Thematic Paper 3

Nature-Based Solutions: An Approach for Joint Implementation of Climate and Biodiversity Commitments

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Key Messages

- The concept of nature-based solutions (NbS) evolved as an umbrella that builds on and embraces concepts such as the ecosystem approach, ecosystem services, ecosystem-based adaptation/mitigation, and ecosystem restoration.
- NbS can be seen as an overarching concept that can support communication and the mainstreaming of the different subsets of approaches across international, multilateral, and global frameworks and their audiences. In addition, the concept has the potential to communicate and build awareness of biodiversity values beyond the conservation community.
- The NbS concept builds on the existing Convention on Biological Diversity (CBD) ecosystem approach and overlaps in large part with other ecosystem-based approaches. They share important attributes and characteristics, namely the importance of the sustainable use of resources to ensure the integrity of natural processes and biodiversity.
- However, the NbS concept integrates various ecosystem-based approaches with each other and fosters their synergies. It goes beyond environmental and conservation-focused ambitions and is more aspirational in its social and economic outcomes. It underscores the role of ecosystem protection and management to achieve sustainable development.

- Despite the increasing popularity of NbS to address societal challenges, concerns have been raised around the lack of outcomes delivered for biodiversity over climate; its relationship with other approaches; and its added value, standards, and guidelines.
- As NbS are adopted and integrated into policy documents, greater clarity and precision are required to ensure their effective deployment. To do so, core standards have been developed to underpin the NbS concept and its relationship to other related approaches, as well as to guide implementation on the ground.
- It is important to evaluate the full range of potential benefits and to actively equitably identify, manage, and mitigate trade-offs and conflicts. Focusing only on some benefits, such as carbon sequestration, can lead to adverse impacts such as biodiversity loss.

Introduction

NbS are a relatively new concept that has emerged within the last decade in climate-related policy processes and literature. The concept recognises that people should not just be passive beneficiaries of nature but rather proactively protect, sustainably manage, or restore natural and semi-natural ecosystems to help address a range of major societal challenges, not least climate change. NbS has gained significant traction as an umbrella concept that encompasses many approaches that can jointly address climate change and biodiversity loss while also supporting sustainable development goals (SDGs). Use of the concept is thus currently promoted within both biodiversity and climate-related processes, including in the Convention on Biological Diversity (CBD) negotiations for a post-2020 global biodiversity framework (GBF), the 14th Conference of the Parties (COP 14) Sharm-el-Sheikh to Kunming Action Agenda and the COP 15 Kunming Declaration, as well as United Nations Framework Convention on Climate Change (UNFCCC) COP 26 discussions surrounding the Paris implementation strategy. Arguments highlight that NbS can be used to contribute to tackling the climate crisis sustainably and provide tools to mainstream biodiversity into climate-related policies and projects. An additional merit of the concept lies in its potential to communicate and raise awareness about biodiversity values beyond the conservation community.

More than 130 countries have already included NbS actions in their nationally determined contributions (Nature-based Solutions Platform, n.d.), on top of—or as a complement to—technology-based solutions. The UN Climate Action Summit in 2019 brought great political attention to the potential of NbS for achieving climate, nature, and sustainable development ambitions. A new NbS coalition, co-led by China and New Zealand, launched the NbS for Climate Manifesto, a plan "to unlock the full potential of nature for climate action, with the support of more than 70 governments, private sector, civil society and interna-

tional organisations and accompanied by nearly 200 initiatives and best practices from around the world" (United Nations Environment Programme, n.d.).

The UN Summit on Biodiversity 2020 launched the Leaders' Pledge for Nature, committing to reversing biodiversity loss by 2030 for sustainable development and sending "a united signal" to step up global ambition for biodiversity, nature, climate, and people. In line with this commitment, G7 and G20 leaders acknowledged the urgency of preserving marine and terrestrial ecosystems, including through NbS. In the lead-up to UNFCCC COP 26 in Glasgow, Scotland, and CBD COP 15 in Kunming, China, governments continued to underscore the links between climate change and nature and the need for a joint approach to NbS.

In March 2022, the United Nations Environment Assembly (UNEA) 5.2 adopted an international definition for NbS as follows: "nature-based solutions are actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems, which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services and resilience and biodiversity benefits [...]" (Resolution Nature-based Solutions for Sustainable Development UNEP/EA.5/L.9/REV.1).

Despite the increasing popularity of the concept of NbS, concerns have been raised around (i) potential trade-offs in delivering positive outcomes for biodiversity versus climate, (ii) unclear definitions, and (iii) standards (not least in relation to other approaches) and guidelines. Such concerns are arguably linked to a lack of common understanding between or within different sectors but often with different views and understanding of NbS. This policy brief revisits the concept of NbS and its relationship to other approaches that rely on the delivery of services by nature, along with its synergistic potential and added value. The remainder of the brief will discuss existing concerns and challenges, as well as highlight the International Union for Conservation of Nature's (IUCN) proposed Global Standard for NbS to serve as a foundation for effective and rigorous NbS implementation.

What Are Nature-based Solutions?

Figure 1. Conceptual structure of the NbS umbrella

Source: IUCN, 2020 *based on* Cohen-Shacham et al., 2016

In particular, since the 2005 Millennium Ecosystem Assessment,[1] research and policy have analysed and discussed nature's benefits for humans; many theoretical and practical approaches have been developed as a result. The concept of NbS evolved out of this work as an umbrella concept encompassing a range of existing concepts—such as the CBD's ecosystem approach, green and blue infrastructure, ecosystem-based adaptation/mitigation, and ecosystem restoration (Dick et al., 2020)—all of which strive to deliver ecosystem services through the protection, restoration, or sustainable management of natural or semi-natural systems.

The concept is grounded in the knowledge that healthy natural and managed ecosystems can produce a diverse range of services on which human well-being depends. The primary objective of NbS is to address specific or multiple societal challenges while simultaneously providing wider societal, environmental, and economic benefits (Cohen-Shacham et al., 2016). These multiple benefits are a key element underpinning NbS: they can contribute to climate change mitigation and adaptation while simultaneously delivering benefits across different sectors, such as water, agriculture, and disaster risk reduction, as well as health, economic prosperity, and societal well-being (Seddon et al., 2021).

1 See a guide to the Millennium Ecosystem Assessment

It is important to note that the ecosystem-based approaches under the NbS umbrella are not mutually exclusive; instead, the NbS concept recognises that encompassed approaches work synergistically, delivering a range of outcomes and multiple benefits. NbS is seen as an over-arching concept that can be used to support communication and the mainstreaming of these different subsets across international and multi-lateral agreements and global frameworks as well as their audiences. For simplicity, these approaches can be placed into five categories (Cohen-Shacham et al., 2016) (see Table 1).

NbS have been defined by IUCN as "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" (Cohen-Shacham et al., 2016). This definition – in line with the UNEA 5.2 definition – is the most prominent one and has been included in CBD and Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services glossaries, among others; however, definitions by the European Commission[2] or the Organisation for Economic Co-operation and Development[3] also share common elements.

2 European Commission (2021). The EU and nature-based solutions.
3 Organisation for Economic Co-operation and Development. (2020). Nature-based solutions for adapting to water-related climate risks (OECD Environment Policy Paper No. 21).

Table 1. Five main categories of the Nature-based Solutions umbrella

Category of NbS approaches	Description	Example
Ecosystem restoration approaches	The process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed (Society for Ecological Restoration, 2004).	The restoration of a forest area degraded by mining activities or the restoration of a polluted river basin. Ecosystem restoration can also include the introduction of a particular species or the use of a species that traps sediment for coastal protection.
Issue-specific ecosystem-related approaches	These approaches include emerging types of ecosystem-based approaches that aim to address specific hazards. They encompass ecosystem-based adaptation, which aims to address the role of ecosystem services in moderating climate impacts on people, while ecosystem-based mitigation targets the causes of climate change by reducing GHG emissions or enhancing carbon sinks (Staudinger et al., 2012). Similarly, the Ecosystem-based Disaster Risk Reduction (Eco-DRR) approach focuses on minimising the impacts of hazard events that are not necessarily linked to climate change by enhancing people's capacities to better manage and recover from the impacts of hazards (Renaud et al., 2013).	Examples of ecosystem-based adaptation include the "replanting of forests with more climate-tolerant species to adapt to climate change." An example of ecosystem-based mitigation is the restoration and "sustainable use of coastal and marine ecosystems in order to allow blue carbon to be stored" rather than released to the atmosphere. Eco-DRR could include the restoration of marshlands to protect communities from cyclone or hurricane flooding (Cohen-Shacham et al., 2016).

Infrastructure-related approaches	These approaches include natural infrastructure and green and blue infrastructure approaches. Both terms are often used interchangeably and share many of the same principles, such as connectivity and multifunctionality. They are based on the notion that ecosystems perform a number of the same functions as conventional grey infrastructures, such as water collection, storage, and purification (Cohen-Shacham et al., 2016).	Green roofs and urban forests provide a cooling effect, wetlands that lower flood peaks in downstream cities, or mangroves and coral reefs that protect coastal areas against storms and inundation (Cohen-Shacham et al., 2016).
Ecosystem-based management approaches	Ecosystem-based management is a response to challenges and initiatives in protected areas as well as in regional and environmental planning that consider the entire ecosystem, including humans (Cohen-Shacham et al., 2016).	Integrated coastal zone management or integrated water resources management.
Ecosystem protection approaches	This type of approach promotes the protection and conservation of designated areas / ecosystems.	Area-based conservation approaches, including protected area management.

Source: Adapted from Cohen-Shacham, 2016

The following case studies of the Amarakaeri Communal Reserve in Peru and Medmerry in the United Kingdom highlight the integrated character of NbS and the multiple benefits they can provide.

BOX 1

CASE STUDY 1: THE AMARAKAERI COMMUNAL RESERVE (PERU)

The forests of the Peruvian Amazon are among the most biodiverse in the world and home to a large indigenous population. However, they face growing deforestation and degradation as a result of natural resource extraction (timber, alluvial gold, and hydrocarbons), increasing droughts and floods, and historical processes of colonization and infrastructure investments.

The Amarakaeri Communal Reserve is an initiative headed up by the Peruvian National Service of Natural Protected Areas, with technical support from the United Nations Development Programme and financial assistance from the Government of Germany and jointly implemented with ten indigenous communities. It aims to conserve indigenous communities' ancestral land along with a multitude of ecosystem services, including water, food, and shelter to reduce their vulnerability to climate change, meet their livelihood needs, and diversify economic opportunities.

To diversify and generate sources of income and protect natural resources in the long term, the programme introduced techniques for sustainable chestnut harvesting, fish farming, and experiential tourism, among other things, to help the communities cope with climate change and generate livelihoods. These new strategies were included in both the community life plan and the reserve's master plan. This underpins the protection of river basins to ensure the stability of lands and forests while maintaining the quality and quantity of water for the development of indigenous communities.

Over the lifespan of the programme, community members became gradually involved, growing confidence in the proposed activities. This NbS provides indigenous communities with sustainable livelihoods, increases their adaptive capacity to climate change, and ensures the conservation of approximately 500,000 hectares of high-conservation-value forest.

Source: Dourojeanni, 2016.

BOX 2

CASE STUDY 2: MEDMERRY MANAGED REALIGNMENT SCHEME (UNITED KINGDOM)

Medmerry is surrounded by low-lying and flat land located on the coast of South East England. The area has flooded in recent years, and the shingle defences (small to medium-sized cobbles) were not providing sufficient protection at larger-scale flood events and offered little opportunity for ecosystem functioning and services. To address the issue, the United Kingdom Environment Agency (EA) built 7 km of new flood embankment on higher ground, creating a large lagoon / salt marsh in place of the current crumbling sea wall. The project took a holistic approach and was designed to address three key challenges:

1. Increase the standard of flood protection for the surrounding properties by absorbing the wave energy in a newly built wetland.
2. Create a compensatory intertidal habitat that delivers an accessible nature reserve for loss of wildlife habitat through development in other areas.
3. Create new access routes and viewpoints for walkers, cyclists, and horse riders.

The new flood embankment has been designed to be resilient to sea level rise for at least 100 years by providing a sustainable and natural approach to flood risk management in which the habitat will absorb and dissolve the sea's energy.

It further provides important fish spawning and nursery areas that offer opportunities for low-intensity mixed farming, which are being developed in partnership with local graziers and tenant farmers. The project demonstrates adherence to the three pillars of sustainable development and the multiple benefits NbS can provide.

- **Economic benefits** include vastly reduced ongoing maintenance costs of flood defences as well as benefits to local businesses from the establishment of a new tourist attraction and a fish nursery to help sustain the local fishing fleet.
- **Environmental benefits** include a contribution to and enhancement of biodiversity resulting from the creation of new habitats and improved connectivity between existing nature reserves.
- **Social benefits** include well-managed access for walking and cycling that offers the human health benefits of physical activity and exposure to natural environments. There are educational opportunities for local schools and colleges, which will focus on wildlife and habitats, heritage, flood risk management, and sustainability. These benefits were backed up by a health impact assessment.

Source: Lewis et al., 2016.

Challenges and Concerns Associated With Nature-based Solutions

While the concept of NbS has received significant endorsement—in particular, from the climate community—various challenges, questions, and concerns continue to emerge. It is important to shed light on them and discuss how they might be addressed.

- **Potential misuse of NbS offsetting:** NbS is increasingly being pushed by the climate community as a solution to mitigation and adaptation challenges, supported by optimistic studies on estimates around mitigation and carbon sequestration potential. This has led to widespread concerns about the potential for NbS to be used as an emission-offsetting option by the private sector rather than rapidly phasing out fossil fuel emissions and neglecting technological efforts (Anderson et al., 2019). Further, there are limitations on the extent to which NbS can contribute to offsetting fossil fuel emissions due to the uncertainty around the level of warming (the carbon-binding potential of vegetation is dependent on temperature) (Girardin et al., 2021), the limits of carbon that can be removed by natural carbon sequestration processes (e.g., trees, soils, aquatic organisms), and constraints on the availability of land. It is important that if offsetting via NbS is taking place, it is accompanied by efforts to rapidly phase out emissions or, in the best case, combined with NbS approaches. Ecosystems themselves face tipping points and become stressed, which can turn carbon sinks into carbon sources—for example, through warming oceans and soils, melting permafrost, and more frequent wildfires (Seddon et al., 2021). This emphasises the need for stringent criteria and standards to ensure the quality and sustainability of NbS initiatives.

- **Vagueness of the concept:** Due to the relative newness of the concept and its broad scope, some have argued that the NbS concept is too vague and over-simplified and that it is difficult to establish clear differences and links to other existing concepts (Nesshöver et al., 2017; Pauleit et al., 2017). Others have argued that NbS does not aim to erase existing approaches or concepts (like Eco-DRR, EbA, and Integrated Water Resource Management) but rather draws attention to them under one umbrella, ideally creating new momentum and increased visibility across actors and discourses. It can serve as a useful "boundary concept" to bridge actors from different perspectives and backgrounds (Hanson et al., 2020; Weldon et al., 2021). Similarly, it offers more focus and immediacy as a planning approach due to its aim to provide solutions to societal and sustainability problems (Dorst et al., 2019). It places nature at the centre of development, equal to socio-economic benefits (Mell and Clement, 2019). Despite these differences, it is noteworthy that there is broad consensus that NbS overlap with other approaches, providing an umbrella for them, and should therefore not be considered a competing or isolated concept (Lafortezza et al., 2018; Mell & Clement, 2019; Sekulova & Anguelovski, 2017). Instead, NbS and other nature-based approaches should be considered complementary, mutually reinforcing, and providing a holistic approach to societal, natural, and climate challenges. By treating NbS as an umbrella term, established concepts can continue to thrive and—potentially—improve in order to take increased account of, for example, multifunctionality, inclusiveness, and justice. Core governance principles such as adopting socially inclusive and rights-based approaches, benefit sharing, and adaptive management need to be operationalised if NbS is to make a substantial contribution to addressing societal challenges (for further information, see Thematic Paper 4: Good Governance for Integrated Climate and Biodiversity Policy-Making).

- **Lack of involvement of all relevant stakeholders:** To deliver legitimate and equitable outcomes, all relevant stakeholders, in particular indigenous peoples and local communities, should either lead or be engaged in the design, implementation, and management of NbS. To be effective, interventions should foster ownership and empowerment and lead to the improved well-being of indigenous peoples and local communities (Seddon et al., 2020). Concerns have been raised within the biodiversity community that the IUCN NbS definition does not make specific reference to the third objective of the CBD regarding the "fair and equitable sharing of benefits" that biodiversity provides. This is in contrast to the "ecosystem approach," which functions as the primary framework of action under the CBD (CBD, 2021) and clearly outlines central components and implementation guidelines for ecosystem management processes. Similarly, indigenous peoples and civil society have argued that the concept of NbS may be used to promote the privatisation of nature and commodification through market-based mechanisms. This has led to apprehension that trade-offs possibly generated by NbS are ignored while some stakeholders benefit at the expense of others. Similarly, some are wary that procedural aspects such as involving indigenous peoples and local communities in decision-making will be reduced to formalities and box-ticking, ultimately marginalising communities and vulnerable groups (Seddon et al., 2020). This reiterates the importance of just NbS initiatives that ensure equitable and inclusive processes, underpinned by robust standards to ensure an equitable sharing of the benefits arising from NbS.
- **Limitation to forest ecosystems:** There are concerns that NbS are primarily focused on delivering mitigation and adaptation benefits, creating a "tyranny of trees" that overlooks crucial biodiversity values of other non-forested ecosystems (Veldman et al., 2015). For example, carbon stored in the ground is much more secure than carbon stored in trees, as they are exposed to risk, including deforestation, pest, fires, and droughts. Few studies on NbS include explicit monitoring of biodiversity outcomes, and often current pledges do not mention important safeguards or consider unintended consequences (Seddon et al., 2020). For example, many pledges focus on commercial plantations and agroforestry rather than the protection and regeneration of existing diverse ecosystems, which has led to the concern that interventions labelled by the climate community as "NbS" will in fact not uphold basic principles. The planting of low-diversity plantations of non-native species, for example, should not be considered an NbS, as they potentially harm biodiversity and do not act as locally adapted, resilient, multifunctional natural areas. To alleviate this criticism, NbS must be explicitly designed to demonstrate measurable benefits for biodiversity. To that end, baseline assessments, quantitative targets, and approaches involving a suitable mix of native species and biodiversity safeguards are crucial.

- **A lack of adequate NbS monitoring:** Criticism has been raised that the NbS concept does not adequately address uncertainty and the temporal dynamics and scale of ecosystems—for example, the temporal variance of carbon stocks in reforestation areas for biomass production (Cohen-Shacham et al., 2019). This concern is related to the need for long-term objectives and maintenance of initiatives, including monitoring, to ensure the stabilisation of ecosystems and the services they provide. Similar to any climate change or conservation project, NbS initiatives must be underpinned by robust monitoring frameworks co-produced by relevant stakeholders and rightsholders within a particular land area. Monitoring frameworks for NbS should also provide the country with the possibility to fulfil its reporting requirements under UNFCCC and CBD respectively. This in turn will help to provide the oftentimes lacking "business case" for NbS.

Identifying and understanding the gaps within the current NbS concept is critical to ensure that they are considered and addressed through standards and quality principles when developing an operational framework for NbS. IUCN has taken important steps toward the development of criteria to strengthen the sound management and implementation of well-designed NbS and is currently developing a certification scheme based on existing ones (IUCN, 2021).

Core Standards for the Operationalisation of Nature-based Solutions

It is important to acknowledge and address the above challenges and concerns, as countries and other actors are starting to incorporate NbS into their plans and strategies. Simultaneously, consensus, clear guidelines, and a standardised approach for the design and implementation of NbS are underscored to ensure the quality and credibility of NbS and align climate change and biodiversity commitments while providing wider societal benefits.

The NbS concept builds on the existing Convention on Biological Diversity (CBD) ecosystem approach and its 12 principles and includes in large part ecosystem-based approaches such as for climate change adaptation (EbA) and disaster risk reduction (Eco-DRR), that have internationally agreed safeguards. For example, the CBD voluntary guidelines for EbA and Eco-DRR are underpinned by principles and safeguards that were developed by reviewing existing literature for EbA and related practices (CBD, 2019). Consequently these safeguards also provide the basis for NbS.

Further, in March 2022, at the United Nations Environment Assembly (UNEA) 5.2, countries requested "to assess existing and discuss possible new proposals, criteria, standards and guidelines to address divergences with a view to reaching a common understanding between Member States for the implementation of nature-based solutions" [...] (Resolution Nature-based Solutions for Sustainable Development UNEP/EA.5/L.9/REV.1).

As NbS are adopted and integrated into policy documents, greater clarity and precision are required to ensure their design and implementation meet a set of basic requirements, including biodiversity benefits. As such, core standards have been developed by IUCN to underpin the NbS concept and its relationship with other approaches, as well as to guide implementation on the ground. It should be noted that the current standards serve as a foundation for further development for the successful implementation of NbS.

The global NbS standards developed by IUCN consist of eight criteria and 28 indicators to build a common language and understanding of NbS. The standards equip implementers with a robust framework for designing, verifying, and implementing effective NbS, which can be tailored to the implementation context. Applying the standard is key to achieving effectiveness, sustainability, adaptability, and scale in NbS initiatives. The criteria listed here are interactive, as opposed to independent, and should be considered in relation to each other (IUCN, 2020).

Criterion 1

NbS effectively address societal challenges. An NbS initiative must address a specified challenge that is being identified as a priority by those who are or will be directly affected by it. All rightsholders and potential beneficiaries of the NbS must be involved in an inclusive planning and decision-making process, as opinions may differ between external stakeholders and local populations.

Example: An NbS initiative may have defined climate change adaptation as the primary focus based on identified climate change impacts, but through inclusive community engagement processes, it becomes clear that stakeholders face additional challenges, such as food security, ecosystem degradation, and disaster risks. Inclusive planning allows project teams to design activities that include an array of challenges and capture a wide range of multiple benefits by being inclusive of local needs.

Criterion 2

Design of NbS is informed by scale. Many NbS are implemented over large spatial scales, such as watersheds, forests, or grasslands. These usually combine various ecosystems and, in some cases, might be transboundary. The purpose of the criterion is that when applying NbS at scale, implementers recognise the complexity and interactions between different aspects in the wider environment.

Example: In Kenya, applying landscape analysis and simulation modelling at a watershed level when comparing grey and natural infrastructure highlighted the additional benefits provided, such as the provision of water- and biodiversity-related services that deliver irrigation and safeguard benefits in the face of climate change (IUCN, n.d.). Natural infrastructure can outweigh the benefits of grey infrastructure when applying a whole-ecosystem lens and allow a better understanding of additional services, synergies, and trade-offs within the larger landscape.

Criterion 3

NbS result in a net gain of biodiversity and ecosystem integrity. The intention of this criterion is to underscore that NbS are derived from goods and services of ecosystems and therefore depend on the health and functionality of an ecosystem. Therefore, NbS initiatives must avoid undermining the integrity, functionality, and connectivity of ecosystems. In practical terms, this means implementers must have a very good understanding of the current state of the ecosystems concerned, conduct baseline assessments, and make use of various forms of evidence to evaluate the impact of the intervention where possible, including local and scientific knowledge.

Example: Restoring natural coastal vegetation as physical protection against storm surges or flooding can recreate biodiversity habitats (Mackley, n.d.). Initiatives like these in the United Kingdom are underpinned by systemic and repeated scientific studies to generate lessons learned on biodiversity benefits and build a better understanding of failures in previously engineered infrastructure and the costs associated with losses from natural hazards.

Criterion 4

NbS are economically viable. A key attribute and determinant of the success of an NbS is the economic viability of the initiative and equity in the distribution of benefits. Performing cost-benefit analyses that incorporate environmental, social, and economic benefits; costs; and externalities—and also consider climate change risks—will increase the predictability and certainty of natural infrastructure's performance.

Example: A cost-benefit analysis of the Saloum Delta in Senegal found that the cumulative value of ecosystem services is EUR 5.47 billion over 40 years. Improved conservation can generate positive spillovers into the local economy, create employment, and increase the delivery of ecosystem services. Indeed, the analysis forecasts an additional income of EUR 14.8 billion over the next 40 years if the ecosystem remains protected (Bassi et al., 2020).

Criterion 5

NbS are based on inclusive, transparent, and empowering governance processes. The design and implementation of NbS initiatives must produce societal benefits in a fair and equitable manner and adhere to inclusive participation based on mutual respect and equality. NbS initiatives need to provide benefits to various stakeholders, from local communities to private or government actors at local, regional, or national scales, depending on the context. Participation must be based on equality regardless of gender, age, or social status and uphold the rights of indigenous peoples to free, prior, and informed consent.

Example: The City of Antwerp engaged community members from different backgrounds, qualifications, and knowledge systems in a **community co-creation process to inform the design of a green corridor** to introduce different NbS solutions for water retention. Engagement processes like these are crucial to building ownership of NbS initiatives as well as trust in governments and project implementers, which in turn is key to the sustained effectiveness of the intervention.

Criterion 6

NbS equitably balance trade-offs between the achievement of primary goal(s) and the continued provision of multiple benefits. It is inevitable that there will be trade-offs when designing and implementing NbS initiatives. Hence, a thorough understanding of these trade-offs and benefits (current and projected) is essential when considering different NbS activities. This must be underpinned by an equitable, fair, and transparent process that involves all affected stakeholders negotiating how trade-offs will be addressed.

Example: In Bangladesh, a **temporary annual ban on hilsa fish** (a staple food in the country) was implemented to allow the population to recover due to a dramatic decline from overfishing and habitat degradation. An assessment of trade-offs and costs related to the ban revealed that it threatened the livelihood of 3 million fishers. Payment for an ecosystem services scheme was set up, providing affected fisher communities with rice in return for not fishing in affected areas. However, trade-offs varied greatly between stakeholders which needed to be re-assessed and responses adjusted accordingly (**Rahman et al., 2020**).

Criterion 7

NbS are managed adaptively based on evidence. The long-term stability and sustainability of NbS depend on implementation plans that enable adaptive management and iterative learning. Ecosystems are complex, dynamic, and interconnected, and it is difficult to predict what the short- and long-term impacts of various factors are. Any adaptive management approach should be evidence based and supported by regular monitoring and evaluation that draws from scientific data as well as indigenous, traditional, and local knowledge.

Example: In Tanzania, a large-scale national restoration initiative involved the planting of 1 million exotic trees that were distributed to villages to plant. The initiative was met with little enthusiasm due to the lack of ownership and engagement of villages, and the villagers rejected the exotic trees over native and indigenous tree species. The failure of the top-down approach led to a revaluation of project activities, which involved prioritising local engagement processes through traditional institutions to redesign restoration efforts. As a result, 300,000 hectares of degraded land were restored (Duguma et al., 2015).

Criterion 8

NbS are sustainable and mainstreamed within an appropriate jurisdictional context. For NbS initiatives to be scaled up and have broad influence, it is essential to incorporate and align them with national and subnational policies and strategies, as well as sectoral development plans. NbS provide multiple benefits and are likely to contribute to achieving commitments under multiple global agendas. Making these linkages explicit and seeking synergies will further strengthen the role and uptake of NbS and secure support.

Example: El Salvador is implementing a large-scale National Ecosystem and Landscape Restoration Programme that seeks to restore 122,093 hectares using a forest restoration approach. An analysis was undertaken to highlight the associated benefits, including reversing biodiversity loss, emission reductions, and direct and indirect job creation. Most importantly, El Salvador has identified 10 different national policies, plans, and strategies that the initiative is contributing to. Seeking out these synergies helps them to mobilise actions at scale (Initiative 20x20, n.d.).

Given the close relationship between NbS and other ecosystem-based approaches, it is beneficial to look in more detail at the commonalities and attributes of the NbS approach, as well as the CBD's ecosystem approach and its 12 principles (Box 3).

BOX 3

COMPARING THE NBS CONCEPT AND THE CBD'S ECOSYSTEM APPROACH

The CBD has three main objectives: "(1) the conservation of biological diversity; (2) the sustainable use of the components of biological diversity; and (3) the fair and equitable sharing of the benefits arising out of the utilization of genetic resources" (CBD, 2004, p. 29). The ecosystem approach is defined by the CBD as a "strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way." The ecosystem approach has emerged as a central principle in the implementation of the CBD and has been adopted as the main avenue of action to achieve a balance of the three objectives of the Convention. It is underpinned by 12 principles to support operationalization (CBD, 2004):

1. The objectives of management of land, water and living resources are a matter of societal choice.
2. Management should be decentralised to the lowest appropriate level.
3. Ecosystem managers should consider the effects (actual or potential) of their activities on adjacent and other ecosystems.
4. Recognising potential gains from management, there is usually a need to understand and manage the ecosystem in an economic context. Any such ecosystem-management programme should:
   a. Reduce those market distortions that adversely affect biological diversity;
   b. Align incentives to promote biodiversity conservation and sustainable use;
   c. Internalise costs and benefits in the given ecosystem to the extent feasible.

5. Conservation of ecosystem structure and functioning, in order to maintain ecosystem services, should be a priority target of the ecosystem approach.
6. Ecosystems must be managed within the limits of their functioning.
7. The ecosystem approach should be undertaken at the appropriate spatial and temporal scales.
8. Recognising the varying temporal scales and lag-effects that characterise ecosystem processes, objectives for ecosystem management should be set for the long term.
9. Management must recognise that change is inevitable.
10. The ecosystem approach should seek the appropriate balance between, and integration of, conservation and use of biological diversity.
11. The ecosystem approach should consider all forms of relevant information, including scientific and indigenous and local knowledge, innovations and practices.
12. The ecosystem approach should involve all relevant sectors of society and scientific disciplines.

Both approaches—NbS and the ecosystem approach—share attributes, namely the importance of the sustainable use of resources to ensure the integrity of natural processes and biodiversity. Similarly, they both adhere to natural and cultural contexts with respect to ecosystem management, and they both embrace broad participation and transparency and the importance of addressing trade-offs. While equitable sharing of benefits is much more prominent in the ecosystem approach, underscoring a fundamental element of success of management interventions, IUCN's Criterion 5 refers to the importance of NbS initiatives producing societal benefits fairly and equitably.

On the other hand, NbS act as an umbrella under which various ecosystem-based approaches can be integrated with each other and work in synergy, thus being much wider than—but building on—the ecosystem approach as the underlying strategy. More broadly, the ecosystem approach is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use of biodiversity and ecosystems (largely for their own sake), while NbS underscore the role of ecosystem protection and management as a tool to respond to a range of societal challenges.

What is Novel About Nature-based Solutions?

Understanding the added value and what is novel about the NbS concept further informs its operationalisation and maximises multi-functionality, generating benefits.

The NbS concept and its criteria overlap and are consistent with other ecosystem-based approaches and related principles, underlining the close relationships between concepts. Hence, NbS is presented as a "large family" of approaches that do not compete with but complement each other and offer a demand-oriented range of possibilities that can be stand-alone technical concepts or applied in combination with each other. While the NbS concept is deeply grounded in existing ecosystem-based approaches, its novel aspect is to integrate different types of solutions (for example, an NbS combined with grey infrastructure) to meet societal challenges and mainstream it into planning and policy (Cohen-Shacham et al., 2019).

The extent to which NbS focuses on integrating policy and planning is more explicit than in other ecosystem-based approaches. NbS and IUCN Global Standard criteria are designed with a clear focus on integrating NbS into a wide range of policies and mainstreaming biodiversity into landscape-related policies and projects. For example, IUCN's Criterion 8 calls specifically for integrating management activities with policy and planning processes, a central element to improving and successfully achieving ecosystem health and human well-being. This allows the consideration of all relevant interactions between ecosystems and human activities that are taking place within the landscape, accounts for wider benefits, and addresses threats that would otherwise continue to cause degradation.

The NbS concept is crosscutting and can support the communication and integration of the different subsets of approaches that address multiple societal challenges beyond biodiversity loss and climate change, including food security, sustainable cities, and health. This provides the concept with the added value and potential for communication and awareness raising of biodiversity values beyond the conservation community. NbS can be communicated and used as a concept to strengthen synergies among ongoing international processes seeking to address a wide variety of issues, including climate change, land degradation, desertification, human settlements, agriculture, forests, and others. In addition, integration allows for a broader range of social and environmental benefits to be supported through connected interventions.

IUCN's Criterion 2 reflects NbS's novel consideration of landscape. It stresses that if site-specific interventions and projects are being implemented without considering the potentially wider causes of degradation, any achievements might be short term and lost to external factors that may continue to damage the ecosystem. Taking a landscape-wide approach enables the consideration of a wider array of ecosystems, how they interact, and what activities may threaten them that are beyond the primary project site. Barriers that limit the uptake of working at scale are often related to land tenure, administrative boundaries, legal mandates, technical capacities, and funding support.

Finally, another novel aspect is that NbS seek to address the complexity of the problem by emphasising coordination efforts via Criterion 8. This matches the scale of the solution required to the complexity of the challenges faced given the interlinkages of ecological, social, and economic needs—an aspiration that exceeds what site-level initiatives can realistically achieve. It stresses the importance of moving beyond project-site approaches to larger programmatic and policy interventions that recognise the scale and complexity of the societal challenges NbS aim to address (Cohen-Shacham et al., 2019).

While there is no perfect NbS concept, its core aims to go beyond solely environmental and conservation ambitions to achieve multifunctionality to deliver wider social and economic benefits. It is vital to note that the concept of NbS goes far beyond a single focus (e.g., mitigation or a single ecosystem). Rather, it draws attention to established and new approaches (EbA, water resource management, green and blue infrastructure) and puts them under one umbrella. Ideally, this will generate new momentum and increased visibility among a wide range of policy actors of nature's potential contributions to adaptation, disaster risk reduction, biodiversity conservation, and much more.

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