



eNABLS

Education and NBS -  
bending the curve for biodiversity

# A Comprehensive Overview of Nature-Based Solutions

Harnessing Nature for Environmental and Social Benefits



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## Publication Information

Title	A Comprehensive Overview of Nature-Based Solutions: Harnessing Nature for Environmental and Social Benefits
Authors	Michael Jones (Association for European Life Sciences Universities, ICA) Tigran Keryan (University of Natural Resources and Life Sciences, BOKU) Mieke de Wit (Wageningen University & Research, WUR) Julia Klawitter (University of Hohenheim, UHOH)
Brief summary	<p>The term Nature-Based Solutions (NBS) comprises various approaches that address social and environmental challenges in a way that is beneficial to both biodiversity and human well-being. To establish a common understanding of the NBS concept among all stakeholders in the ENABLS project, this document provides an overview and examples of what is, and what is not, considered a Nature-Based Solution based on the literature. In summary, NBS represent a strategy for promoting sustainable development and enhancing resilience, emphasizing the importance of nature to our well-being and the need to protect, restore, and sustainably manage it. Through NBS, we work towards a more equitable, prosperous, and environmentally sustainable future for all. Additionally, the multiple benefits of NBS are described in this document, as well as strategies for effective scaling up of NBS.</p>
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# 1 Definition of Nature-Based Solutions (NBS)

Nature-Based Solutions (NBS) encompass innovative and strategic approaches and actions to tackle societal and environmental challenges including food and water security, human health, climate change mitigation and adaptation, biodiversity conservation, economic and social development, and disaster risk reduction. They aim to protect, restore, and sustainably use natural and human-modified ecosystems in a cost-effective, resource-efficient way adapted to local conditions.

The core of NBS lies in their capacity to provide a holistic, adaptive approach that combines the benefits of conventional and nature-based methods, focusing on local adaptability and economic viability. By emphasizing synergy between different types of solutions and tailoring actions to specific needs, NBS restore biodiversity and foster a systemic integration of nature into urban and other highly modified environments. NBS extend beyond mere technical solutions to embody a societal way of life.

In summary, NBS represent a strategy for promoting sustainable development and enhancing resilience, emphasizing the importance of nature in our well-being and the need to protect, restore, and sustainably manage it. Through NBS, we work towards a more equitable, prosperous, and environmentally sustainable future for all.<sup>1</sup>

## 2 Examples of NBS

**Ecosystem restoration** involves the recovery or enhancement of ecosystems that are degraded, damaged, or destroyed to improve their ecological integrity and functioning. This process contributes to environmental recovery at a desired level to provide a range of ecosystem services (not necessarily full recovery). Such ecosystem services include carbon sequestration, water purification, and habitat provision for flora and fauna. Examples include:

- Reforestation and replantation of native vegetation to restore degraded landscapes.
- Restoration of wetlands to improve water quality and biodiversity.
- Regeneration of coral reefs and revitalization of depleted fisheries.
- Rewilding of landscapes with species that have a key role in restoring and maintaining the structure and function of ecosystems.

**Ecosystem protection** emphasizes conserving intact and relatively undisturbed semi-natural areas to maintain their ecological integrity and the services they provide. By safeguarding nature's assets, these strategies contribute to biodiversity conservation, climate change mitigation, and cultural preservation. Examples include:

- Establishment of protected areas and preservation of wilderness to conserve biodiversity.
- Restoration of degraded peatland ecosystems to mitigate climate-related challenges.
- Implementation of indigenous land tenure systems.
- Empowerment of local communities in natural resource management through community-based conservation initiatives.

**Green-blue infrastructure and sustainable urban design** encompass the design, planning, and implementation of infrastructure and systems that integrate natural elements, offering multiple benefits to humans and the environment. Both, human wellbeing, and urban biodiversity are

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<sup>1</sup> European Commission, N.D.; Sowińska-Świerkosz & García, 2022; Bianciardi, Becattini, & Cascini, 2023

addressed, requiring a careful design of NBS that balances human needs with ecological integrity. Examples include:

- Installation of green roofs and walls in urban settings to mitigate the effects of urban heat islands.
- Development of permeable pavements to enhance water management and reduce runoff.
- Enhancement of urban biodiversity by creating green corridors and spaces that support natural habitats.
- Establishment of community gardens to promote recreation, mental well-being, and social cohesion.
- Fostering human-nature interaction overall in urban settings.

**Ecosystem-based approaches (EbA) and ecosystem disaster risk reduction (Eco-DRR)** are strategies to mitigate climate-related and other hazards. They emphasize the role of biodiversity and ecosystems in reducing risk and build on conservation and ecosystem restoration practices to enhance resilience for human benefit. EbA focus on climate-related hazards and slow-onset climate change impacts. Eco-DRR addresses both non-climate hazards (e.g., earthquakes) and climate-related hazards (e.g., heat waves). Both involve managing human activities within ecosystems to maintain or restore their ecological integrity while meeting societal needs by harnessing the power of nature. And both integrate nature into strategies for reducing the risk and impact of disasters. Examples include:

- Implementation of agro-ecological methods to restore and maintain soil health, protect water resources, and support biodiversity, contributing to food and water security, poverty alleviation, and environmental conservation.
- Adaptation of climate change resilience strategies including mangrove restoration, sustainable management of forests, and agroforestry systems to enhance resilience against climate change impacts.
- Adaptation of integrated water resources management to utilize natural solutions for sustainable water resources management, such as rainwater harvesting and river restoration projects, merging with integrated watershed management approaches for comprehensive outcomes.
- Restoration of coastal wetlands, coral reefs, and overall coastal vegetation to mitigate coastal erosion and provide flood protection, enhancing ecosystem resilience against climate change.
- Management of ecosystem-based fisheries to ensure long-term food security and livelihoods by maintaining healthy fish stocks and ecosystems, and promoting sustainable fishing practices.
- Maintenance of healthy ecosystems to reduce the likelihood and severity of wildfires and forested mountains and slopes to stabilize sediments and prevent landslides
- Utilization of natural barriers like mangroves and coral reefs to mitigate the impact of storms and flooding.
- Integration of local expertise and traditional knowledge into disaster risk reduction strategies for ecosystem management and resilience building.
- Ecosystems can enhance the durability and longevity of built infrastructure, safeguarding investments in engineered defences; for example, by restoring salt marshes next to sea walls.

For literature on this chapter, see the footnote<sup>2</sup>

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<sup>2</sup> Sowińska-Świerkosz & García, 2022; Bianciardi, Becattini, & Cascini, 2023; Kabisch, Frantzeskaki, & Hansen, 2022; Secretariat of the Convention on Biological Diversity, 2019; Carver, 2021; Montanarella, Pennock, & McKenzie, 2015

### 3 Benefits provided by NBS

- Climate resilience and adaptation
- Water management and conservation
- Green space management and urban development
- Biodiversity preservation and enhancement
- Air quality improvement
- Place regeneration and sustainable urban development
- Social justice, social cohesion, and community support
- Improved mental and physical health and human well-being
- Reduction of risk of natural disasters and their consequences
- Creation of green jobs and new business opportunities
- Reduced water and energy costs<sup>3</sup>

### 4 Evaluation dimensions of NBS

Criteria used to assess the effectiveness, impact, and sustainability of NBS:

- Management and governance capabilities: Involving stakeholders, citizens, NGOs, and researchers in the management and governance of NBS to ensure transparency, social learning, flexibility, and adaptation in a dynamic and unpredictable world.
- Locally adapted solutions: Tailored to local ecological, economic, social, and policy conditions.
- Economic efficiency: Cost-effectiveness ensuring benefits outweigh costs.
- Producing services: Simultaneous assessment of multiple benefits using performance indicators for systematic evaluation.
- Restoring and maintaining regulating ecosystem services: Habitat creation, soil formation, water and air quality improvement, and climate change mitigation.<sup>4</sup>

### 5 Exclusion criteria for NBS

Formulating exclusion criteria is essential to differentiate NBS from other green or blue interventions. These criteria can be categorized as either hard criteria, which are crucial for identifying an action as NBS, or soft criteria, which pertain to the effectiveness and efficiency of NBS actions.

1. **No ecosystem integration:** To be recognized as NBS, interventions must incorporate or improve ecosystems and biodiversity. This excludes activities such as harnessing wind, wave, or solar energy.
2. **Biomimicry:** Copies nature's designs and processes to produce novel ways of enhancing resilience but it is not an NBS unless it is used to improve ecosystems and biodiversity.

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<sup>3</sup> Sowińska-Świerkosz & García, 2022; Bianciardi, Becattini, & Cascini, 2023

<sup>4</sup> Sowińska-Świerkosz & García, 2022; Bianciardi, Becattini, & Cascini, 2023; Díaz, 2018



3. **Random interventions:** NBS must be deliberate, with defined goals and well-structured management systems, following an assessment of social, economic, and environmental conditions. Mimicking natural processes without delivering ecosystem benefits, such as artistic plant installations, do not qualify.
4. **Post-implementation goals:** NBS are oriented towards addressing pre-identified problems by providing solutions with a focus on biodiversity protection, management, and sustainable use. Identifying challenges before action is essential. While historical green and blue infrastructures can serve as NBS, they're not adequate for today's ecological issues. They need modernization to effectively tackle these challenges. Thus, historical gardens and parks modernized to meet current challenges, for instance, exemplify this criterion.
5. **Negative / no negative impact on biodiversity:** NBS must enhance biodiversity. Actions that copy ecosystems without contributing to biodiversity, like the increase of forested areas by establishing monoculture tree plantations, and actions that may harm biodiversity, are excluded.
6. **Same benefits as grey infrastructure:** NBS should offer additional benefits beyond traditional infrastructure. Actions that replicate the benefits of grey infrastructure without added value, such as green roofs that do not provide extra environmental or social value, are not considered NBS.
7. **Unfair benefit distribution:** NBS must offer simultaneous benefits to the environment and society, avoiding actions that benefit only one aspect. NBS should be implemented with the full engagement and consent of Indigenous Peoples and local communities.
8. **Ineffective or inefficient solutions:** NBS effectiveness is context-specific and requires adaptive management. Solutions with a 'copy-paste' approach, static management, high costs relative to benefits, or lacking local adaptation and stakeholder involvement are excluded.
9. **Top-down model of governance:** NBS must be designed through transparent processes involving all stakeholders to address specific issues. Active, broad, and transparent participation ensures that decisions align with community needs and concerns. Implementing solutions without consulting local communities does not fit the NBS approach and may risk amplifying social and economic inequalities.
10. **Static management approach:** NBS must be based on adaptive management, allowing for flexibility and adjustment based on evolving knowledge and conditions. Successful NBS implementation requires day-to-day management rather than static approaches, enabling effective responses to unforeseen challenges. Transparent decision-making processes and stakeholder involvement are vital in this regard.
11. **Unbalanced costs and benefits:** NBS should be cost-effective, ensuring that financial expenses are appropriate to the benefits gained. A solution relying on frequent plant replacements or constant infrastructure repairs isn't an effective NBS. The costs of NBS should be comparable to or lower than alternative solutions, considering both economic and non-economic benefits.
12. **Microscale approach:** Effective NBS should involve coordinated efforts that consider cumulative impacts and engage multiple stakeholders to achieve significant city/village/community-wide, or regional benefits.

For literature on this chapter, see the footnote<sup>5</sup>

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<sup>5</sup> Sowińska-Świerkosz & García, 2022

## 6 Scaling up NBS

NBS require strategic planning and management to ensure their long-term sustainability. Effective scaling up of NBS involves the following strategies:

1. **Evidence base and demonstration projects:** A comprehensive evidence base on the social, economic, and environmental effectiveness of NBS compared to traditional solutions must be compiled. This includes addressing the limits of NBS under different environmental conditions. Also, demonstration projects are necessary to test the transferability of solutions across different regions in Europe. These projects help to synthesize and communicate results effectively to maximize the uptake of the most effective solutions.
2. **Business and investment models:** New business and investment models are needed to leverage private capital flows and embed NBS into society, business, and policy. This involves developing adequate integrated institutional and legal frameworks and governance structures to capture the multiple benefits of NBS. Collaboration between public and private sectors, including the development of public-private partnerships and market incentives, is crucial for the long-term financing and mainstreaming of NBS.
3. **Policy and legislation:** Changes in policy, legislation, regulatory frameworks, and spatial planning are ways to enhance the uptake of NBS. This involves understanding and aligning with existing policies as well as collaborating with decision-makers to address any limitations or inconsistencies that may hinder the NBS rollout. This also includes incorporating the value of ecosystems and ecosystem services into planning and economic decisions from the outset of urban projects. Systemic urban governance requires a multi-stakeholder approach to map, analyse, and assess successful business models, financing mechanisms, and municipal initiatives.
4. **Communication and education:** To effectively scale up and mainstream NBS, it is crucial to share their design, implementation, and lessons learned. This sharing process can trigger transformative change by scaling up through policy or programmatic mainstreaming, expanding geographically or sectorally, or replicating successful NBS models. All approaches to mainstreaming NBS depend on strategic communications and outreach engaging multiple key stakeholders, including citizens, decision-makers, investors, other relevant individuals and institutions, and global networks such as the Sustainable Development Goals (SDGs) and the Paris Agreement. Implementing strategies through tools and methods that facilitate communication and dissemination is necessary to establish the ground for future collaborations and innovations in NBS. Demonstration projects should aim to reconnect people with nature, particularly urban and peri-urban populations, to build a sense of community and support behavioural shifts.
5. **Innovative methods and local adaptation:** Developing innovative methods for delivering ecosystem services that maintain or restore ecosystem structure and function is critical. This includes ensuring that restoration methods are adapted to local conditions considering variations in soil, climate, and hydrology. There is a need to leverage existing city networks to identify frontrunners and followers, enabling replication and up-scaling of successful NBS interventions.
6. **National and global impact:** NBS should contribute to national and global targets related to human well-being, climate change, biodiversity, and human rights, including the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP). Explicitly documenting and communicating these contributions helps secure political and societal support.

For literature on this chapter, see the footnote<sup>6</sup>

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<sup>6</sup> European Commission, 2015; IUCN, 2020

## References

- Bianciardi, A., Becattini, N., & Cascini, G. (2023, Dezember 1). How would nature design and implement nature-based solutions? (Elsevier, Ed.) *Nature-Based Solutions*, pp. 1-9. doi:<https://doi.org/10.1016/j.nbsj.2022.100047>
- Carver, S. (2021, November 29). Guiding principles for rewilding. (W. P. Inc., & S. f. Biology, Eds.) *Conservation Biology*(Issue 6), pp. 1882-1893. doi:<https://doi.org/10.1111/cobi.13730>
- Díaz, S. (2018, January 19). Assessing nature's contributions to people - Recognizing culture, and diverse sources of knowledge, can improve assessments. *Science*(Issue 6373), pp. 270-272. doi:<https://doi.org/10.1126/science.aap8826>
- European Commission. (2015). *Towards an EU Research and Innovation policy agenda for Nature-Based Solutions & Re-Naturing Cities - Final Report of the Horizon 2020 Expert Group on 'Nature-Based Solutions and Re-Naturing Cities' (full version)*. Brussels: Directorate-General for Research and Innovation, Directorate I — Climate Action and Resource Efficiency, Unit I.3 — Sustainable Management of Natural Resources. doi:<https://doi.org/10.2777/765301>
- European Commission. (N.D.). *Research and Innovation*. Retrieved April 16, 2024, from Nature-based solutions - The EU and nature-based solutions: [https://research-and-innovation.ec.europa.eu/research-area/environment/nature-based-solutions\\_en](https://research-and-innovation.ec.europa.eu/research-area/environment/nature-based-solutions_en)
- IUCN. (2020). *Global Standard for Nature-based Solutions. A user-friendly framework for the verification, design and scaling up of NbS. First Edition*. Gland, Switzerland: IUCN. doi:<https://doi.org/10.2305/IUCN.CH.2020.08.en>
- Kabisch, N., Frantzeskaki, N., & Hansen, R. (2022, January 17). Principles for urban nature-based solutions. (T. R. Sciences, Ed.) *Ambio - A Journal of Environment and Society*, pp. 1388-1401. doi:<https://doi.org/10.1007/s13280-021-01685-w>
- Montanarella, L., Pennock, D., & McKenzie, N. (2015). *Status of the World's Soil Resources (SWSR) - Technical Summary*. Rome: Food and Agriculture Organization of the United Nations (FOA); Intergovernmental Technical Panel on Soils (ITPS).
- Secretariat of the Convention on Biological Diversity. (2019). *Voluntary guidelines for the design and effective implementation of ecosystem-based approaches to climate change adaptation and disaster risk reduction and supplementary information. Technical Series No. 93*. Montreal: Secretariat of the Convention on Biological Diversity.
- Sowińska-Świerkosz, B., & García, J. (2022, December 1). What are Nature-based solutions (NBS)? Setting core ideas for concept clarification. (Elsevier, Ed.) *Nature-Based Solutions*, pp. 1-9. doi:<https://doi.org/10.1016/j.nbsj.2022.100009>

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## Project information

**Title** ENABLS - education and **Nature-Based Solutions**: enable **Society** to bend the curve for biodiversity (GA No 101135035)

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**Coordinator** University of Hohenheim (UHOH)  
Dr. Ann-Catrin Fender  
(anncatrin.fender@uni-hohenheim.de)

**Project overview** **ENABLS** will set the basis of networking and collaboration to promote, embed and unfold Nature-based Solutions (NBS) concepts and approaches within universities and vocational schools, the professional sphere and society at large through transdisciplinary dialogue. ENABLS envisions the creation of 7 Living Labs (DE, NL, FI, AT, LT, EL, CZ), incorporating all 'voices' and leaving no one behind. The goal is to enable society to bend the curve for biodiversity by mainstreaming both NBS and biodiversity in higher education and Technical and Vocational Education & Training (TVET). The ultimate objective is for ENABLS to contribute more generally to i) the advancement of a Nature Positive society through the necessary transformative change of communities, business models and lifestyles, and, specifically, ii) put biodiversity and climate on the path to recovery responding to the objectives of the EU biodiversity strategy for 2030 and the EU climate adaptation strategy.

✉ [info@enabls.eu](mailto:info@enabls.eu)

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