Unpacking Methods for Integrated Assessments of Nature-Based Solutions

Guideline for the European Investment Bank and public authorities

IISD REPORT

IISD International Institute for Sustainable Development

European Investment Bank

Henri Contor

March 2025

Published by the International Institute for Sustainable Development

International Institute for Sustainable Development

The International Institute for Sustainable Development (IISD) is an award-winning, independent think tank working to accelerate solutions for a stable climate, sustainable resource management, and fair economies. Our work inspires better decisions and sparks meaningful action to help people and the planet thrive. We shine a light on what can be achieved when governments, businesses, non-profits, and communities come together. IISD's staff of more than 200 people come from across the globe and from many disciplines. With offices in Winnipeg, Geneva, Ottawa, and Toronto, our work affects lives in more than 100 countries.

IISD is a registered charitable organization in Canada and has 501(c)(3) status in the United States. IISD receives core operating support from the Province of Manitoba and project funding from governments inside and outside Canada, United Nations agencies, foundations, the private sector, and individuals.

Head Office

111 Lombard Avenue, Suite 325
Winnipeg, Manitoba
Canada R3B 0T4

Tel: +1 (204) 958-7700
Website: iisd.org
X: @IISD_news

Unpacking Methods for Integrated Assessments of Nature-Based Solutions: Guideline for the European Investment Bank and public authorities

March 2025

Written by Henri Contor

Photo: iStock

Acknowledgements

This guideline was developed with the financial support of the European Investment Bank.

We would like to thank Catherine McSweeney from the European Investment Bank for her engagement throughout this process, support in providing valuable feedback, and review of the guideline.

Andrea M. Bassi, Ronja Bechauf, Edoardo Carlucci, Liesbeth Casier, Becca Challis, and David Uzsoki reviewed this report and provided valuable feedback.

Table of Contents

List of Figures

List of Tables

List of Boxes

Acronyms and Abbreviations

BCR	benefit-to-cost ratio
CapEx	capital expenditure
CBA	cost-benefit analysis
CDS	Climate Data Store
EIB	European Investment Bank
GIS	geographic information system
IPCC	Intergovernmental Panel on Climate Change
InVEST	Integrated Valuation of Ecosystem Services and Tradeoffs
NBI	nature-based infrastructure
NbS	nature-based solution
NGO	non-governmental organization
NPV	net present value
OpEx	operational expenditure
RCP	Representative Concentration Pathway
SAVi	Sustainable Asset Valuation

Introduction

What Is This Guideline About?

This guideline serves as a comprehensive resource for conducting nature-based solution (NbS) assessments, offering an introduction to NbS and their critical role in municipal projects. It provides detailed instructions at every stage of the assessment process, from identifying the NbS benefits to exploring potential financing options. The guide also includes explanations of key concepts, such as data collection methods, system mapping, and climate data analysis, ensuring users have a thorough understanding of the processes involved in evaluating NbS projects within a municipal context.

This guide caters to a diverse audience involved in project evaluation and sustainability assessment, targeting infrastructure planners, policy-makers, analysts, researchers, decision-makers, and financial institutions. Whether users are new to NbS or seasoned professionals, the guide equips them with the necessary tools and insights to effectively apply the Sustainable Asset Valuation (SAVi) methodology in their project assessments, promoting informed decision making and fostering sustainable practices.

What Are NbS?

NbS are an innovative approach to addressing societal challenges by leveraging natural processes and ecosystems. NbS encompass interventions that protect, restore, and sustainably manage ecosystems to deliver multiple benefits. NbS offer a holistic alternative to traditional—often grey—infrastructure (such as dams and drainage systems) by blending infrastructure needs with ecological sustainability.

Box 1. Definition: NbS

Among the definitions of NbS are the following:

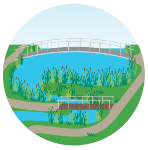
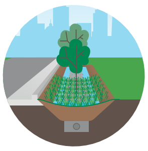
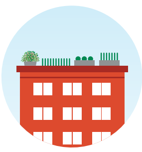
"Actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems, which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services and resilience and biodiversity benefits" (United Nations Environment Assembly of the United Nations Environment Programme, 2022, p. 2)

"Actions to protect, sustainably manage and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits" (International Union for Conservation of Nature, 2016, p. xii).

"Solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience. Such solutions bring more, and more diverse, nature and natural features and processes into cities, landscapes and seascapes, through locally adapted, resource-efficient and systemic interventions" (European Commission, n.d.).

NbS are not just theoretical concepts—they are practical applications that integrate ecological principles into real-world scenarios. These solutions utilize the inherent capacities of ecosystems to mitigate challenges such as climate change, urbanization, and biodiversity loss. By engaging with natural systems, NbS can provide cost-effective, long-term benefits that enhance resilience and sustainability. Table 1 presents various examples of NbS, illustrating their diverse applications and the multiple advantages they offer in addressing environmental and societal needs.

Table 1. Examples of NbS

NbS Type		Definition	Benefits
	**Wetland restoration**	Wetland restoration aims to rehabilitate degraded wetlands to bring back their natural functions.	Flood risk reduction, water filtration, wildlife habitat, carbon sequestration.
	**Urban parks**	Urban forests and parks involve planting trees and creating green spaces in urban areas to improve residents' quality of life.	Air pollution reduction, urban cooling, recreational spaces, biodiversity enhancement, mental and physical well-being.
	**River restoration**	River restoration focuses on improving or restoring the natural flow, ecology, and habitat conditions of rivers.	Flood risk reduction, biodiversity restoration, water quality improvement, recreational opportunities.
	**Green roofs**	Green roofs involve planting vegetation on building rooftops to provide insulation and manage rainwater.	Energy efficiency, stormwater management, air quality improvement, habitat creation.

Source: Authors.

What Role Can NbS Play?

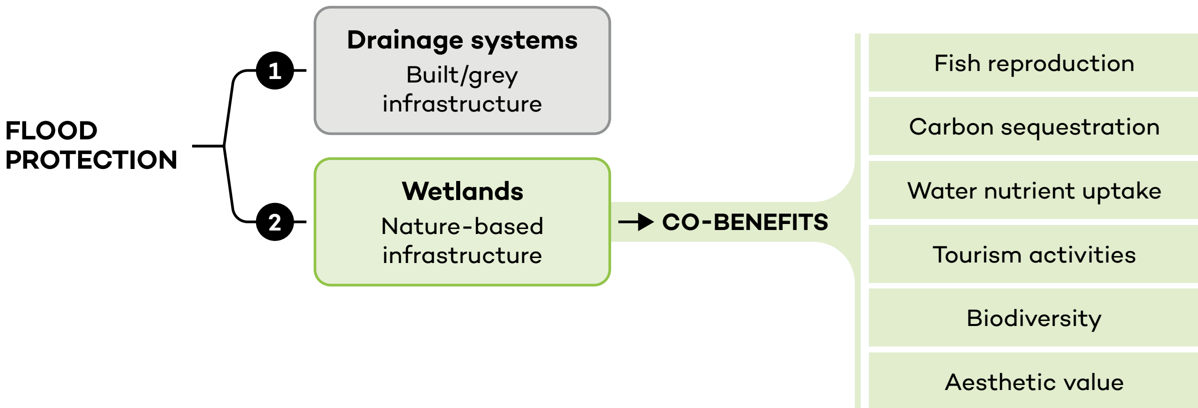
NbS play a vital role in addressing environmental challenges by harnessing the inherent functions of ecosystems to provide multiple societal benefits, as illustrated in Figure 1. They offer a sustainable alternative to traditional infrastructure by leveraging natural processes to deliver services such as flood control, water purification, and climate regulation, which not only address immediate issues but also contribute to long-term resilience. By integrating NbS into urban planning, disaster risk management, and ecosystem restoration efforts, we can simultaneously enhance ecosystem health and improve human well-being.

Figure 1. From implementation to societal gains

Source: Authors.

Unlike grey infrastructure, which tends to focus on single-purpose outcomes, NbS are multifunctional and generate a wide range of co-benefits. These solutions help create healthier, more resilient environments that support biodiversity, enhance local economies through job creation and tourism, and contribute to societal well-being through improved living conditions. The flexibility and adaptability of NbS make them particularly suited to addressing both current and future environmental and societal challenges, delivering value across multiple sectors. For example, as illustrated in Figure 2, restoring wetlands in flood-prone areas can reduce flood risks while simultaneously improving water quality, providing habitats for wildlife and supporting local recreation. In contrast, traditional stormwater drainage systems may address immediate risks but fail to deliver these additional ecosystem services.

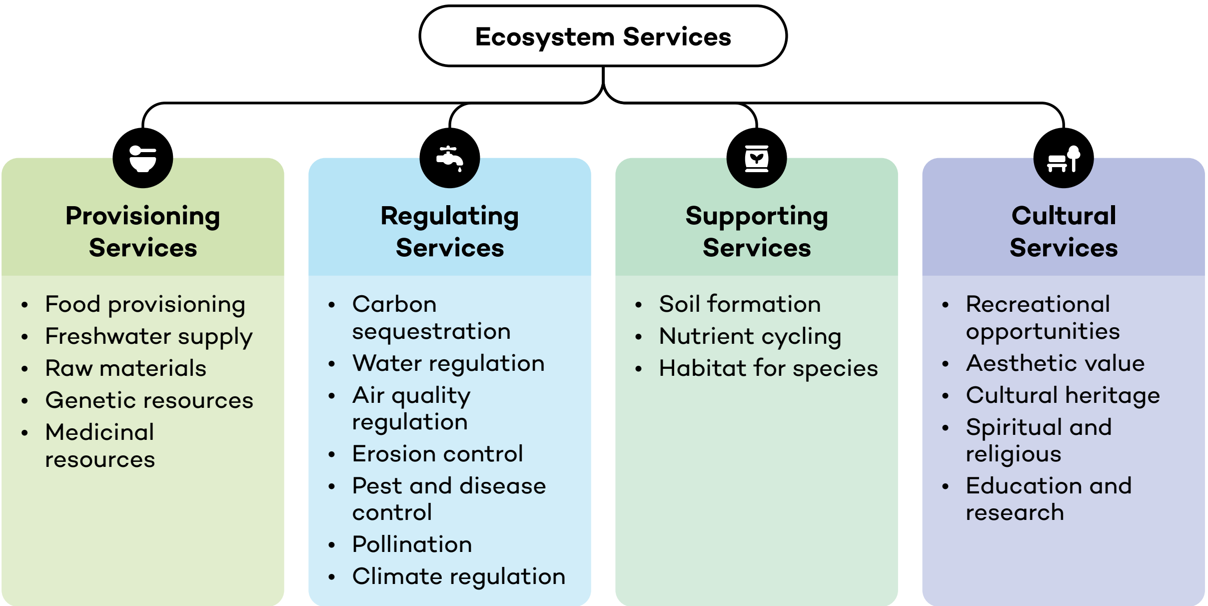
Figure 2. An illustrative example of NbS co-benefits



Source: Authors.

Ecosystem services are the benefits that humans derive from the natural environment. They encompass a wide range of ecological functions that support life and improve quality of life. These services are critical for sustaining not only biodiversity but also human health, economies, and cultures. They operate on both local and global scales, providing essential resources like food and water while also regulating climate, supporting soil fertility, and offering spaces for recreation and cultural enrichment (see Figure 3 for more examples). Recognizing the value of these services is crucial when developing NbS, as they leverage these natural processes to address societal challenges more sustainably.

Figure 3. Ecosystem services generated by NbS



Source: Authors.

How to Integrate NbS Into Projects

Integrating NbS into project development requires a structured approach to ensure solutions are both effective and feasible. This process begins with identifying the core societal challenges or risks, followed by evaluating whether NbS can address these issues in a sustainable and cost-effective way. The decision-making framework outlined in Table 2 guides municipalities and project developers through a step-by-step evaluation, from assessing the suitability of NbS interventions to conducting a cost–benefit analysis (CBA) that compares them to traditional solutions. By following this pathway, projects can ensure that NbS are thoughtfully integrated and optimized for long-term success.

Table 2. Decision tree for NbS integration

1	**Identify the problem/risk**	Are there societal issues/risks impacting the municipality?	**Yes →** Assess the magnitude and frequency of the issue.
			No → Reassess project needs/priorities.
2	**Evaluate current solutions**	Are traditional solutions in place or being considered?	**Yes →** Evaluate their effectiveness and sustainability.
			No → Consider the feasibility of NbS alternatives.
3	**Assess NbS suitability**	Is the problem suitable for an NbS intervention?	**Yes →** Proceed to define NbS conceptual design.
			No → Reassess options, consider hybrid solutions.
4	**Evaluate NbS feasibility**	Is there sufficient space, funding, and political will to implement NbS?	**Yes →** Proceed to CBA.
			No → Identify opportunities for stakeholder engagement.
5	**Conduct CBA**	What are the costs, benefits, and long-term maintenance needs of the NbS?	**Favourable benefit-to-cost ratio (BCR) →** Proceed with project formulation.
			Unfavourable BCR → Consider improving design or finding a different solution or alternative funding.

Source: Authors.

CBAs play a critical role in several stages of the European Investment Bank (EIB) project life cycle (illustrated in Figure 4), especially when integrating NbS. During the *Identification* stage, a preliminary CBA helps assess the feasibility and potential value of NbS interventions compared to traditional solutions. In the *Formulation* stage, a more detailed CBA is essential to evaluate the economic viability of the proposed NbS, ensuring the project can deliver long-term benefits relative to its costs. Finally, during the *Evaluation & Audit* stage, a retrospective CBA can help measure the actual benefits achieved, confirming the effectiveness and sustainability of the NbS implementation. This structured approach ensures that NbS are not only feasible but also provide measurable value throughout the project's life cycle.

Figure 4. Stages in the project life cycle

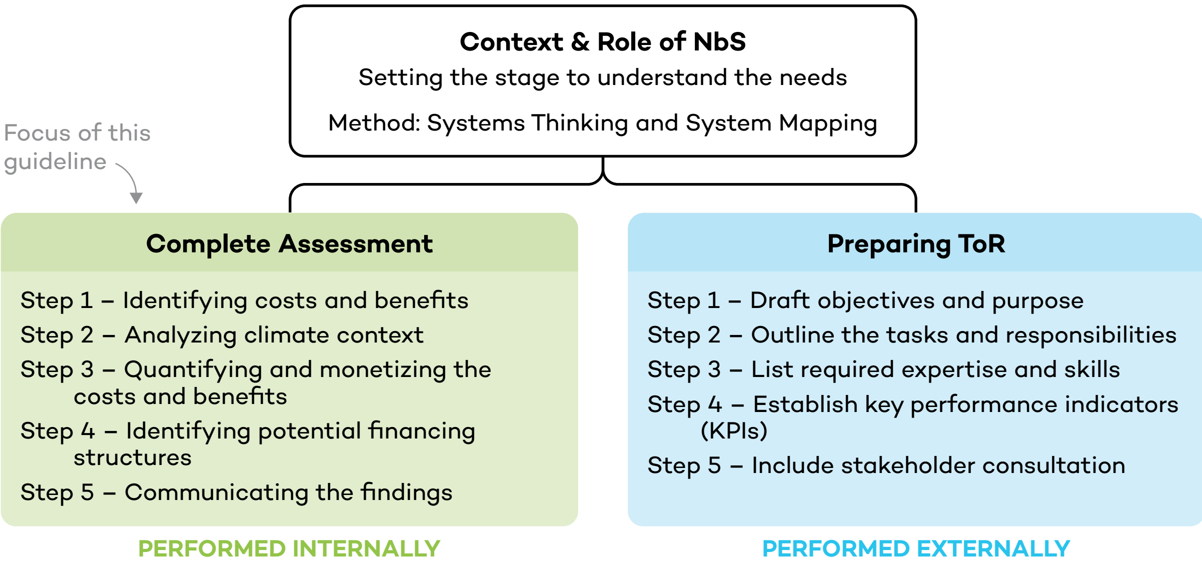
Programming	Identification	Formulation	Implementation	Evaluation & Audit
The purpose of this initial stage is to identify the vision, strategy, and objectives that a public authority or private promoter has over a specific time frame to provide a framework within which projects can be identified and prepared.	The purpose of this stage is to identify project ideas that are consistent with the development priorities and to assess their relevance and feasibility.	In this stage, the project's overall potential viability is examined using data and information gathered in a feasibility study.	In this stage, the project takes shape. It is during implementation that the project becomes visible to outsiders, to whom it may appear that the project has just begun.	In this post-implementation stage, the project's effectiveness, impact, compliance and sustainability are analyzed.

Source: Adapted from EIB.

To ensure that municipalities can effectively integrate NbS into a project's life cycle, conducting a thorough CBA is vital. Municipalities have two main options for performing this analysis, depending on their internal capacities. The first is to carry out a comprehensive internal assessment following a structured process that accounts for the full range of costs, benefits, and climate factors. The second option is to hire external experts and prepare detailed Terms of Reference to guide the contractor in delivering a robust and targeted CBA. Both approaches provide pathways to assess the value of NbS, ensuring that they are aligned with local needs. Figure 5 outlines these two options.

The present guideline focuses on the "complete assessment" process, offering detailed guidance on how to approach each step. Even when a municipality opts to outsource the CBA, understanding the complete assessment is essential. It equips the municipality with a clear framework to guide external consultants and ensure that the process meets the standards and objectives outlined here.

Figure 5. Options for conducting a CBA assessment



Source: Authors.

Figure 6. NbS assessment in the context of infrastructure planning

Source: IISD.

Note that incorporating NbS into infrastructure planning requires a cross-sectoral approach, ensuring that multiple perspectives and long-term environmental and social impacts are considered throughout the CBA process (as outlined in Figure 6). Key elements to keep in mind when conducting the CBA include engaging diverse stakeholders to capture local needs and priorities, integrating gender-sensitive approaches to address differential impacts, and utilizing climate projections to assess risks over time. Additionally, a thorough land-use and infrastructure analysis is essential to understand the interaction between existing developments and potential NbS interventions. Evaluating the ecosystem services and broader impacts of the NbS will help ensure that the solutions are sustainable, equitable, and aligned with local contexts.

For a clear example of a complete assessment, see Case Study 1. This kind of example will be provided throughout the guideline to better grasp how each step in assessing an NbS project is applied to real-world situations.

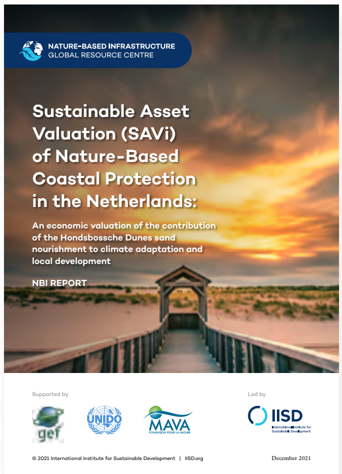
Case Study 1: Coastal Protection

Location: Netherlands

Hazard: Rising sea levels

NbS: Dune landscapes

Report: Bechauf et al., 2021.



The Hondsbossche Dunes project in the Netherlands is an example of NbS for coastal flood protection. Located along a 7-km stretch of the Dutch North Sea coast, this project was initiated when the existing sea dike no longer met Dutch flood safety standards. Rather than raising the dike, an artificial dune landscape was constructed on the seaside of the existing seawall, providing both flood protection and recreational amenities.

The dunes were designed to withstand extreme storm surges, withstanding 1-in-10,000-year flood conditions, and mitigate sea level rise for at least 50 years. Protecting over 900 ha of land, more than 60% of which is used for agriculture, the dunes also safeguard the beach resort town of Petten and nearby communities. This project has a profound impact on the lives of approximately 3,000 residents.

Beyond flood protection, the Hondsbossche Dunes offer significant co-benefits, including for biodiversity and tourism. The landscape provides diverse habitats for plants and animals, while new infrastructure, such as bike paths and recreational facilities, makes the area a magnet for visitors. Over a 50-year period, tourism revenue from the dunes is projected to increase by almost EUR 203 million, compared to EUR 103 million for a conventional dike.

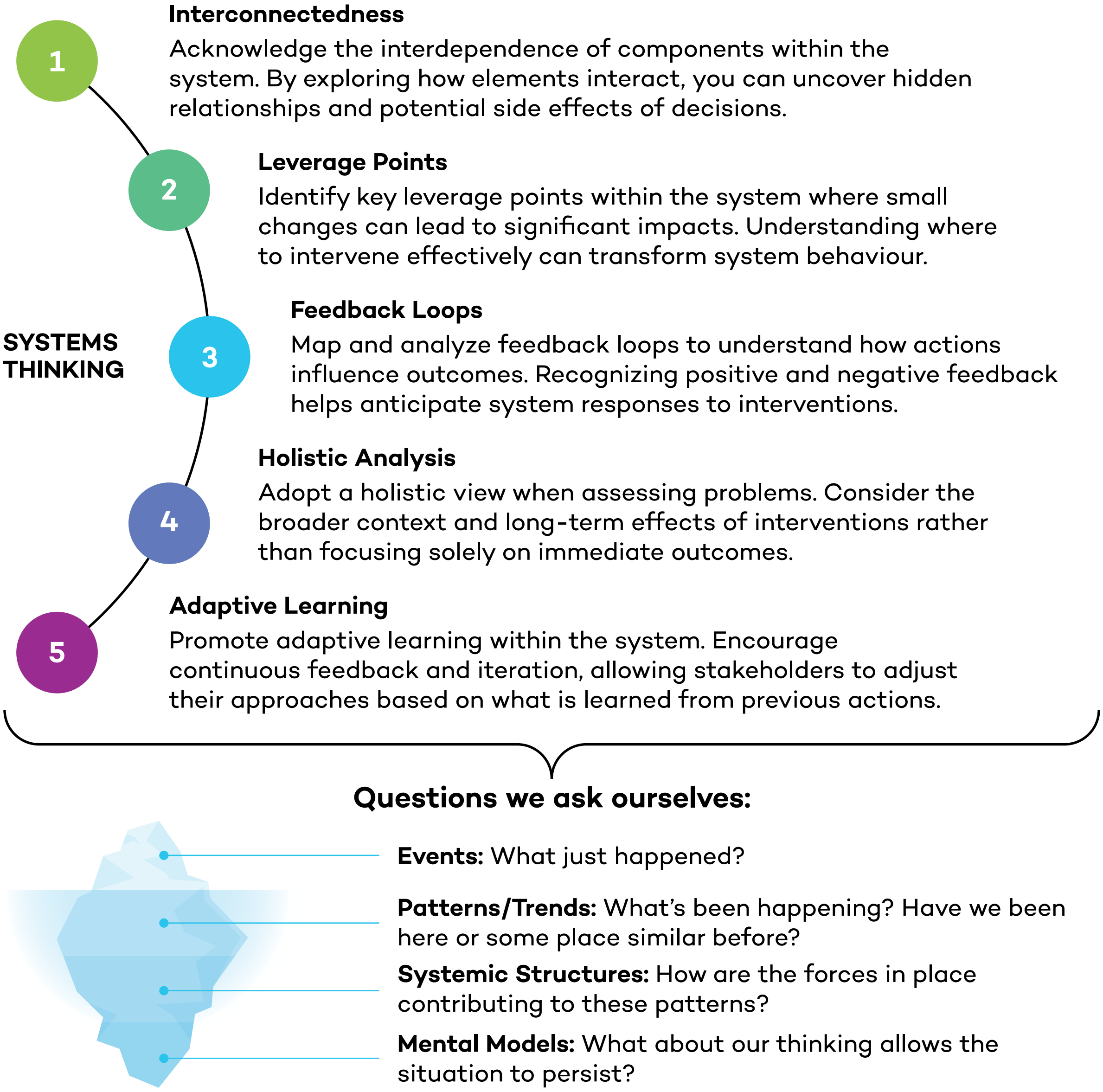
Key takeaways:

- Lower construction costs and increased tourism revenue make the dunes a more cost-effective solution.
- The dunes' flood protection capabilities provide significant avoided costs in potential flood scenarios.
- NbS, such as the Hondsbossche Dunes, offer flexible and sustainable alternatives to traditional flood protection, with long-term economic and environmental benefits.

The Context and Role of NbS

Understanding the context in which NbS will be implemented is crucial for effective decision making. To begin, it is essential to ask critical questions: What specific societal challenges or risks is the municipality facing? Are these challenges related to climate change, biodiversity loss, or social inequities? How are current solutions addressing these issues, and what are their limitations? By identifying these problems and evaluating existing solutions, project planners can better assess the suitability of NbS as a viable option. This process is not merely about finding immediate fixes; it is about understanding the complex interrelationships within the system that influence these challenges. This is where systems thinking becomes invaluable.

Figure 7. Systems thinking



Source: Authors.

As highlighted in Figure 7, systems thinking allows municipalities to view the interconnectedness of various components within a system, providing a holistic perspective that is essential for addressing multifaceted issues. Systems thinking makes it possible to identify leverage points within the system where NbS could be most effective. This approach encourages collaboration and active participation among stakeholders, ensuring that diverse perspectives are considered. The following infographic illustrates the principles of systems thinking, highlighting its significance in contextualizing NbS within the larger framework of municipal challenges.

Following the infographic, planners can delve into the practical application of systems thinking through system mapping. This method enables stakeholders to collaboratively visualize the components of the system, identify relationships, and recognize feedback loops that may not be immediately apparent. By engaging in this mapping process, stakeholders will gain insights into how different factors influence one another, facilitating a deeper understanding of the problem space. The participatory nature of system mapping fosters a sense of ownership among various groups involved in nature-based infrastructure (NBI) projects, promoting collective responsibility for addressing the identified challenges. To achieve a system map, several methods are used, including the following:

- **Participatory System Mapping/Group Model Building:** This method involves collaborative workshops where stakeholders collectively create visual representations of the system. By building models together, participants can explore different scenarios, understand interactions, and identify leverage points for intervention. Best practice is to support this process with expert consultations and a literature review.
- **Expert and Stakeholder Consultations:** Engaging with experts and stakeholders provides valuable insights into the system dynamics and potential impacts of NbS. These consultations help to identify key issues, validate assumptions, and gather diverse perspectives.
- **Literature Review:** Reviewing existing literature helps to ground the system-mapping process in established knowledge and best practices. It provides context and supports the identification of relevant indicators and metrics for assessing NbS.

Suggested additional reading:

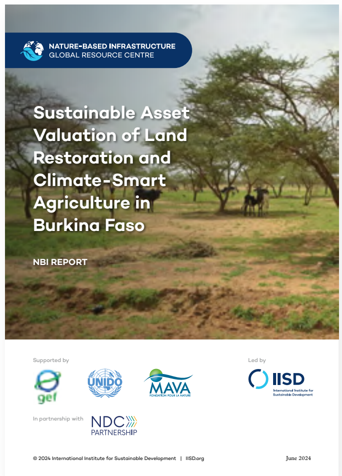
1. *Systems Mapping: How to Build and Use Causal Models of Systems*
   Pete Barbrook-Johnson & Alexandra S. Penn, 2022
   https://link.springer.com/10.1007/978-3-031-01919-7
2. *Systems Thinking for Sustainable Development: Climate Change and the Environment*
   Edward Saja Sanneh, 2018
   https://link.springer.com/book/10.1007/978-3-319-70585-9
3. *Thinking in Systems: A Primer*
   Donella H. Meadows & Diana Wright, 2011
   https://www.goodreads.com/book/show/3828902-thinking-in-systems

Case Study 2: Land Restoration and Climate-Smart Agriculture

Location: Burkina Faso

NbS: Climate-smart land and agriculture

Report: Carlucci & Guzzetti, 2024.



Burkina Faso faces severe challenges from climate change, including extreme rainfall, flooding, droughts, and land degradation. With 46% of the country's arable land already degraded, the impact on food security and rural livelihoods is alarming. To address these issues, Burkina Faso is implementing a land restoration project over 100,270 km^2 benefiting 26,071 households, with a particular focus on women's inclusion.

This report evaluates the economic, environmental, and social impacts of the project through an integrated CBA, comparing NbS, hybrid infrastructure, and grey infrastructure alternatives. The assessment includes key land restoration efforts across 6,000 ha of landscaped vegetation, 700 ha of lowland development, and 10,500 ha of assisted natural regeneration. Climate-smart agriculture practices, solar-powered irrigation systems, and conventional water storage solutions are analyzed to determine their effectiveness in enhancing agricultural productivity, water management, and food security.

Key takeaways:

- The proposed infrastructure solutions yield substantial economic returns of USD 869.57 million for NBI and USD 1.09 billion for hybrid solutions.
- Improved agricultural productivity enhances food security and reduces conflict.
- Carbon sequestration from NBI generates USD 28.1 million in avoided costs and financing opportunities through carbon credits.
- Nature-based and hybrid interventions outperform conventional grey infrastructure and provide broader environmental and social benefits. The discounted BCR of the NBI is 12.97, while the grey option only provides 4.75 over 20 years with a 3.5% discount rate.
- The scalable nature of NBI interventions offers a replicable model for combating desertification and sustaining livelihoods across Burkina Faso and similar regions.

Applying this step: "Context and Role of NbS"

The project applied systems thinking and system mapping to gain a holistic understanding of the interconnected challenges posed by climate change on agricultural productivity. By utilizing systems thinking, the project team identified key feedback loops influencing the system, such as soil erosion, extreme weather events, and land-use changes. Through system mapping, these dynamics were visualized, highlighting how soil erosion leads to declining soil quality and productivity, which in turn exacerbates flood risks and the need for further agricultural expansion. The map captured the systemic interactions between climate, land degradation, and agriculture, demonstrating how investments in NbS, like land restoration and climate-smart agriculture practices, could break the negative feedback loops, improving resilience, productivity, and well-being.

5 Steps for Evaluating NbS Projects

STEP 1: IDENTIFY COSTS AND BENEFITS

STEP 2: ANALYZE THE CLIMATE CONTEXT

STEP 3: QUANTIFY AND MONETIZE COSTS AND BENEFITS

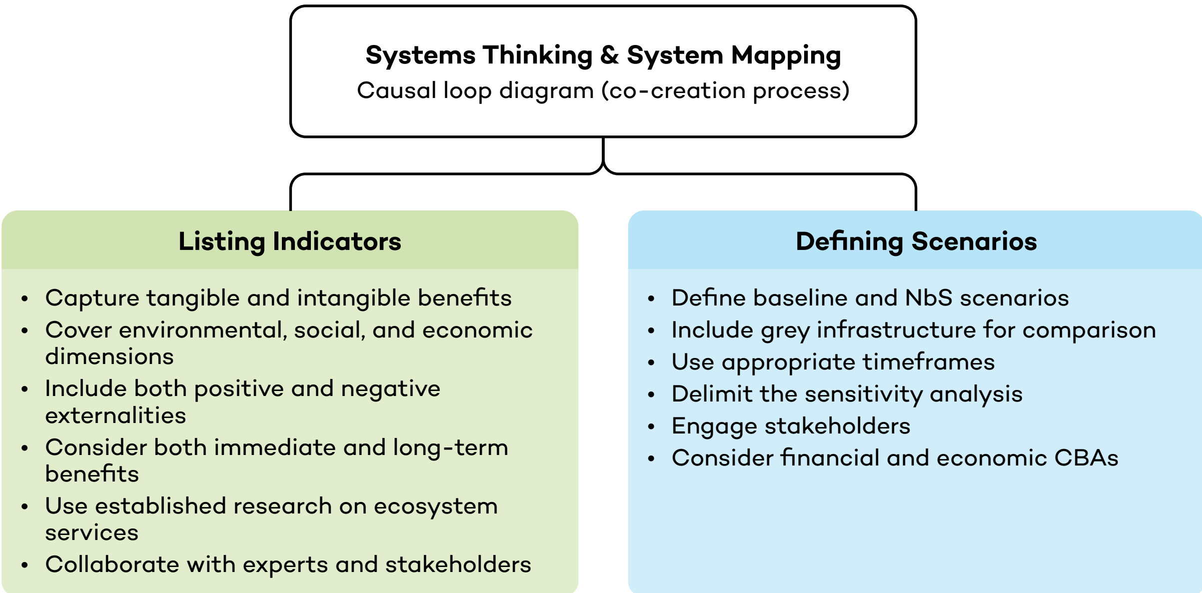
STEP 4: IDENTIFY FINANCING STRUCTURES

STEP 5: COMMUNICATE FINDINGS

Step 1: Identify Costs and Benefits

The first step in conducting a complete assessment is to identify the list of indicators and define scenarios, as illustrated in Figure 8. Once the system map is established and the underlying dynamics of the problem are clear, it becomes possible to extract the key indicators that will guide the valuation of both costs and benefits. These indicators should capture a broad range of dimensions—economic, environmental, and social—reflecting the system's behaviour over time. By reviewing variables and feedback loops within the map, planners can pinpoint factors that directly or indirectly influence outcomes, such as economic costs, ecosystem services, and social benefits. This ensures that both tangible outcomes, like reduced flood damage, and intangible benefits, like enhanced well-being, are considered in the evaluation of NbS.

Figure 8. Setting up the framework for the CBA



Source: Authors.

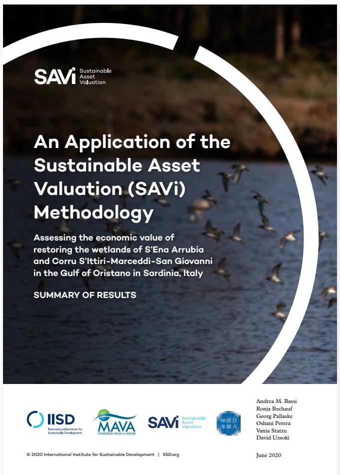
Defining scenarios builds on the selection of indicators, offering a structured way to explore potential outcomes of NbS interventions under different conditions. Scenarios help answer "what if" questions, such as how climate conditions might change or how quickly benefits may materialize. This process typically involves comparing a baseline "business-as-usual" scenario with an NbS intervention scenario and sometimes with a grey infrastructure alternative. Establishing a suitable time horizon is essential, as NbS often deliver benefits gradually, with long-term gains such as carbon sequestration and ecosystem resilience becoming more apparent over decades. Scenario definition, combined with sensitivity analysis, enables stakeholders to assess the robustness and long-term value of NbS interventions, supporting informed decision making.

Case Study 3: Wetland Restoration

Location: Italy

NbS: Wetland restoration

Report: Bassi et al., 2020.



The S'Ena Arrubia and Corru S'Ittiri-Marceddì-San Giovanni wetlands in Sardinia are vital ecosystems supporting biodiversity, agriculture, and tourism. The SAVi tool was applied at the request of stakeholders, such as the MAVA and MEDSEA foundations, to compare the wetlands' natural capital with built infrastructure alternatives and explore re-targeting agricultural subsidies for environmental improvements.

The wetlands are projected to generate EUR 306 million in ecosystem services from 2020–2060, with an additional EUR 171 million if their quality is maintained, while local governments could gain EUR 338 million (S'Ena Arrubia) and EUR 593 million (Corru S'Ittiri-Marceddì-San Giovanni) in tax revenue. However, if degradation continues, a 36%–48% loss in aquaculture labour income could occur over 40 years, and replacing ecosystem services with built infrastructure would cost EUR 92 million. Additionally, circular economy opportunities, such as reusing livestock manure for biogas, could generate EUR 81.3 million (S'Ena Arrubia) and EUR 124.2 million (Corru S'Ittiri-Marceddì-San Giovanni) in net benefits. Ecosystem services in both wetlands have declined in value due to degradation, highlighting the need to align agricultural subsidies with environmental performance to enhance ecosystem health.

Key takeaways:

- Preserving wetlands offers significant economic benefits and tax revenues.
- The cost of replacing natural services with infrastructure far exceeds maintenance costs.
- Circular economy solutions like biogas production can drive profits for local industries.
- Aligning agricultural subsidies with environmental goals could improve ecosystem services.

Applying Step 1:

The Sardinia case study involved defining key indicators and scenarios based on system mapping and ecosystem services literature. The assessment compared two overarching scenarios: continued degradation and a "no damages" scenario, where conservation efforts are implemented. Key indicators included soil erosion, nitrogen concentration, and vegetation cover, alongside the valuation of ecosystem services such as flood control, carbon sequestration, and water filtration. These indicators, grounded in site-specific data and stakeholder collaboration, allowed for a detailed comparison of the economic, environmental, and social benefits of wetland restoration versus built infrastructure alternatives.

Step 2: Analyze the Climate Context

Understanding the local climate context is a critical component of NbS planning and implementation, given the role NbS can play in climate adaptation. Climate data analysis plays a central role in identifying current and future climate-related impacts on social, economic, and environmental systems. It allows for an assessment of how NbS can mitigate climate risks, improve resilience, and deliver long-term benefits in the face of a changing climate.

Figure 9. Objectives of climate data analysis

Understand local climate impacts

This involves identifying the most significant climate-related hazards and risks specific to the geographical area of interest.

Provide data inputs for the CBA

A key component of integrating NbS into economic evaluations is translating climate data into inputs for the CBA. This requires linking climate projections to economic impacts.

Assess potential social, economic, and environmental consequences

Climate data analysis helps identify how climate hazards affect local populations, ecosystems, and economic activities.

Transfer climate risk knowledge to partners and stakeholders

Effective climate risk management depends on disseminating clear knowledge to project partners, decision-makers, and the wider community.

Source: Authors.

Data Collection

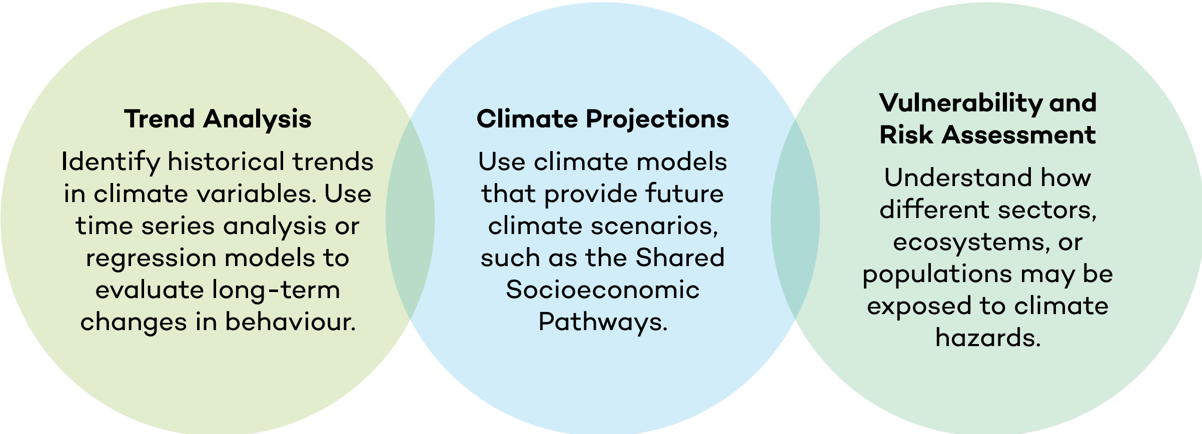
Accurate climate data is the backbone of climate risk analysis. This step involves gathering both historical climate data and future climate projections from reliable sources. One of the most valuable resources for NbS projects is the European Union's Copernicus Climate Change Service,[1] which provides a wealth of open-access data on climate variables, including temperature, precipitation, humidity, and more. Copernicus databases, such as the Climate Data Store (CDS), offer both observational data and modelled projections based on various greenhouse gas emission scenarios. Additional sources of climate data may include the Intergovernmental Panel on Climate Change (IPCC), the World Meteorological Organization, and the World Bank's Climate Change Knowledge Portal.

[1] Available at https://climate.copernicus.eu/

Data Analysis

After collecting the necessary climate data, the next step is to conduct an in-depth analysis to understand the trends, patterns, and potential future scenarios. This analysis can be both qualitative and quantitative, depending on the data type and project objectives.

Figure 10. Climate data analysis



Source: Authors.

Several tools and platforms can assist in analyzing exposure to climate hazards to support the Vulnerability and Risk Assessment process. Table 3 introduces some of these resources, each offering unique features to help practitioners assess climate risks across various sectors, infrastructures, and ecosystems. These tools provide valuable starting points for more in-depth analysis, enabling users to tailor assessments to their specific project needs.

Table 3. Toolbox for risk assessment

Tool	Tool description	More info
Global Infrastructure Risk Model and Resilience Index (GIRI)	GIRI is a publicly available probabilistic risk model to estimate risk for infrastructure assets.	Organization: CDRI https://giri.unepgrid.ch/
Fathom	Fathom is a platform that supports the understanding of present and future impacts of climate risks.	Organization: Fathom https://www.fathom.global/
Climate and Disaster Risk Screening Tools	The Climate and Disaster Risk Screening Tools offer two assessments: In-Depth for detailed risk evaluation and Rapid for faster screening. It is ideal for users already familiar with climate and disaster risks.	Organization: World Bank

Tool	Tool description	More info
CLIMADA	CLIMADA estimates economic damage from climate risks, offering global hazard data. It is open-source and available in Python.	Organization: ETH Zurich https://www.climada.tech/ & https://wcr.ethz.ch/research/climada.html
OS-Climate	OS-Climate fosters open-source collaboration to develop transparent data and tools for climate finance. It unites financial institutions, companies, and non-governmental organizations (NGOs) to accelerate climate transition through innovation.	Organization: The Linux Foundation https://os-climate.org/

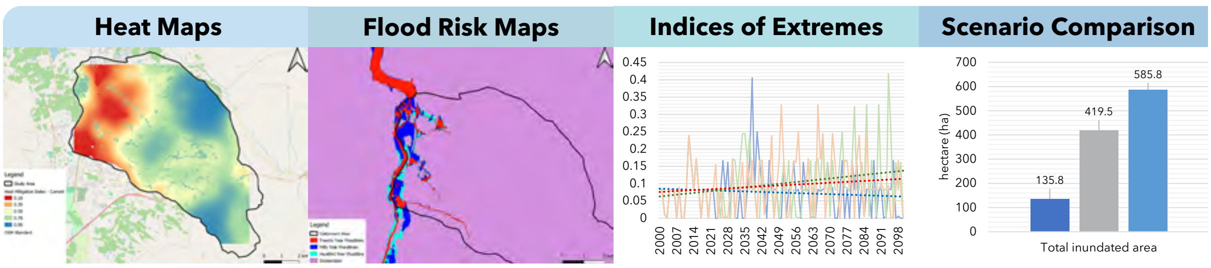
Source: Authors.

To strengthen the climate data analysis, it is crucial to compare findings with existing research through a literature review. This helps validate the results by aligning them with broader trends and insights from global or local studies. Drawing from sources like the IPCC *Sixth Assessment Report* or regional climate assessments ensures that the analysis remains robust and reflective of the latest climate science. Cross-referencing with established benchmarks supports more accurate projections, making sure that NbS interventions are informed by the most reliable data available.

Data Visualization

Data visualization is a critical step in making climate data and projections accessible to stakeholders, policy-makers, and decision-makers. Effective visualization techniques help communicate complex climate information in a clear and intuitive way, aiding in the decision-making process. Common visualizations may look like those illustrated in Figure 11.

Figure 11. Visualization of climate data



Source: Authors.

Case Study 4: River Restoration

Location: Greece

Hazard: Floods

NbS: River restoration

Report: Bechauf et al., 2023.

Thessaly, a key agricultural region in Greece, experiences frequent floods, water scarcity, and environmental degradation—challenges that are expected to intensify with climate change. Local stakeholders are exploring NbS alongside traditional grey infrastructure to address these issues.

A comprehensive CBA was conducted to assess the restoration of 1,520 ha of floodplains and riparian forests in the Pineios River basin. The study compared three scenarios:

1. **NBI:** restoration of riparian forests and floodplains.
2. **hybrid infrastructure:** NBI combined with small sediment retention dams.
3. **grey infrastructure:** dike construction for flood protection.

The assessment used the SAVi methodology, integrating spatial analysis and system dynamics to evaluate the social, environmental, and economic outcomes of each option. The results highlighted that the NBI approach delivered the highest BCR of 2.9, compared to 2.4 for the hybrid option and 1.5 for grey infrastructure.

Moreover, the NBI scenario demonstrated significant co-benefits, including improved agricultural productivity due to reduced erosion and enhanced ecosystem services, such as carbon sequestration valued at EUR 12.8 million. While grey infrastructure had lower initial costs, its long-term economic and environmental returns were substantially lower.

Key takeaways:

- NBI provided the highest BCR (2.9), outperforming both hybrid and grey infrastructure alternatives.
- NBI contributed significantly to carbon sequestration (EUR 12.8 million) and reduced sediment export, boosting agricultural productivity by EUR 4.5 million.
- Grey infrastructure, though cheaper initially, had limited co-benefits and much lower net benefits (EUR 900,000).
- Implementing NBI can deliver substantial long-term economic, environmental, and social returns, particularly in regions facing climate change impacts like Thessaly.

Applying Step 2:

The Thessaly case study assessed the projected impacts of climate change on precipitation using two climate scenarios: Representative Concentration Pathway

(RCP) 4.5 and RCP 8.5. These scenarios provided a range of possible futures, with RCP 4.5 assuming mid-century emissions peaking and RCP 8.5 projecting continued emissions growth. By simulating outcomes under both scenarios, the analysis explored how decreasing precipitation levels would affect flood risks, water scarcity, and environmental degradation in the Pineios River basin. This climate data was crucial for evaluating the long-term effectiveness of NbS and hybrid solutions compared to grey infrastructure, particularly regarding water retention, flood control, and ecosystem service provision.

Step 3: Quantify and Monetize Costs and Benefits

Quantifying and monetizing the costs and benefits of NbS is essential for providing a clear and measurable understanding of their value, which helps inform decision making and financing. The goal is to create a robust quantitative framework that assesses the long-term impacts of NbS across environmental, social, and economic dimensions. By systematically working through the stages outlined in Figure 12, practitioners can ensure that both tangible and intangible benefits of NbS are captured and compared against traditional alternatives. The holistic approach depicted in the infographic emphasizes the importance of rigorous methodologies, from quantifying physical impacts to translating them into monetary terms and aggregating results into clear decision metrics. It ultimately ensures that outcomes are adequately considered, supporting a comprehensive evaluation of the true value of NbS.

Figure 12. Steps to CBA modelling NbS

Quantification	Monetization	Materialization	Net Change Calculation	Aggregation
Measure the physical benefits of the NbS (e.g., water retained, carbon sequestered) using environmental modelling or other simulation tools to project the effects of the intervention.	Translate these physical benefits into monetary values by applying economic valuation methods like avoided cost analysis, market pricing, or willingness-to-pay studies from relevant literature.	Estimate when and how these benefits will materialize over time, often using time-based projection models to map the trajectory of the benefits in different scenarios.	Calculate the difference between the baseline scenario and the NbS scenario, applying comparative analysis to determine the added value or avoided losses.	Sum the total costs and benefits over the project's timeframe and compute key financial metrics like the benefit-cost ratio (BCR) and net present value (NPV) for decision making.

INPUTS → **OUTPUTS**

Source: Authors.

The initial step of quantifying physical benefits can be daunting, but a series of user-friendly tools have been developed by leading institutions to facilitate this process. These tools support mapping, assessing, and quantifying ecosystem services, each tailored to specific needs in ecosystem management and conservation. As illustrated in Table 4, these resources range from comprehensive platforms that integrate biophysical and economic data to specialized toolkits for site-based assessments.

Table 4. Toolbox for quantifying NbS benefits

Tool	Tool description	More info
Integrated Valuation of Ecosystem Services and Tradeoffs (InVEST)	InVEST is a free tool that maps and values ecosystem services, helping decision-makers assess tradeoffs and balance environmental and economic goals across various ecosystems.	Organization: Stanford University https://naturalcapitalproject.stanford.edu/software/invest
Toolkit for Ecosystem Service Site-based Assessment (TESSA)	TESSA is a toolkit that guides low-cost assessments of ecosystem services at specific sites, helping conservation practitioners and resource managers evaluate the benefits of nature to inform decision making. It provides methods for measuring various services and comparing current and alternative site states.	Organizations: University of Cambridge, Anglia Ruskin University, Birdlife International, UN Environment, Royal Society for the Protection of Birds, University of Southampton, World Conservation Monitoring Centre, Tropical Biology Association https://www.birdlife.org/tessa-tools/
Artificial Intelligence for Environment & Sustainability (ARIES)	ARIES is an open-source modelling platform that quantifies and maps ecosystem services. It integrates biophysical generation, flow, and extraction by beneficiaries using simulations. ARIES provides accessible modelling capabilities, uncertainty estimates, and a library of sustainability models and spatial datasets for global and local applications.	Organization: ARIES https://aries.integratedmodelling.org/
Integrated Natural Capital Accounting (INCA)	The INCA project advances ecosystem accounting in Europe by developing tools and guidelines for tracking changes in ecosystems, measuring ecosystem services, and linking them to economic activities.	Organization: European Commission https://ecosystem-accounts.jrc.ec.europa.eu/
Co$tingNature	Co$tingNature is an open-access tool for mapping natural capital and ecosystem services, helping businesses assess risks related to nature loss. It provides global maps and metrics for nature-related financial risk disclosure, enabling companies to evaluate dependencies on nature, assess risks, and prepare responses.	Organization: King's College London https://www.policysupport.org/home

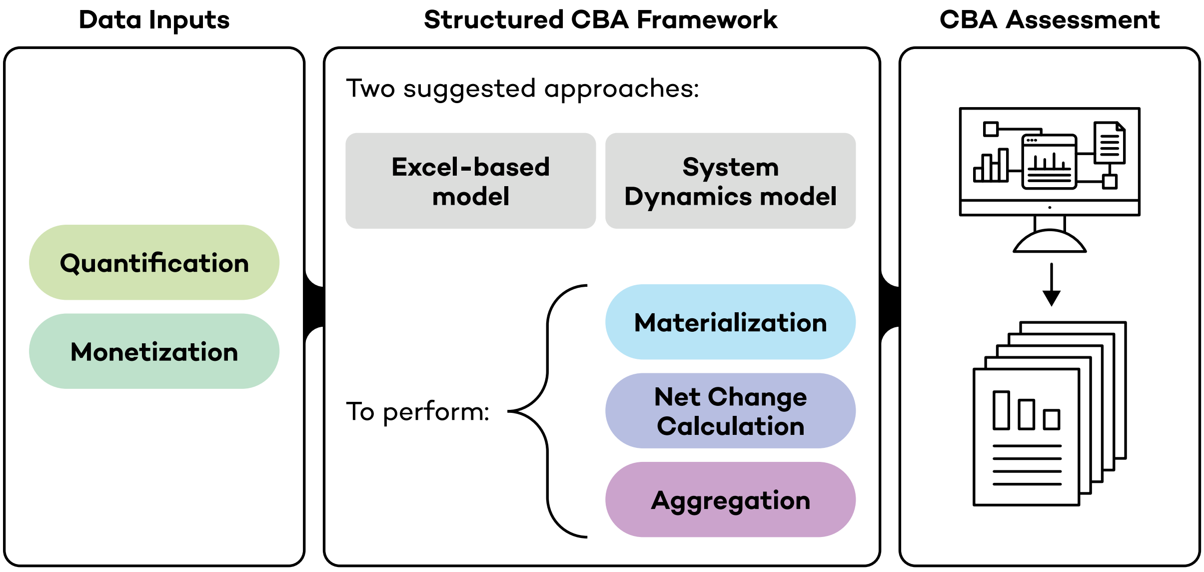
Tool	Tool description	More info
Mapping and Assessment of Ecosystems and their Services (MAES)	The MAES report evaluates EU ecosystems, revealing mixed trends: decreasing land take and air pollution but increasing climate change impacts and invasive species. It highlights a decline in ecosystem service potential amid rising demand and calls for stronger protection and restoration efforts to combat biodiversity loss.	Organization: European Commission https://publications.jrc.ec.europa.eu/repository/handle/JRC120383
Social Values for Ecosystem Services (SolVES)	SolVES is a geographic information system (GIS) tool that maps and quantifies the perceived social values of ecosystem services, especially cultural ones like aesthetics and recreation. It generates a 10-point "value index" based on stakeholder preferences and environmental metrics.	Organization: United States government https://www.usgs.gov/centers/geosciences-and-environmental-change-science-center/science/social-values-ecosystem

Source: Authors.

For the monetization step, several economic valuation methods can be employed to translate physical benefits into monetary values. Avoided or replacement cost analysis assesses the savings associated with ecosystem services that prevent damages or reduce the need for expensive alternatives. Market pricing involves evaluating ecosystem services based on existing market prices, such as timber or recreational access fees, providing a direct monetary value. Willingness-to-pay studies estimate the monetary value individuals are willing to pay for specific ecosystem services, often gathered through surveys or contingent valuation methods. Other methods include hedonic pricing, which examines how environmental features influence external value, such as property values, revealing the economic worth of ecosystem services. Finally, benefit transfer carefully applies values from existing studies to a specific project and adjusts them to fit the local context. Overall, each method provides a unique perspective on value, enabling a comprehensive understanding of NbS benefits.

With both physical and monetized inputs, one needs to put this data to use in a structured CBA framework to perform all three consequent steps in the process, as illustrated in Figure 13. For this, two approaches are suggested: Excel-based models or system dynamics models. In essence, these models are customized to make the best use of the data inputs while capable of producing the desired outputs for the CBA assessment. In other words, given the nature of NbS and their associated maturing time, models must be able to accurately capture the gradual evolution of benefits through time-series analysis. Moreover, the overall reflection and objective of the CBA assessment imposes a comparison between a scenario of no action (e.g., baseline) and a scenario of action (e.g., an NbS project), therefore justifying the need for models capable of handling and defining different scenarios. Finally, to tailor the outcomes of the model into meaningful metrics, it must be capable of aggregating the variables into key indicators, such as total costs, total benefits, BCR, NPV, and internal rate of return.

Figure 13. Structured CBA framework



Source: Authors.

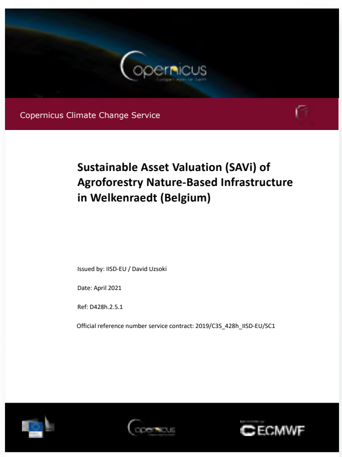
When choosing between an Excel-based model and a system dynamics model for the CBA framework, consider the project's complexity and the available resources. Excel-based models are user-friendly, cost-effective, and flexible, making them ideal for simpler, linear analyses. They offer transparency and ease of use but struggle with complex interactions or large datasets. System dynamics models, on the other hand, handle dynamic systems, feedback loops, and long-term scenarios, making them better suited for complex NbS projects. However, they require specialized software and more time for development and have a steeper learning curve.

Case Study 5: Agroforestry

Location: Belgium

NbS: Agroforestry

Report: Bassi et al., 2021.



The Municipality of Welkenraedt's agroforestry project aims to maintain soil productivity, combat erosion, preserve water quality, and enhance climate resilience. The SAVi assessment evaluated the project's economic, environmental, and financial benefits using climate data from the CDS under RCP 4.5 and RCP 8.5 scenarios. It focused on the impacts of precipitation, temperature, evaporation, and wind speed on soil erosion, water quality, agricultural productivity, and revenues.

The project is projected to generate net benefits of EUR 3.9 million over 20 years from an initial investment of EUR 607,629, with positive externalities and additional revenue streams improving financial performance. As climate change advances, the project's economic value is expected to rise, particularly from enhanced livestock cooling effects that boost milk production and farmers' incomes. These findings underscore the importance of NbS in climate adaptation and sustainable agriculture.

Key takeaways:

- The agroforestry project offers net benefits of EUR 3.9 million over 20 years.
- Climate change enhances these benefits, making such projects financially attractive.
- Additional revenue from fodder and wood pellet production adds to the project's economic viability.
- Farmers and policy-makers can leverage these findings to promote climate resilience, sustainable agriculture, and NbS.

Applying Step 3:

To establish an integrated CBA for the agroforestry project, the authors first established a systemic understanding of the NbS context through system mapping. After validating the list of indicators and scenarios, the data collection process had a clear direction. This latter consisted of a mix of climate data from the CDS, spatial analysis data through the use of the InVEST suite of models, location-specific data provided by partners, and a literature review. Following the SAVi process, this data was integrated into a customized Excel-based model defining how each of the indicators evolve over time. For example, indicators such as carbon sequestration, nutrient removal, and water supply impacts were assessed using the InVEST models, which translated spatial and environmental data into measurable units. Socio-economic indicators, like employment creation and tourism value, were derived from site-specific and regional datasets.
To monetize these indicators, standard valuation methods were applied: for example, carbon sequestration was monetized using social cost of carbon estimates and tourism spending was valued based on historical data. This comprehensive approach ensured that both environmental and social benefits were captured in financial terms, providing a robust foundation for the CBA.

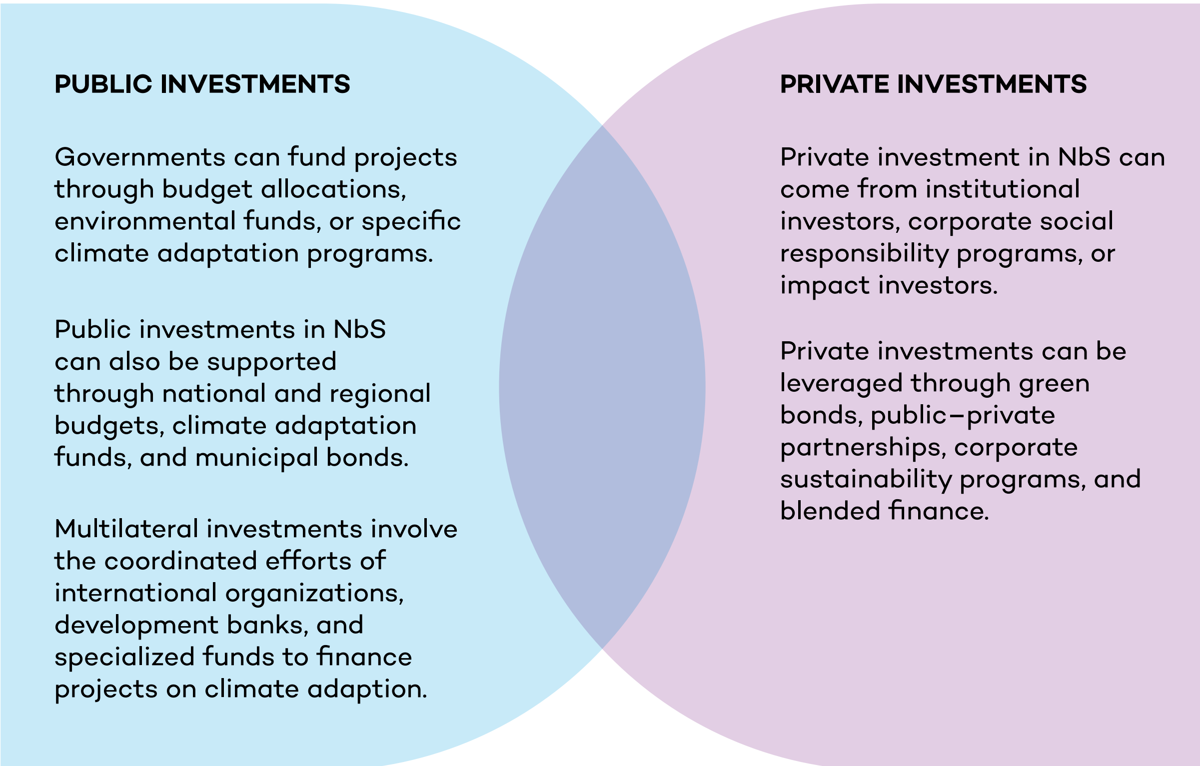
Step 4: Identify Financing Structures

After quantifying and monetizing the costs and benefits of NbS in the previous steps, it is crucial to identify viable financing strategies that can support their implementation. Successful NbS projects often rely on a combination of public and private investments and grants, using innovative financial instruments that are tailored to the unique nature of these projects. This section outlines the different approaches in financing structures for NbS projects, with the goal of ensuring long-term financial sustainability and scalability.

Public and Private Investments

One way to finance NbS projects is through a mix of public and private investments (see Figure 14 and Figure 15). Both sources of financing play a critical role in delivering the necessary financial resources to cover the upfront capital expenditure (CapEx) and ongoing operational expenditure (OpEx) associated with implementing and maintaining NbS projects.

Figure 14. Public and private investments

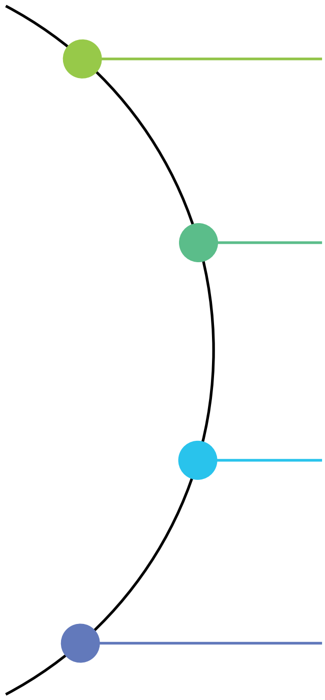


Source: Authors.

One of the key challenges for NbS projects is establishing consistent revenue streams. This sets them apart from traditional infrastructure projects, which typically generate income through clearly defined sources like user fees, tolls, or service charges. While conventional infrastructure projects incorporate revenue generation as a core component of their financial models, NbS projects primarily focus on delivering societal and environmental benefits, such as improved ecosystem services, climate resilience, and public health. However, these benefits often do not translate into direct financial returns, making it harder to attract investors or secure funding. To overcome this issue, innovative financing mechanisms are crucial to ensure sufficient resources for these projects.

Grants and Subsidies

Figure 15. Grants and subsidies



International climate and environmental funds
Global funds such as the Global Environment Facility and the European Union's LIFE program provide grant funding for projects that promote sustainability, climate adaptation, and biodiversity.

Bilateral and multilateral donor funding
Donor governments and international organizations often offer grants to support NbS projects in developing countries or regions facing high climate risks.

Philanthropic organizations
Foundations and philanthropic organizations increasingly recognize the importance of NbS in addressing climate and social challenges, and they provide funding to support these projects.

Subsidies for NbS
Subsidies can encourage investment in NbS by lowering implementation costs or supporting operational expenses, often through financial incentives or tax breaks for companies and landowners.

Source: Authors.

Innovative Financial Instruments[2]

To address the key challenges of financing NbS and resolving the issue of revenue generation, it is essential to explore innovative financial instruments that can make these projects financially viable while ensuring funding for their implementation and long-term operation and maintenance (see Figure 16). Since no single solution fits all, a combination of tailored financial tools can be employed to tackle these barriers effectively. Each instrument must be carefully selected and adapted to align with the unique characteristics, scale, and objectives of individual NbS projects.

[2] Innovative financial instruments are explained in more detail in IISD's NBI Academy. To access these free learning materials, you can sign up for the e-course and navigate to Module 5: https://nbi.iisd.org/nbi-module/module-5-financing-nbi/

Figure 16. Innovative financial instruments

Carbon Markets and Carbon Credits	Outcome-Based Financing	Insurance-Linked Financial Instruments
• Voluntary carbon markets • Compliance carbon markets	• Payment for ecosystem services • Environmental impact bonds • Social impact bonds	• Catastrophe bonds • Resilience bonds

Source: Authors.

Carbon credits, for example, are generated by monetizing one specific benefit of NbS—carbon sequestration—creating a revenue stream from this service. However, they only capture a fraction of the overall ecological value provided by such initiatives. To better reflect the full spectrum of ecosystem services and generate diverse revenue streams, additional financing solutions should be considered. In particular, financing instruments that focus on specific benefits and identify potential beneficiaries can help create sustainable revenue streams, making these projects financially viable.

For example, an outcome-based model is a financial mechanism that transforms the benefits of NbS into consistent revenue streams. In this approach, investors provide upfront funding to cover implementation costs, while beneficiaries—whether public or private entities—pay for specific outcomes or ecosystem services generated by the NbS. These payments create a revenue stream used to repay investors. A facilitator or intermediary typically manages the process, including setting payment terms, establishing contracts, and potentially overseeing implementation (Puzyreva et al., 2024).

Box 2. Case study: The Forest Resilient Bond – Yuba I pilot project (2019–2022)

The FRB is an outcome-based financing model that mobilizes private capital for forest restoration in California. It aims to reduce fire risks and deliver environmental and social benefits. Beneficiaries, such as the U.S. Forest Service, water utilities, and government agencies, make annual payments based on quantified benefits like disaster risk reduction, improved water security, reduced fire suppression costs, and local economic gains. These payments create a stable revenue stream that supports project implementation (South Pole, 2022).

The financing structure uses a special purpose vehicle to manage funds from investors providing upfront capital through concessional or commercial loans. The National Forest Foundation oversees restoration activities across 5,890 ha in the Yuba River watershed. The model combines philanthropic and commercial investments with foundations offering low-interest loans to attract market-rate investments while keeping payment obligations affordable for beneficiaries (South Pole, 2022).

This model can incentivize contributions from beneficiaries who gain value from reduced risks or enhanced ecosystem services. For instance, sectors like tourism or local businesses may contribute regularly if they benefit from decreased damage caused by natural events. An example is the Forest Resilient Bond (FRB), which illustrates how monetizing benefits through structured payments from beneficiaries can generate reliable revenue streams. Such mechanisms not only make these initiatives financially sustainable but also attract private capital for their implementation (Puzyreva et al., 2024).

In addition, insurance-linked financial instruments, such as catastrophe bonds and resilience bonds, leverage the monetization of the benefits associated with disaster risk reduction and resilience-building measures. Catastrophe bonds transfer financial risks from governments or insurers to capital markets, offering rapid payouts after disasters while providing financial protection. Resilience bonds take this concept further by linking insurance coverage to investments in risk-reducing initiatives, such as flood defences or ecosystem restoration. They utilize mechanisms like resilience rebates, which quantify avoided losses to generate funding. These instruments are grounded in measurable benefits, including reduced disaster-related costs, strengthened infrastructure protection, and enhanced community safety (Vaijhala & Rhodes, 2018).

Step 5: Communicate Findings

Effectively communicating NbS value is key to ensuring stakeholders understand its benefits and viability. This section outlines strategies for clear, accessible communication of CBA results, focusing on key indicators like BCR and tailoring insights to inform decision making and support NbS implementation.

Key Indicators and Their Communication

To effectively communicate key findings, it is crucial to present them in a way that resonates with diverse stakeholders. Figure 17 highlights strategies for making these metrics clear and accessible, ensuring transparency around assumptions, simplifying complex data with visuals, and tailoring the message to align with stakeholder priorities. These techniques will help foster understanding, collaboration, and informed decision making.

Figure 17. Key indicators and their communication

Transparent and contextual communication of BCR

Clearly present the BCR along with its assumptions, using terms like “forecast” and “projected” to emphasize that benefits are not guaranteed, ensuring stakeholders, including local communities, fully understand the projected nature of the outcomes.

Simplify metrics with visual aids and clear language

Use visual aids like charts to simplify complex data, provide real-world context by comparing the BCR to benchmarks, and ensure all stakeholders can understand the results through clear, jargon-free communication.

Tailor findings for stakeholder relevance

Customize the communication of benefits to align with the goals of different stakeholder groups, fostering collaboration and securing buy-in, which is critical for funding discussions.

Source: Authors.

Tailoring Insights for Various Stakeholders

Different stakeholders have varying interests and concerns regarding NbS projects. Tailoring communication to address these diverse perspectives enhances the relevance and impact of the information.

Figure 18. Tailoring insights for various stakeholders

Policy-makers and planners

For policy-makers, highlight how the NbS project supports public goals like climate adaptation, disaster risk reduction, and economic development. Emphasize cost savings compared to grey infrastructure and long-term benefits using case studies to demonstrate potential outcomes.

Investors and financial partners

Emphasize key metrics like return on investment, net present value, and internal rate of return for investors, along with risk and sensitivity analyses. Provide detailed financial models to showcase project viability and clearly present financing options and revenue streams. Use straightforward visuals to ensure clarity and secure investor buy-in.

Communities

Show how the NbS project addresses local issues like flooding and heat stress, emphasizing benefits such as increased property values and better air quality. Use statistics and community stories to connect data to real life, engaging residents through visuals and outreach.

NGOs and academics

Highlight the project's contributions to research, climate adaptation, and sustainability. Emphasize data for academics and mission alignment for NGOs, focusing on collaboration in monitoring and advocacy to support research and societal goals.

Environmental and advocacy groups

Stakeholders are often interested in the ecological and social impacts of NbS projects. Emphasize environmental benefits like improved biodiversity, carbon sequestration, and ecosystem services, and highlight the project's contributions to conservation goals and sustainable development.

Source: Authors.

Communication Formats and Strategies

A strategic, audience-focused approach is vital to ensuring that the results of the CBA are accessible and impactful. Below are some potential techniques that can be employed to effectively communicate the results of an integrated CBA for NbS.

Figure 19. Communication formats and strategies

Visual assets

Create infographics, videos, and articles to illustrate CBA results and benefits. Visuals convey complex information effectively, with infographics on BCR and cost breakdowns presenting results clearly.

Knowledge sharing

Share case studies and key themes from integrated CBA findings at events and in literature to enhance CBA visibility for NbS projects, helping stakeholders start investments and providing real-life examples for investors.

Public engagement and social media

Use social media, presentations, workshops, and webinars to engage stakeholders, present CBA results, and gather feedback. These forums address questions, discuss implications, and build support for the project.

Interactive tools

Create interactive tools like calculators or dashboards for stakeholders to explore scenarios and outcomes, providing personalized insights and enhancing engagement.

Case studies and testimonials

Share real-world examples and success stories to highlight the benefits of NbS projects. Testimonials from stakeholders add credibility, build trust, and showcase a track record for potential investors.

Executive summaries

An executive summary should outline the community's infrastructure problem, proposed solutions, and benefits, highlighting key messages and recommendations for decision-makers and investors.

Source: Authors.

Case Study 6: Urban Green Spaces

Location: Colombia

NbS: Urban green spaces

Report: Bechauf et al., 2024.

Medellín, Colombia's second-largest city, has faced erosion and flooding on the banks of its namesake river due to rapid urban development and the effects of climate change. To address this, the city's long-term vision is to develop a continuous green park along the river, creating an attractive, accessible green space that improves air and water quality, provides habitats for biodiversity, and enhances social cohesion.

The current focus is on a 300,000 m^2 extension of the park, with the first phase covering 7 ha. Of this, 2.6 ha is already funded and approved. IISD collaborated with the Secretariat of Physical Infrastructure of Medellín and the C40 Cities Finance Facility to produce a SAVi analysis that quantifies the multiple environmental, social, and economic benefits of Parques del Río Norte.

Using spatial models such as InVEST and Excel-based models, the analysis evaluates key benefits like flood risk reduction, increased property value, and health benefits from increased physical activity.

Key takeaways:

- Parques del Río Norte generates USD 1.67 in societal value for each dollar invested.
- Green space per inhabitant will increase from 1.32 m^2 to 1.44 m^2, improving the overall quality of life for the city's residents.
- Environmental benefits include flood risk mitigation, preventing USD 312.4 million in damages over 30 years, as well as an 86.43% increase in habitat quality and 103.75% increase in carbon storage within the buffer zone by 2053.
- The expanded green space also provides an economic boost to the city: property value increases of USD 35.45 million and increased retail revenue of USD 318.3 million.
- Urban green space is also valuable to society through improved public health. The park is expected to attract nearly 45,000 visitors daily, providing health benefits worth USD 495.36 million through increased physical activity.
- This project provides a compelling case for further investment in green infrastructure and supports future financing strategies for park development in Medellín.

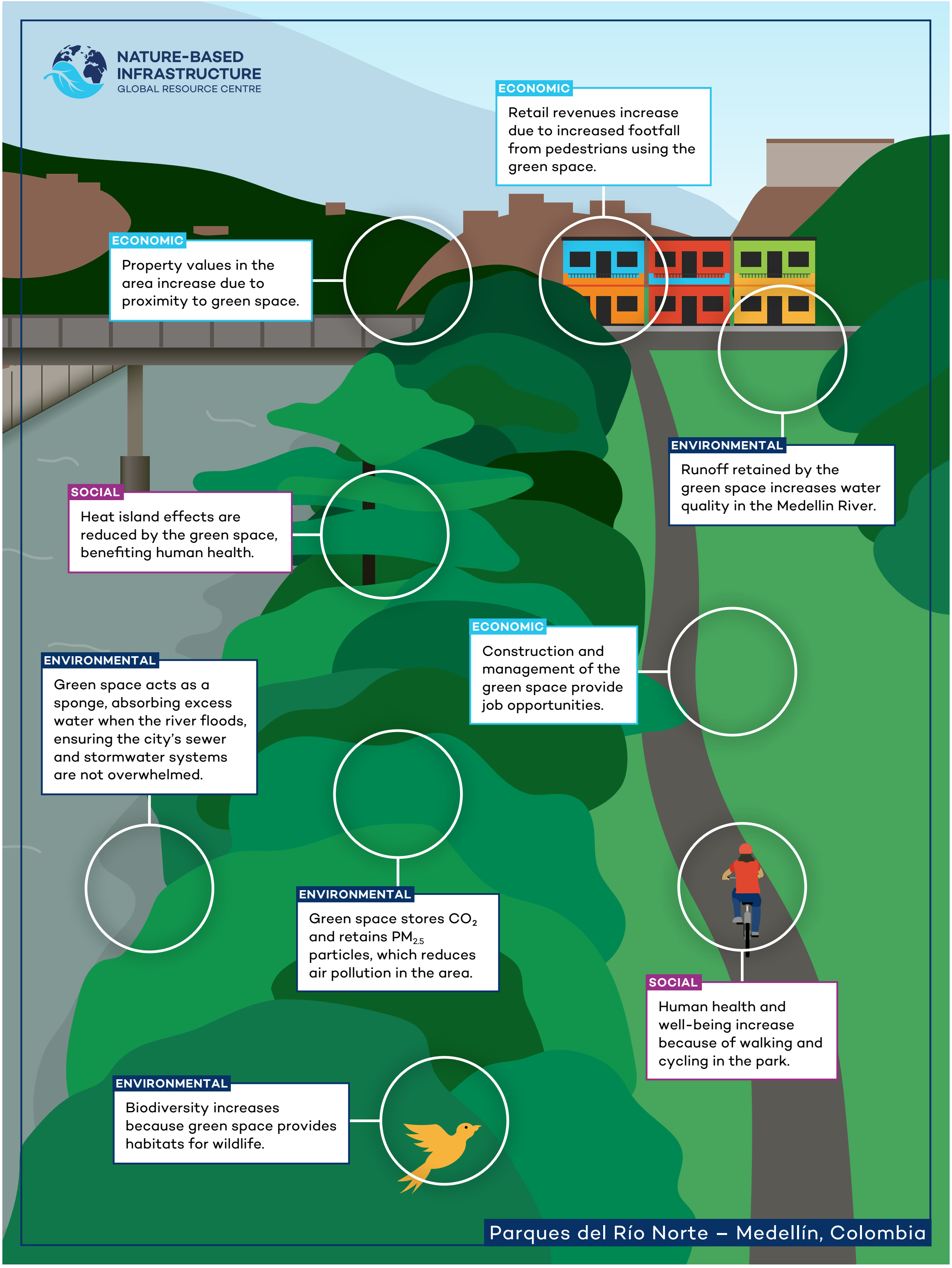
Applying Step 5:

With the partners, IISD developed a communications strategy to clearly demonstrate the results of the SAVi analysis, focusing on the key benefits the project would offer for the community impacted, to provide a compelling case for local policy-makers.

With this target audience in mind, IISD produced a topline summary document focused on problem-solution storytelling, conveying the key messages of the analysis and, finally, policy recommendations for local stakeholders. All materials were made available in both English and Spanish to cater to a wide audience both locally and as a scalable case study for wider relevance.

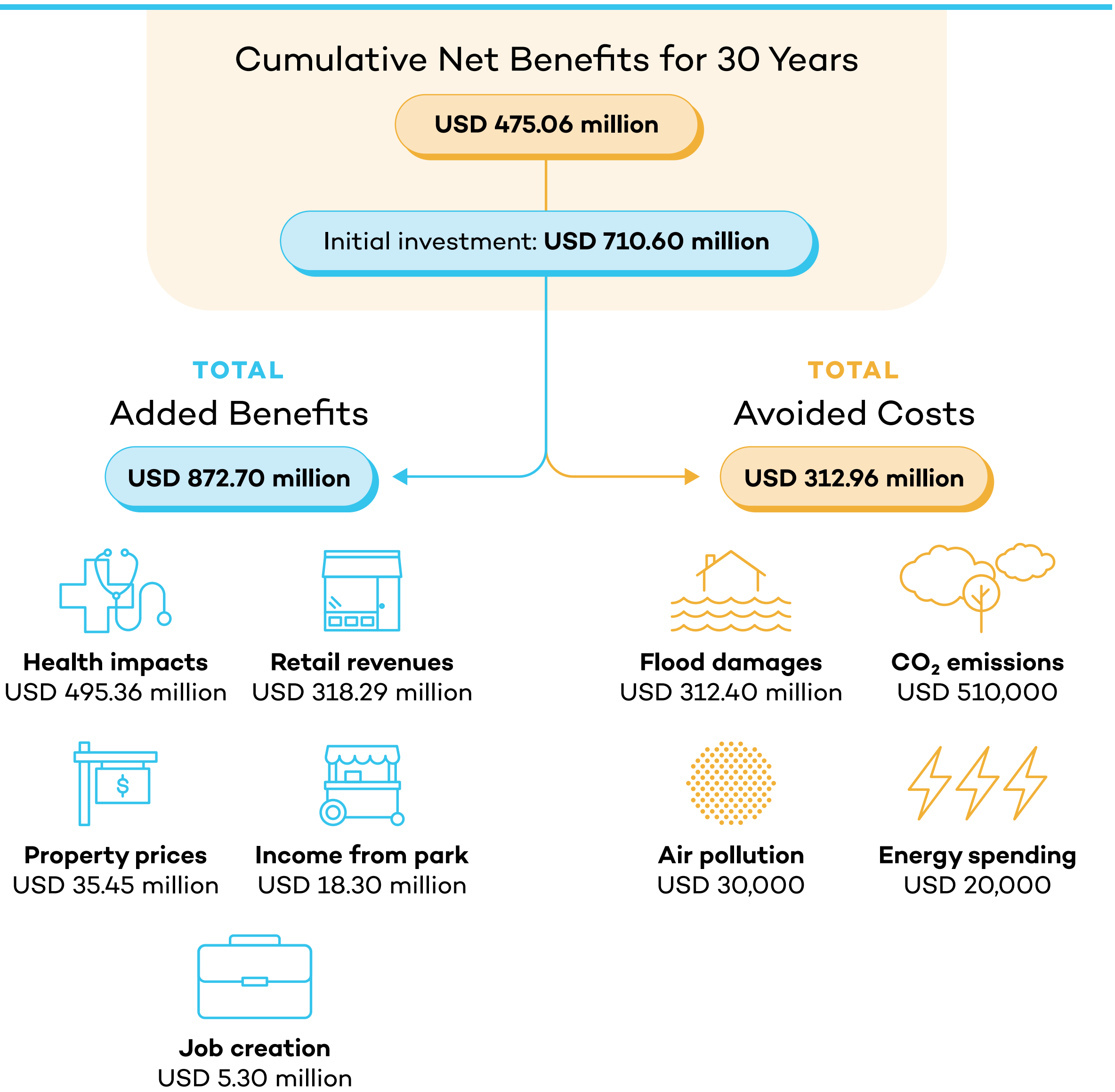
Visual depictions of the benefits were important in making results tangible and digestible (see Figures 20 and 21). Figure 20 illustrates the variety of economic, social, and environmental benefits outlined in the results by mapping them onto an infographic visualization of an urban park. Figure 21 presents the results of the CBA in a simplified infographic format, presenting the qualitative and quantitative aspects of the findings in two visual forms.

Figure 20. The benefits of green spaces in Medellín



Source: IISD.

Figure 21. CBA results for green spaces in Medellín



Source: IISD.

Conclusion

In conclusion, this guideline provides a comprehensive framework for evaluating NbS through integrated CBA. It aims to support infrastructure planners, policy-makers, analysts, researchers, and decision-makers in harnessing the full potential of these approaches. NbS leverage natural processes to tackle societal challenges and offer a range of benefits beyond those of traditional grey infrastructure. As demonstrated by several case studies, NbS can be both economically and environmentally advantageous, often resulting in lower costs and increased revenue opportunities compared to conventional methods.

Effective NbS studies are rooted in a structured approach that includes interdisciplinary collaboration and a clear definition of objectives. This ensures that the scope of the study aligns with specific environmental and climate needs while incorporating the perspectives of local stakeholders. The identification of costs and benefits therefore involves a thorough process of engaging with local experts, collecting and verifying data, and employing systems thinking to understand the interconnectedness of society, the economy, and the environment. System mapping and causal loop diagrams further aid in co-creating the analysis, visualizing complexity, and assessing qualitative benefits, setting the stage for the quantitative analysis.

The framework for quantitative analysis involves selecting relevant indicators and defining scenarios that capture both the positive and negative externalities of NbS interventions. This informs the creation of integrated, systemic quantitative models. Quantifying and monetizing the costs and benefits of NbS is essential for understanding their value and informing decision making. Utilizing various modelling techniques, including spatial, Excel-based, and system dynamics modelling, enables a holistic view of the social, economic, and environmental impacts. Analyzing the local climate context provides critical insights into climate-related risks and helps tailor NbS to specific site challenges, enhancing their effectiveness and resilience. It is also important to consider potential financing options to ensure the long-term success of NbS projects.

Finally, effectively communicating the results of NbS assessments is crucial for gaining support and facilitating informed decision making. This involves presenting key metrics, such as the BCR, in a clear and accessible manner, using visual aids to simplify complex information and tailoring insights to various stakeholders, including decision-makers, investors, community members, and environmental groups. Diverse communication formats, from executive summaries and detailed reports to interactive tools and public engagements, enhance understanding and support for NbS projects.

By following the structured approach outlined in this guide, stakeholders can take an active role in the NbS assessment and better identify, quantify, analyze, and understand the multifaceted benefits of NbS. This will ultimately help to better integrate NbS into broader urban and environmental strategies. Overall, this comprehensive framework aims to promote a more sustainable and informed approach to infrastructure planning, ensuring that NbS are effectively evaluated, financed, and communicated for the benefit of communities and ecosystems alike.

Further Resources

1. Nature-Based Infrastructure Global Resource Centre
   International Institute for Sustainable Development, 2025
   https://nbi.iisd.org/ | https://nbi.iisd.org/academy/ | https://nbi.iisd.org/resources/
2. *Handbook of Nature-Based Solutions to Mitigation and Adaptation to Climate Change*
   Walter Leal Filho, Gustavo J. Nagy, & Desalegn Yayeh Ayal, 2023
   https://link.springer.com/10.1007/978-3-030-98067-2
3. *Evaluating the Impact of Nature-Based Solutions: A Handbook for Practitioners*
   European Commission, 2021
   https://data.europa.eu/doi/10.2777/244577
4. *Assessing the Benefits and Costs of Nature-Based Solutions for Climate Resilience: A Guideline for Project Developers*
   World Bank, 2023
   https://openknowledge.worldbank.org/handle/10986/39811
5. *Investing in Nature-Based Solutions: State of Play and Way Forward for Public and Private Financial Measures in Europe*
   European Investment Bank, 2023
   https://data.europa.eu/doi/10.2867/031133
6. *Financing Nature as a Solution*
   European Environment Agency, 2022
   https://data.europa.eu/doi/10.2800/868074
7. *Financing Nature-Based Solutions: Exploring Public, Private, and Blended Finance Models and Case Studies*
   Robert C. Brears, 2022
   https://link.springer.com/10.1007/978-3-030-93325-8
8. *Integrating Nature-Based Solutions Into Policies for Climate Change Adaptation and Disaster Risk Reduction*
   International Union for Conservation of Nature, 2022
   https://portals.iucn.org/library/node/49992
9. *Public Procurement of Nature-Based Solutions: Addressing Barriers to the Procurement of Urban NBS: Case Studies and Recommendations*
   European Commission, 2020
   https://data.europa.eu/doi/10.2777/561021

References

Bassi, A. M., Bechauf, R., Pallaske, G., Perera, O., Statzu, V., & Uzsoki, D. (2020). *An application of the Sustainable Asset Valuation (SAVi) Methodology: Assessing the economic value of restoring the wetlands of S'Ena Arrubia and Corru S'Ittiri-Marceddì-San Giovanni in the Gulf of Oristano in Sardinia, Italy.* International Institute for Sustainable Development. https://nbi.iisd.org/wp-content/uploads/2021/09/savi-sardinia-italy-wetlands-en.pdf

Bassi, A. M., Casier, L., Guzzetti, M., Schlageter, A., & Uzsoki, D. (2021). *Sustainable Asset Valuation (SAVi) of agroforestry nature-based infrastructure in Welkenraedt (Belgium)*. International Institute for Sustainable Development. https://www.iisd.org/publications/savi-agroforestry-welkenraedt-belgium

Bechauf, R., Carlucci, E., Cutler, E., & Guzzetti, M. (2023). *Sustainable Asset Valuation (SAVi) of river restoration in Greece*. International Institute for Sustainable Development. https://nbi.iisd.org/report/savi-river-restoration-in-greece/

Bechauf, R., Cutler, E., Gouett, M., & Guzzetti, M. (2021). *Sustainable Asset Valuation (SAVi) of nature-based coastal protection in the Netherlands: An economic valuation of the contribution of the Hondsbossche Dunes sand nourishment to climate adaptation and local development.* International Institute for Sustainable Development. https://nbi.iisd.org/report/savi-nature-based-coastal-protection-netherlands/

Bechauf, R., Guzzetti, M., & Niño, N. (2024). *Sustainable Asset Valuation of Parques del Río Norte in Medellín, Colombia.* International Institute for Sustainable Development. https://nbi.iisd.org/report/sustainable-asset-valuation-of-parques-del-rio-norte-in-medellin-colombia/

Carlucci, E., & Guzzetti, M. (2024). *Sustainable Asset Valuation of land restoration and climate-smart agriculture in Burkina Faso.* International Institute for Sustainable Development. https://nbi.iisd.org/report/sustainable-asset-valuation-of-land-restoration-and-climate-smart-agriculture-in-burkina-faso/

European Commission. (n.d.). *Nature-based solutions.* https://research-and-innovation.ec.europa.eu/research-area/environment/nature-based-solutions_en

International Union for Conservation of Nature. (2016). *Nature-based solutions to address global societal challenges.* https://doi.org/10.2305/IUCN.CH.2016.13.en

Maes, J., & Jacobs, S. (2017). Nature-based solutions for Europe's sustainable development. *Conservation Letters, 10*(1), 121–124. https://doi.org/10.1111/conl.12216

Puzyreva, M., Carlucci, E., Uzsoki, D., & Méthot, J. (2024). *Financing for natural infrastructure projects: Viable pathways to scale up natural infrastructure investments on the Canadian Prairies.* International Institute for Sustainable Development. https://www.iisd.org/publications/report/financing-natural-infrastructure-projects

South Pole. (2022). *Case study: The forest resilience bond.* https://www.wwf.org.uk/sites/default/files/2022-07/case_study_forest_resilience_bond.pdf

United Nations Environment Assembly of the United Nations Environment Programme. (2022). *Resolution adopted by the United Nations Environment Assembly on 2 March 2022 5/5: 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

Vaijhala, S., & Rhodes, J. (2018). Resilience bonds: A business-model for resilient infrastructure. *Field Actions Science Reports, Special Issue, 18,* 58–63. http://journals.openedition.org/factsreports/4910

Published by the International Institute for Sustainable Development

Head Office

111 Lombard Avenue, Suite 325
Winnipeg, Manitoba
Canada R3B 0T4

Tel: +1 (204) 958-7700
Website: www.iisd.org
X: @IISD_news

IISD

iisd.org