature Atlas website preview

Key takeaways:

Knowledge and Capacity

- **Essential Skills and Knowledge:** The interviewee emphasized the importance of having a "champion" to drive NBS projects forward and ensure they remain aligned with local needs. It is also critical for local authorities to have expertise in waste management, urban design, and citizen engagement. NBS practitioners, from city planners to local residents, must understand both the environmental and societal benefits of NBS .
- **Strategic Foresight:** A key gap in knowledge is understanding how NBS can address future risks posed by climate change. Research should focus on translating risks into practical planning scenarios, not just from a risk perspective but also by promoting the co-benefits of NBS, such as creating recreational spaces for children. The long-term success of NBS projects requires anticipating future challenges while emphasizing their immediate social benefits.

Policies and Governance

- **Governance Structures:** The interviewee highlighted that projects often need both private and public sector involvement to be sustainable, especially for large-scale projects. NBS should also aim to deliver benefits for diverse groups within communities, ensuring that projects are fair, inclusive, and avoid green gentrification.
- **Stakeholder Engagement:** The interviewee pointed out that community engagement should not focus solely on marginalised groups; it must also involve actors who hold significant responsibility, such as businesses and landowners. Balancing marginalized voices with those who have decision-making power is essential for creating inclusive NBS projects.
- **Barriers to Scaling**: One structural barrier to scaling NBS is the **perception that green infrastructure should only replace grey solutions.** However, the interviewee argued that NBS requires different financing structures and governance approaches. Policymakers need to be convinced of the multiple benefits that NBS can offer, not just in environmental terms but also in health, recreation, and urban resilience.

Financing

- **Private Sector Involvement:** Involving the private sector is critical for the long-term sustainability of NBS.
- **Financing Mechanisms:** One challenge highlighted was that NBS projects often struggle to access financing, especially when the benefits are diffuse or indirect. It was suggested looking at projects like the **Cape Town Water Fund**, where companies like Coca-Cola and Nike finance NBS to safeguard water resources they depend on. She recommended moving beyond cost-benefit analyses and demonstrating the long-term value of NBS to the public and private sectors.
    - It was suggested that public mandates from prominent figures or organizations can play a key role in advancing NBS. Examples were provided, such as the **Nature Conservancy Water Funds,** where private companies dependent on public goods like water (e.g., Coca-Cola) contribute to financing NBS.

SAND MOTOR

Project Name: Zandmotor (Sand Motor)

Project Description: In 2011, a large peninsula/artificial sandbank was constructed off the coast near The Hague, using 21,5 million cubic meters of sand. Ocean currents, wind and waves are gradually spreading the sand along the coast and into the dunes. It was deemed as a success, as after its initial duration of ten years, evaluation showed that the coast was wider, that the dunes were growing and that leisure visitors frequented the area. The project has also contributed to knowledge development about coastal management and maintenance, and inspiring other coastal protection projects worldwide.

Key Objectives:

- **Reinforce the coastline** in the long term to prevent flooding and improve coastal safety.
- Create an **attractive area for leisure and nature**, improving the quality of life of local communities.
- **Assess, monitor and generate knowledge** in the innovative application of mega sand nourishments for coastal management.

Type of NBS: Coastal protection and land management, involving the use a mega-sand nourishment approach, where a large quantity of sand is deposited along the coast to allow natural forces, such as tides, waves, and wind, to redistribute it over time. This dynamic process creates new dunes and beaches, enhancing coastal resilience to rising sea levels and storm surges while also providing space for recreation and biodiversity.

Duration: 2011 – 2021 (as a pilot) and 2023-2028 (as a use case in the Interreg project MANABAS COAST funded by the North Sea Region Programme, focused on the widescale application and implementation (mainstreaming) of NBS in coastal systems of the North Sea Region by developing a proven and accessible framework, tools, guidelines based on pilot examples)

Budget: approximately between €50-70 million

Interviews:

- Technical Advisor, Deltares (site visit on 25/10/2024).
- Project Coordinator, Dutch Ministry of Infrastructure and Water Management (06/11/2024).

Figure 1 The Sand Motor after construction in 2011.

The Sand Motor after completion of the "pilot" project in 2021, as well as a depiction of the shoreline as of 2024.

Key takeaways

Knowledge and Capacity

- **Capacity Building and Knowledge Development:** Knowledge institute Deltares played a critical role in research, capacity building, and stakeholder alignment through monitoring and data-sharing, collaborating also with other research institutions. Innovative tools such as ecosystem-based modelling and environmental impact assessments were employed to track the Sand Motor's effects on sediment movement and ecological health.
- **Long-Term Monitoring and Adaptive Management:** As conditions changed, the monitoring programme informed decisions by project owners, particularly as the lagoon gradually filled in due to natural sand redistribution. This adaptive management illustrates how NBS projects can balance ecological and social needs through ongoing knowledge integration and flexibility.

Governance and Stakeholder Engagement

- **Conducive Policy Framework**: The Sand Motor benefited from the strong enabling policy framework in the Netherlands (i.e., Dutch Water Act, National Water Plan, and the National Policy Strategy for Infrastructure and Spatial Planning), which emphasises sediment-based coastal protection and promote adaptive, nature-driven solutions as alternatives to grey infrastructure.
- **Collaborative, Formalised Governance**: A steering group led by the Ministry of Infrastructure and Water Management and the Province of South Holland regularly met with other key players. This effort allowed to manage both the protective and recreational benefits of the Sand Motor, addressing needs for safety, ecological health, and community use. Today no longer a "pilot," the ownership and maintenance hast shifted fully and solely to the Ministry. As a result, conflicts have arisen over competing priorities, such as the Province's focus on recreation and the Ministry's emphasis on ecological stability, as well as uncoordinated interventions. This underscores the importance of formalised, ongoing governance structures to manage NBS projects beyond their pilot phases.
- **Community Engagement and Public Safety**: Public engagement included informational outreach and community feedback sessions to address safety concerns, such as currents and quicksand, that emerged as the sand spread. Input from local communities, beach pavilions, and recreational stakeholders helped refine safety measures like lifeguard placements and signage.

Financing

- **Stable Public Funding and Cost-Effectiveness:** The Sand Motor's construction cost approximately €50 million funded through a reserve fund established by Dutch law to support crisis-related projects. The project also leveraged economies of scale, negotiating favourable conditions when contracting dredging companies that were already working nearby, further reducing costs by leveraging pre-existing resources and equipment. The Ministry initially expected to invest another €50 million for further nourishment after 20 years, but current data suggests the Sand Motor may last 30-40 years, thus proving to be cost-effective in the long term. Although a comprehensive economic evaluation is pending, initial indicators suggest that the Sand Motor is a financially viable NBS model that could inform similar projects globally.
- **Limited Private-Sector Engagement**: The "pilot" designation created hesitation among businesses, as they perceived the project as unproven. While kitesurfing schools and beach pavilions benefited from the Sand Motor's recreational spaces, attempts to solicit financial support for visitor amenities were unsuccessful.

Other interviews (non-NBS case studies/projects)

Besides having conducted interviews with NBS case studies, the project team has also interviewed other stakeholders due to their relevant experiences in regard to NBS. These included interviews with representatives from the Ministry of Public Administration and Regional Development of Hungary; and from the Wayapa Wuurrk community.

Ministry of Public Administration and Regional Development of Hungary

Interview with a representative from the Ministry of Public Administration and Regional Development of Hungary, for the experience with fostering awareness of Nature Based Solutions for local and regional authorities in Hungary. The interviewee highlighted two key projects LIFE LOGOS 4 WATERS and NBS4LOCAL, both of which focus on implementing small-scale water related NBS in local municipalities.

NBS4LOCAL

Project name: Adopting Nature-Based Solutions to Improve the Climate Resilience of Local Governments

Brief description of the project

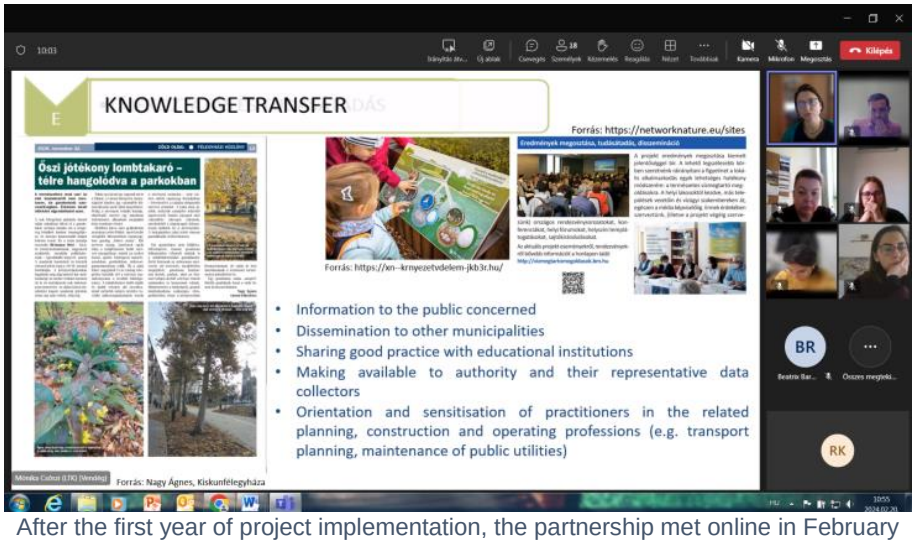
This project aims to contribute to the integration of NBS into national or regional policy instruments, ensuring that local authorities view them as viable tools for development. In this project, partners gather good practices related to NBS in their specific areas.

Key objectives include:

- Explore how different methodological solutions can be further developed and aligned with sectoral planning tools;
- Mainstream NBS coordination among local governments;
- Developing quantitative indicators to measure the of NBS agendas.

Duration: March 2023 – May 2027

Budget: €2 039 442,45, of which €1 819 180 are funded by the Interreg Europe



After the first year of project implementation, the partnership met online in February 2024 to review implementation progress and results achieved.

Key takeaways:

Knowledge and Capacity

- **Capacity Building for Local Municipalities:** A recurring challenge for local municipalities in Hungary is a **lack of knowledge and competence** regarding NBS. The Ministry plays a role in addressing this by organising regular training sessions. The first type of training covers the basics of NBS, while more advanced training focuses on planning, financing, and stakeholder cooperation. Local municipalities often lack the capacity to navigate complex projects and funding mechanisms, making **training in financial planning** crucial.
- **Stakeholder Engagement and Cooperation**: A major challenge is **fostering cooperation between local authorities and other stakeholders**. Local authorities often struggle to work together, and the Ministry acts as a facilitator. This requires specific skills in moderating and managing stakeholder engagements, something that local governments frequently lack.
- **Role of Municipalities**: Local municipalities play a crucial role in implementing NBS projects but are often constrained by **limited financial and technical capacities**. Local governments should be equipped with the capacity to secure and manage long-term funding. Moreover, competition between municipalities can hinder knowledge sharing.

Policies and Governance

- **Governance Challenges:** Governance structures are often hindered by changes in government and short-term thinking driven by election cycles. **Long-term projects like NBS need to transcend political changes,** and cooperation at the professional level is often more stable than at the political level. Local governments also have difficulty in **accessing EU funding** because they lack the capacity for direct applications.
- **Legislation and Policy Recommendations**: While European legislation offers several tools that could support NBS, Hungarian legislation is not yet fully aligned. There is a strong need for policy changes that integrate NBS into larger infrastructure projects, which currently focus on grey solutions.
- **International Project Models:** The NBS4LOCAL project explores successful models from other European countries, such as the Blue Deal in Belgium, which involves written agreements between stakeholders for managing water resources. The project also looks at innovative funding mechanisms like citizen-financed projects in Finland, where residents can contribute to preserving natural areas.

Financing

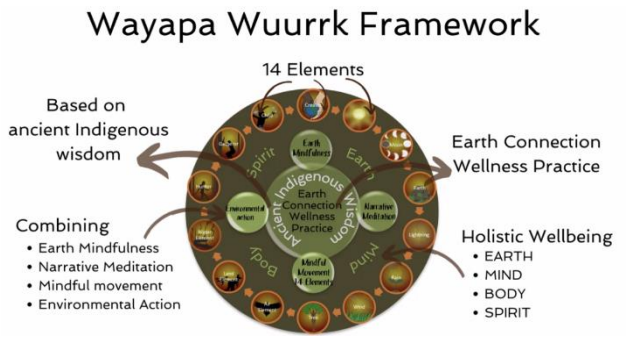
- **Funding and Project Success:** One of the key barriers to scaling NBS in Hungary is the **lack of financial capacity** at the local level. Many municipalities have just enough funding for basic operations and rely heavily on external funds (e.g., EU funds) for development. The interviewee highlighted the importance of 100% funding for municipalities, similar to what exists in other European countries like Spain.
- **Long-Term Financing Needs:** A major issue for Hungarian municipalities is the lack of long-term funding structures for NBS. While short-term EU projects provide some support, there is a need for a more sustainable financial model that includes national funding. This gap in long-term financing limits the potential for larger, multi-country NBS projects that could have a broader impact.

Wayapa Wuurrk

What is Wayapa Wuurrk? Wayapa Wuurrk is an internationally accredited Earth Connection Wellness Practice rooted in the wisdom of Indigenous Australian traditions. It derives its name from the Maara and GunaiKurnai languages, meaning “Connect to the Earth.” Developed by Jamie Thomas (First Nations Australian/European ancestry) and Sara Jones (Celtic/Canadian ancestry), it represents the first Indigenous Wellbeing Modality recognised by the International Institute for Complementary Therapies. Wayapa combines mindfulness, storytelling, physical movement, and environmental action to foster holistic wellbeing for individuals and the planet.

What Does Wayapa Wuurrk Do? The practice centres on the interconnectedness of life through the "14 natural elements," teaching participants to reconnect with nature, honour ancestral wisdom, and embrace their roles as Earth stewards. It integrates ancient ways of knowing, being, and doing into modern life, encouraging participants to live regeneratively, for future generations. Wayapa’s activities include:

- **Workshops and Training:** Offered globally online and in-person, including programmes for children, educators, and corporate groups.
- **Community Engagement:** Partnerships with schools, rehabilitation centres, aged care facilities, and environmental organisations.
- **Collaborative Research:** Collaborates with academic institutions, such as Deakin University in Melbourne, to integrate Wayapa into Western therapeutic frameworks like Cognitive Behavioural Therapy (CBT).



Key Objectives:

1. **Reconnecting People to Nature:** Cultivating deep, meaningful relationships with the Earth through mindfulness, movement, and ancestral narratives.
2. **Promoting Collective Wellbeing:** Viewing individual and planetary health as interdependent and fostering generational wellness.
3. **Integrating Indigenous Wisdom:** Bridging traditional and modern approaches to environmental stewardship and personal wellness.

Relevance to NBS: Wayapa Wuurrk aligns seamlessly with the principles of NBS, offering a unique perspective that integrates Indigenous wisdom into sustainable practices. By emphasising reciprocal relationships with the Earth, Wayapa complements NBS efforts to address ecological challenges such as climate adaptation and habitat restoration. It provides:

- **A Regenerative Approach:** Moving beyond sustainability to ensure long-term ecological health.
- **Cultural Relevance:** Tailored tools and practices that resonate with diverse communities.
- **Holistic Impact:** Enhancing physical, mental, and spiritual wellbeing alongside environmental recovery.

Key Takeaways

Unlike other interviews, which tended to focus on technical aspects (e.g., financing, governance), this interview introduced the concept of deep reciprocity and cultural respect for nature. It highlighted that NBS should not only be about solving immediate environmental issues but also about healing the relationship between people and the Earth. In essence, the interview with Wayapa practitioners contributed a vital cultural and spiritual lens to the broader discussion of NBS, advocating for inclusive, long-term, and relational approaches to environmental restoration.

Recommendations for Inclusive NBS Approaches:

- **Indigenous Wisdom as a Tool for NBS:** The interview emphasised the need to integrate Indigenous wisdom into modern NBS frameworks. There is strong evidence that when people care for nature, nature responds. The interviewees suggest that many solutions to modern environmental challenges already exist within Indigenous cultures - they simply need to be recognised and applied.
- **Community Involvement and Long-Term Thinking: Wayapa** practitioners advocate for thinking in terms of generations rather than just short-term outcomes. This mindset aligns with sustainable NBS approaches, where the benefits are designed to last far into the future, benefiting ecosystems and human communities alike.
- **Accessibility and Application:** Indigenous knowledge, according to Wayapa practitioners, is often overlooked in mainstream NBS approaches. However, there are few barriers to sharing this knowledge globally - online platforms and workshops are excellent tools for reaching wider audiences. Wayapa itself is an accessible practice, offering both well-being and NBS through mindfulness.
- **Breaking Down Hierarchies:** One key challenge is dismantling hierarchies that separate people from nature. The interview called for a shift from hierarchical decision-making to a more circular, inclusive approach, where all voices - especially those of Indigenous peoples - are heard and respected. A key recommendation was the use of yarning circles which are a traditional Indigenous practice used to foster open, respectful dialogue and the sharing of knowledge, stories, and experiences. They are grounded in Indigenous Australian culture and are used as a method of communication that promotes equality, inclusion, and deep listening.

RECOMMENDATIONS

FOR NATURE-BASED SOLUTIONS PROJECTS

01. Knowledge and Capacity

- Establish information hubs to provide accessible and updated information on NBS, including guidelines and best practice examples.
- Include academic and research institutions in project monitoring and evaluation, to support data-drive decision-making
- Development of targeted capacity-building programmes for project managers, municipalities and local stakeholders.

02. Governance and Stakeholder Engagement

- Formalise governance agreements to provide stability across political cycles
- Highlight cost-effectiveness and long-term benefits to secure political commitment and funding
- Foster co-governance structures to share decision-making power and align diverse stakeholder interests.
- Actively include Indigenous Peoples, and local communities in governance and decision-making processes

03. Finance

- Increase Public-Private financing models for high-cost NBS projects.
- Leverage Environmental Impact Bonds (EIBs) by linking investor returns' directly to measurable ecological outcomes.
- Enable concessional financing in order to reduce financial risks through the lowering of borrowing costs through public guarantees
- Continue investing in capacity-building to support NBS financing and implementation.
- Possibly force companies to contribute financially to ecosystem protection through regulatory frameworks by making it mandatory for companies to consider NBS solutions.