

Nature-based Solutions for Coastal Resilience in Europe and beyond

Lessons from Case Studies

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The Infrastructure & Nature pillar, one of the three strategic pillars of GIB, drives the integration of nature into infrastructure systems, enabling communities and ecosystems to thrive in harmony.

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Disclaimer:

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About the report and its objectives

This report provides an overview of the potential and practicalities of Nature-based Solutions (NbS) for coastal protection. The report's primary aim is to identify and highlight enabling factors that support successful NbS implementation, drawing from a global review of case studies.

By analysing patterns, barriers, and enablers in diverse settings, the report offers practical recommendations to mainstream NbS in policy and practice. The focus is on actionable insights for policymakers, practitioners, and coastal managers, emphasising collaborative governance, technical excellence, robust monitoring, innovative finance, and policy integration.



The opportunity of applying NbS for coastal protection

Coastal zones are increasingly threatened by sea-level rise, extreme weather, and ecosystem degradation – risks exacerbated by climate change and unsustainable human activity. NbS present an effective response, leveraging the protective and restorative functions of ecosystems such as sand dunes, salt marshes, seagrass meadows, and artificial reefs. These approaches not only reduce coastal erosion and flood risk but also deliver a suite of co-benefits, including biodiversity support, carbon sequestration, recreation, and local economic development.

- **Flexible and adaptive:** NbS can evolve with changing conditions, enhancing long-term resilience.
- **Cost-effective:** Compared to traditional “grey” infrastructure, NbS often require lower capital and maintenance costs.
- **Multi-benefit:** NbS support e.g. biodiversity, climate mitigation, fisheries, tourism, and community well-being.
- **Urgency:** With the intensification of coastal hazards, integrating NbS into coastal management is an urgent necessity.





Challenges for the implementation of NbS for coastal protection

Despite clear benefits, several challenges can hinder the mainstreaming of NbS. There is often a preference for traditional, technical approaches, especially when safety is a priority. Governance around NbS projects is frequently fragmented, and late stakeholder involvement can undermine project effectiveness. Consistent monitoring is also often lacking, especially regarding economic and social benefits, which limits confidence in the performance of NbS.

Funding is commonly short-term and project-specific, resulting in gaps in long-term maintenance and management. The lack of standardised frameworks for valuing and reporting benefits not only impedes comparability but also makes investment less attractive. Private sector involvement remains limited as well, due to perceived risks and vague revenue models.

Finally, there are technical challenges that differ by ecosystem, such as maintaining sufficient sediment for dunes, acquiring land for salt marshes, selecting the right sites for seagrass, and ensuring the durability of materials for artificial reefs. These issues require targeted solutions tailored to each context.



Scope and target audience

This report presents a global analysis of 88 NbS projects worldwide – focused on sand dunes, salt marshes, artificial reefs, and seagrasses – expanding upon previous studies concentrated in Europe. With particular attention to replicability and international relevance it examines a range of ecosystems and project types: from interventions based solely on natural processes and materials to hybrid infrastructure solutions that integrate ecosystem services with conventional engineering measures. The intended audience includes:

- Policy makers responsible for coastal adaptation and risk management
- Practitioners in environmental engineering, restoration, and coastal planning
- Coastal managers overseeing local and regional adaptation strategies

The findings and recommendations are designed to inform decision-making, facilitate cross-sector collaboration, and support the upscaling of NbS worldwide.



Enablers for successful implementation

The analysis identifies several key enablers essential for the effective deployment and long-term success of NbS in coastal protection:

Enabler 1: Stakeholder engagement and ownership

- Engage stakeholders early and intentionally, mapping interests and tailoring communication to build trust and acceptance.
- Foster multi-sector partnerships – public, private, academic, and community – with clearly defined roles and shared governance.
- Encourage local stewardship and align methods across projects to enable long-term maintenance, replication, and scalability.

Enabler 2: Fit-for-place technical design

- Prioritise restoration where site conditions support target habitats; design solutions to local sediment and hydrodynamic realities.
- Leverage hybrid approaches that combine natural and engineered elements to meet performance expectations and manage risk.
- Plan at the landscape scale, using scenario planning to align restoration with broader flood risk management policies.

Enabler 3: Monitoring, evaluation, and reporting

- Establish clear baselines and key performance indicators; monitor outcomes over the long term to demonstrate effectiveness.
- Embed monitoring as a contractual and budgeted requirement; use adaptive management to refine interventions as needed.
- Standardise reporting of performance and co-benefits using recognised valuation frameworks to build confidence and comparability.

Enabler 4: Finance models that scale

- Secure predictable, multi-annual funding to support long-term planning and attract co-investment.
- Utilise blended and layered finance, combining public and private capital, to de-risk projects and align incentives.
- Design projects for bankability, with clear revenue attribution, risk management strategies, and credible impact verification.

Enabler 5: Policy integration and procurement

- Integrate NbS into multi-level governance structures to ensure alignment with existing policy frameworks.
- Promote procurement processes that prioritise ecosystem restoration and favour innovative NbS.
- Facilitate scenario planning and co-management to align ecological goals with policy and community needs.



Financing of NbS for coastal protection

Currently, the financing of NbS in coastal regions still relies heavily on public funds, drawn from national, regional, and European authorities. Private investment remains limited, partly due to the lack of clear revenue models and the fragmentation of existing funding streams. A critical success factor is the development of financial models that not only clarify potential revenue but also provide insight into risk management and credible verification of achieved impact. By focusing on these aspects, it becomes easier to attract a range of investors and to successfully launch projects.

- **Challenges:** Cost data is inconsistent, and available funding is often insufficient for ongoing management.
- **Opportunities:** New financing mechanisms, such as blue carbon credits, biodiversity credits, and rewards for ecosystem services, offer prospects for additional revenue sources and shared risk. Blended finance models, in which public and private funding are combined, can be especially effective in coastal areas involving multiple stakeholders.

Making NbS projects more attractive to investors requires transparent and well-considered financial structures that address both risks and returns and offer clear evidence of the positive impact of nature restoration.



Recommendations and conclusion

To accelerate the adoption and scaling of NbS for coastal protection, the following actions are recommended:

- Prioritise early and inclusive stakeholder engagement to build trust, support, and shared ownership.
- Promote multi-sector partnerships with clear governance structures and defined roles.
- Design NbS interventions to local site conditions and favour restoration of existing habitats over new creation, where feasible.
- Adopt hybrid solutions that blend natural and engineered elements, especially in high-risk environments.
- Standardise monitoring and reporting of outcomes and co-benefits using recognised frameworks and ensure long-term funding for these activities.
- Develop innovative, blended finance models to de-risk projects and attract private sector investment, particularly in coastal areas and other multi-beneficiary settings.
- Integrate NbS into policy and procurement frameworks at all levels of governance, ensuring alignment with adaptation and risk management strategies.
- Foster capacity building among underrepresented groups and communicate clear evidence of NbS effectiveness to secure broad-based support.
- Encourage continuous innovation in technical design, monitoring technology, and finance mechanisms.

In summary, enabling factors – early stakeholder engagement, robust partnerships, tailored technical design, standardised monitoring, sustainable finance, and integrated policy – are essential for the successful implementation and upscaling of NbS for coastal protection. By prioritising these enablers, policy makers, practitioners, and coastal managers can unlock the full potential of Nature-based Solutions, building more resilient, adaptive, and sustainable coastlines for the future.

Accelerating a mainstream transition to sustainable, resilient, and regenerative infrastructure.



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