

Ecosystem restoration as a Nature-based Solution

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Key messages

- I **Climate change and biodiversity loss are interdependent and mutually reinforcing, yet have largely been addressed separately to date.** A more integrated approach is needed to tackle these two global challenges effectively. The concept of Nature-based Solutions (NbS) is such an approach and should be considered and applied by decision-makers.
- II **Ecosystem restoration is a NbS** and can make a crucial contribution to achieving international biodiversity and climate goals simultaneously, while contributing to human wellbeing. Furthermore, ecosystems need to be restored to achieve the Sustainable Development Goals 1, 2, 6, 13, 14 and 15.
- III The success of restoration measures depends on their design, on the political, societal and financial support they receive, and on the acceptance of affected stakeholder groups. **Planning restoration measures in line with the eight criteria of the IUCN Global Standard for Nature-based Solutions (IUCN, 2020) can help consider the many different factors (societal, ecological and economic) that are relevant for sustainable implementation.** At the same time, integrated planning processes ensure that restoration measures go some way to resolving both global crises, while avoiding conflicts (IPBES, 2021).

This paper is part of a policy paper series on the UN Decade for Ecosystem Restoration. The UN Decade links issues and challenges that have mostly been considered separately in the past, most notably: climate change, biodiversity loss and land degradation. It examines their interactions and identifies solutions. The Policy Paper series contributes to this, providing ideas and recommendations for joint implementation.



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Introduction

There is increasing recognition in science, among policy makers and in society at large that harnessing nature and ecosystem services is a way of overcoming a range of societal challenges. This is occurring at a critical point in history when it is more urgent than ever before to tackle the biodiversity and climate crises.

The decline in biodiversity worldwide shows little sign of slowing (IPBES 2019). The vast extent of species loss indicates that the sixth mass extinction in the Earth's history is under way – this time, however, attributable directly to human activity and causing catastrophic, long-term harm to the biosphere (Ceballos & Ehrlich, 2018). On top of this, the ongoing destruction of ecosystems continues unabated. Since 1700, as much as 87% of the world's inland wetlands have been lost (Davidson, 2014). The Red List of Ecosystems also shows that many more ecosystems are on the verge of collapse (Valderrábano et al., 2021). At the same time, humankind is facing a climate emergency caused by greenhouse gas emissions (Ripple et al., 2021) that will also undermine the foundations of economies, food security, health and quality of life (IPBES, 2019). Although climate change is not yet recognised as the main cause of the current loss of biodiversity on all three levels, a growing body of data suggests far-reaching impacts (IPBES, 2019; Román-Palacios & Wiens, 2020; IUCN, 2019). Conversely, species loss and the rapid degradation and loss of ecosystems (e.g. primary forests, mangroves) have a major negative influence on the planet's ability to store carbon (IPCC, 2020; Mackey et al., 2020).¹ In some regions, climate change is expected to outpace other major drivers of loss in the coming decades (ibid). Compromised natural ecosystems are already impairing the wellbeing of approximately 3.2 billion people (UNEP, 2021). Each year, ecosystem services with a value of more than 10% of global economic output are lost (UNEP, 2021). The impacts of climate change therefore demand both mitigation and adaptation measures.

In the past, global strategies for mitigating this dual crisis were drafted and addressed separately. This is reflected in the separate international agreements: the United Nations Framework Convention on Climate Change (UNFCCC) and the Convention on Biological Diversity (CBD). Major political processes (the Rio Conventions, the G7 and G20 for example) are now recognising the interdependency of the two challenges, and they are increasingly being addressed collectively in planning and strategy processes. In ground-breaking cooperation between the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) and the Intergovernmental Panel on Climate Change (IPCC), leading experts have confirmed that the climate and biodiversity crises are mutually reinforcing and can only be resolved together (Pörtner et al., 2021).² NbS are a conceptual framework for this.

The **restoration of ecosystems** is a systemic, cost-efficient and multifunctional NbS (Figure 1) that can make a significant contribution to addressing the climate and biodiversity crisis (IUCN, 2022; Pörtner et al., 2021; Turney et al., 2020). For example, restoration of only 15% of the converted land areas could avoid 60% of the expected species extinctions when careful land use planning is conducted and further degradation is prevented (Strasbourg et al. 2020). Restoring forest landscapes alone could cost-effectively remove 0.9-1.5 gigatons of CO₂ from the atmosphere annually (FAO, 2022). In the two most important global agreements on climate (UNFCCC) and biodiversity (CBD), NbS, including restoration measures, are gradually being taken into account.

The [UN Decade on Ecosystem Restoration \(2021-2030\)](#)³ is an opportunity for policymakers to anchor restoration as an NbS more firmly in the conventions and demonstrate the potential synergies.

¹ Between 2007 and 2016, the equivalent of 29% of total CO₂ emissions were caused by ecosystem responses to anthropogenic environmental changes (above all, the transformation of natural habitats into cultivated land) (IPCC, 2020).

² Research findings indicate the existence of synergies; for example, restoration of the most severely degraded areas combined with protection of biodiversity hotspots could significantly increase carbon capture and prevent 70% of predicted species loss (Strassburg et al., 2020).

³ Resolution 73/284 of the United Nations General Assembly

Policy context

The UN Climate Action Summit in 2019 was a key political moment for the concept of NbS. With the support of 70 governments, the private sector, civil society and international organisations, an NbS coalition agreed on the “NbS for Climate Manifesto” – a plan to realise the full potential of nature for climate change mitigation, supported by almost 200 initiatives around the world. This was followed by the UNFCCC COP26 in 2021, where the concept became pivotal in the contexts of forests and land use. It took on concrete form in the [Glasgow Leaders’ Declaration](#), in which more than 100 heads of state and government representatives, together representing more than 90% of global forest area, committed themselves to halting and reversing forest loss and land degradation by 2030. Germany was among the signatories. It is expected that NbS will be further strengthened at UNFCCC COP27. In March 2022, the United Nations also recognised the potential of NbS in a corresponding resolution at the UN Environment Assembly (UNEA). It emphasises the role of NbS in protecting, conserving, restoring, sustainably using and managing ecosystems.⁴ The resolution also calls on UNEP to support the implementation of NbS that safeguard the rights of communities and indigenous peoples.

Ecosystem restoration plays a key role in the implementation of global biodiversity targets, such as those of the new Global Biodiversity Framework (GBF). In the negotiations for a new GBF, one of the targets is to restore at least 20% (or up to 3 billion hectares) of degraded marine and terrestrial ecosystems by 2030 (Target 2). Some states are demanding that a link to the climate targets is expressly made in the wording of the targets. To achieve the goals of the UNFCCC and the Paris Agreement, the restoration of carbon-rich ecosystems is increasingly being incorporated into Nationally Determined Contributions (NDCs) as an NbS (Seddon et al., 2019). Furthermore,

ecosystem restoration is embedded in the UN Sustainable Development Goals (SDGs) (in particular goals 2.4, 6.6, 14.2, 14.4, 15.1-3, 15.8 and 15b) and in the [UN Strategic Plan for Forests 2017–2030](#).

The UN Decade on Ecosystem Restoration is an opportunity to create closer links between different restoration measures (specifically those that so far had a sole focus on climate, biodiversity or economic outcomes) – thereby creating synergies, finding compromises and avoiding harmful practices. The achievement of the goals of the UN Decade will depend above all on a common understanding and strict standards for restoration measures. The ten Principles for Ecosystem Restoration⁵ (Figure 3), elaborated as part of the UN Decade, provide a global framework for this (FAO, 2021) and supplement the existing practice-based principles for certain types of restoration measures (e.g. Ecological Restoration, Forest Landscape Restoration). The IUCN NbS Global Standard (Figure 4) overlaps to some extent with the ten UN Decade principles (see colour blocking in the graphics), but also diverges in some details. The standard consists of eight criteria and associated indicators, which enable a more precise (self-)evaluation (e.g. of restoration measures) with reference to the pillars of sustainable development and resilient project management.

The [Bonn Challenge](#) and its regional initiatives such as [AFR100](#) (Africa) and [Initiative 20x20](#) (Central and South America), which paved the way for the UN Decade declaration, also need to link biodiversity and climate aspects in their implementation phase. However, since there is no binding definition or specifications for the implementation of the pledges, many of the Bonn Challenge measures for the restoration of forests might neither contribute to an increase in the area of natural ecosystems nor to an improvement in their integrity (CBD, 2022).

⁴ “NbS may significantly contribute to climate action, while recognizing the need for analysis including in the long term of their effects and that they do not replace the need for rapid, deep, and sustained reductions in greenhouse gas emissions but can improve actions on adaptation, resilience and mitigation to climate change and its impacts.” (UNEP, 2022a)

⁵ It is an inherent part of the principles that restoration must bring net benefits for biodiversity, the health and integrity of ecosystems, and human wellbeing. This includes the sustainable production of goods and the provision of ecosystem services, climate change mitigation, as well as human health and wellbeing at local, national and global level.

Turning to Europe, the [EU's Proposal for a Nature Restoration Law](#) (EC, 2022a) – as the first binding restoration instrument worldwide – represents a huge opportunity for combating the biodiversity and climate crises. The goal of restoring natural ecosystems in 20% of the EU's land and sea area by 2030 has the potential to instigate decisive change. However, this presupposes that the European Parliament and the European Council adopt and implement this law immediately. Also, a robust compliance architecture will be needed to bring all EU member states into line on implementing and monitoring the national restoration plans, which are to be drawn up within two years.

Restoration mainly occurs at local level, calling for an integrated, integrative and effective approach in which policy makers, the private sector and local implementers work together (as in criteria 2, 4 and 5 of the IUCN Global Standard).⁶ It is thus also relevant to consider the funding landscape for restoration projects (see box on page 7).

Ecosystem restoration as an NbS – definition and classification

- Based on the UNEA definition (UNEP, 2022a) (which itself is based on the 2016 IUCN definition) NbS 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. Thus, NbS help to effectively and adaptively address societal challenges related to climate change, biodiversity loss, land degradation, urbanization, food and water security, extreme weather events, food and water security, human health, as well as socio-economic development. NbS is an umbrella concept embracing a range of ecosystem-based approaches that address societal challenges and simultaneously benefit human wellbeing and biodiversity (see Figure 1). Ecosystem restoration is a NbS.
- The United Nations Environment Programme (UNEP) defines ecosystem restoration as “the process of halting and reversing degradation, resulting in improved ecosystem services and recovered biodiversity” (UNEP, 2021a).
- Ecosystem restoration encompasses a wide continuum of practices (see Figure 2) extending from reduction of societal impacts on the environment, such as pollutants, to rehabilitation and the full recovery of (degraded, impaired or destroyed) native ecosystems, depending on local conditions and societal choice (UNEP, 2021a; Valderrábano, 2021).
- Restoration enlarges the natural ecosystem area only if modified or transformed ecosystems are restored to an intact state comparable with “natural” reference ecosystems, i.e. an ecosystem in similar surroundings with little human influence (CBD, 2022).

⁶ See also Marsters et al., 2021 for Latin America and the Caribbean or EC, 2022b for Europe, for example.



Figure 1 (IUCN, 2020) shows ecosystem restoration as a NbS which addresses societal challenges for the benefit of biodiversity and human wellbeing.

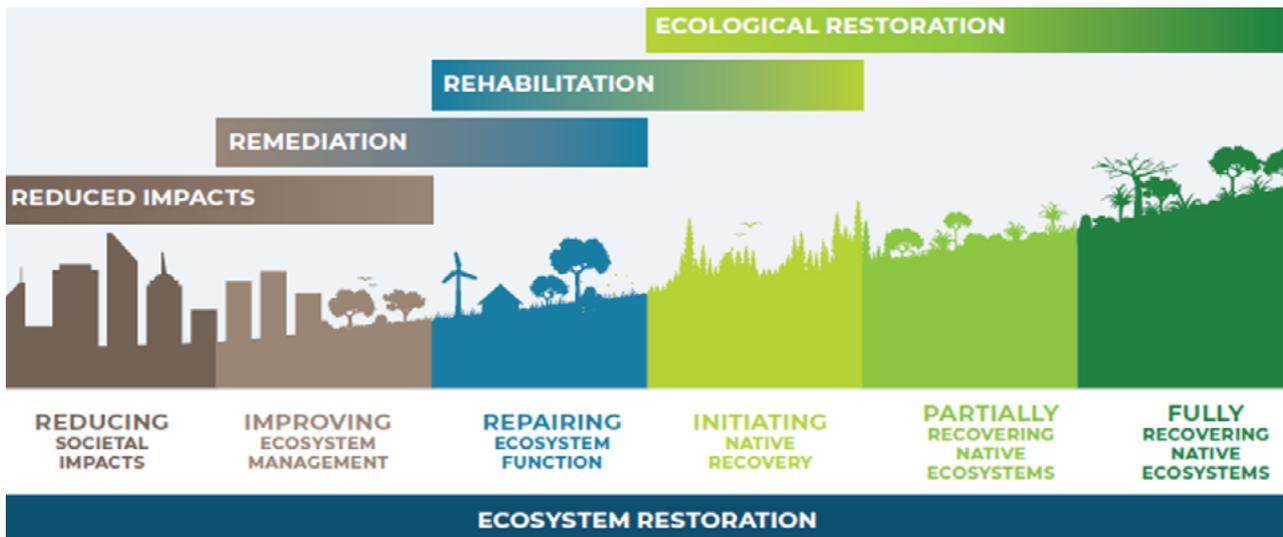


Figure 2 (Gann et al., 2019) shows the different types of restoration activities as a continuum rather than a linear path. Examples of these activities include improving organic carbon levels in agricultural soils, increasing fish stocks in over-fished areas, rehabilitating contaminated locations, restoring ecological processes, restoring biodiversity and conserving fauna and flora (UNEP, 2021b).



Figure 3 (FAO, 2021)

- 1) Ecosystem restoration (ER) contributes to SDGs and Rio Conventions
- 2) ER promotes inclusive and participatory governance
- 3) ER entails a continuum of practice
- 4) ER seeks best outcomes for biodiversity, ecosystem health, and human wellbeing
- 5) ER addresses drivers of degradation
- 6) ER integrates knowledge
- 7) ER sets measurable targets
- 8) ER considers local conditions
- 9) ER includes monitoring and adaptive management
- 10) ER fosters cross-sectoral policy coordination

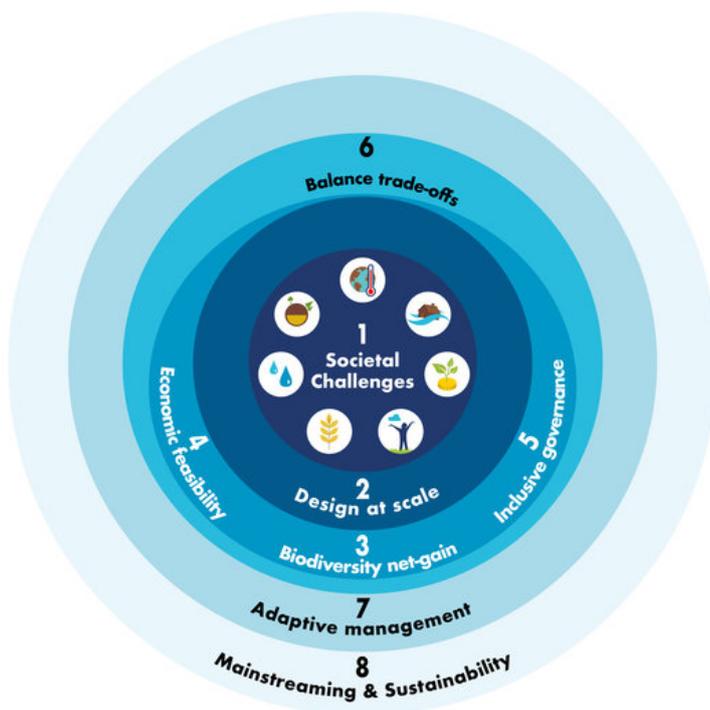


Figure 4 (IUCN, 2020)

- 1) NbS effectively address societal challenges
- 2) Design of NbS is informed by scale
- 3) NbS result in a net gain to biodiversity and ecosystem integrity
- 4) NbS are economically viable
- 5) NbS are based on inclusive, transparent and empowering governance processes
- 6) NbS equitably balance trade-offs between achievement of their primary goal(s) and the continued provision of multiple benefits
- 7) NbS are managed adaptively, based on evidence
- 8) NbS are sustainable and mainstreamed within an appropriate jurisdictional context

Figure 3 shows the ten Principles for Ecosystem Restoration which were developed to support the implementation of the UN Decade. Figure 4 depicts the eight criteria of the IUCN Global Standard for NbS. Lines marked in the same colour indicate overlaps of both approaches

Costs and funding sources

Investment in ecosystem restoration necessary to achieve a significant global impact and thus reverse biodiversity loss is estimated at USD 1 trillion in public and private funds over the course of the UN Decade to 2030 (UNEP, 2022b). In relation to the cost of ecosystem destruction and the extent of the benefits of ecosystem restoration (put at USD 9 trillion in ecosystem services), the investment of USD 1 trillion (approx. 0.1% of expected global GDP up to 2030) is cautious and realistic.

At global level, the multi-partner trust fund is the prime financial driver for implementation of the UN Decade (ibid). The majority of the funds will be used to support flagship initiatives that provide examples of large-scale, long-term restoration of ecosystems in a country or region. The German Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV) has already contributed EUR 14 million to the trust fund.

Other potential funding sources are post-Covid 19 recovery funds and economic stimulus packages (Nature4Climate, 2020).

Here too, it is worth looking to Europe: In the last ten years, around EUR 1.2 billion have been made available to more than 400 projects, in which over 11 million hectares of damaged ecosystems were restored. Interestingly, more than 85% of the restoration projects concentrated on terrestrial ecosystems (primarily forests) (UNEP-WCMC et al., 2020). The EU Biodiversity Strategy for 2030 aims to provide at least EUR 20 billion per annum for investing in nature, including the investment priorities of Natura 2000. However, the annual amount that will be dedicated to restoration remains uncertain. Furthermore, the total amount is already estimated to be too low to achieve the goals of the strategy, meaning that EU member states will need to supply additional funds (Nesbit et al., 2022).

Policy recommendations

The targets of the Post-2020 Global Biodiversity Framework (GBF) and the UNFCCC should be aligned better with each other and with the SDGs. Furthermore, the direct and indirect drivers of ecosystem degradation due to the predominant production and consumption patterns must be eliminated (Reise et al. 2021).⁷ At their 15th conference in December 2022 (COP15), the contracting parties to the Convention on Biological Diversity (CBD) can use the preparation of the GBF as an opportunity to sign a pivotal agreement that can generate the greatest possible synergies with the existing climate agreement.

The following points are crucial for the effective implementation of ecosystem restoration measures:

- **NbS can build bridges between biodiversity and climate.** The use of the NbS concept across Conventions, a common language and common definitions (including in NDCs and NBSAPs) can strengthen the joint implementation of the Rio Conventions.

⁷ For example, Common Fisheries Policy processes for eliminating the destructive effects of fishing on ecosystems, quantified, time-limited targets for removing obstacles in rivers, integration of agriculture in achieving biodiversity goals, for example through sustainable conservation practices in agricultural landscapes (Wanger et al. 2020), development of a circular economy that protects and promotes biodiversity (Sitra, 2022)

- **Mainstream NbS** into a wide range of activities (e.g. construction/infrastructure, see Thorn et al., 2022), sectors (e.g. the private sector, see Karlsson-Vinkhuyzen et al., 2017) and policies (Wamsler et al. 2017). This also includes to further consolidate the mainstreaming of biodiversity in development cooperation. The new GBF offers potential for this (Brörken et al. 2022). In addition, the complex interrelations between the two crises need to be communicated clearly to a wide audience.
- **Mainstream NbS in financing instruments** (e.g. from international cooperation). Financing instruments should be designed and restructured to always take both climate change mitigation and biodiversity conservation into account. For example, it could be made compulsory for all funding applications and project proposals to include a strategy for addressing both topics (e.g. using the eight criteria of the IUCN NbS standard, see Figure 4) or at least to draft a zero-harm strategy. Alignment with the ten principles of restoration (see Figure 3) could be made mandatory for new applications for restoration projects. Furthermore, public-private partnerships, concessions, nature conservation agreements, standards, or public procurement law could play an important role in integrating NbS in all relevant sectors.
- **Use NbS as planning tool.**⁸ Using the NbS concept for planning and implementation of ecosystem restoration can strengthen transdisciplinary approaches and participatory methods which bring together stakeholders from policy, academia, civil society, and the private sector. Thus, NbS can help overcome conflicts and trade-offs. Existing concepts like ecosystem services could provide a useful common basis for evaluating the impacts of different measures (Nesshöver et al., 2017; Ma et al., 2022). The knowledge gained in this way should be used to select the most suitable NbS strategy for each local situation (e.g. insurance, see Lopez-Gunn et al. 2021, or sustainable innovation, see Xie et al. 2022). Additionally, the planning process should always also address the underlying drivers of ecosystem degradation. Institutionalizing Best Practices that show how evidence- and criteria-based planning helps resolve conflicting goals can also be useful.
- **Acknowledge existing weaknesses of the concept and continue working towards its improvement.** Critics of the NbS concept fear that it is misused for greenwashing and is applied with insufficient involvement of local actors, or even violates their (property) rights. For NbS with a focus on natural climate protection, challenges persist in securing the storage of emissions in the long-term and in avoiding carbon leakage effects (Qi et al., 2021). The development of clear guidelines, standards, safeguards, and participation and grievance mechanisms can minimize risks and contribute to implementation success.
- **Promote NbS research.** Research can contribute to extending the scope of NbS and restoration approaches by developing science-based guidelines and decision tools to support decision-makers and other stakeholders in planning and implementation. A comprehensive understanding is needed of how integrated, cross-disciplinary governance approaches can be implemented successfully (Nesshöver et al., 2017), and on how an effective redesign of the socio-ecological system is interlocked with the current economic system (Tzoulas et al., 2021).

⁸ Attempts to achieve biodiversity and climate goals in combination can result in conflicting goals. For example, these can arise between different land use interests (such as agriculture and forestry) and the private sector, or between biodiversity conservation and carbon capture or storage measures and can be exacerbated by rapid changes in environmental conditions.

Conclusion

Ecosystem restoration is a NbS with major potential for effectively addressing both the biodiversity and climate crises. However, the restoration of degraded ecosystems is a complex task requiring considerable time, resources, and knowledge. For this reason, it is vital to protect existing ecosystems. Moreover, it is crucial to address underlying drivers of degradation. Furthermore, local stakeholders, including land managers and owners, authorities, and civil society, must be involved at an early stage to ensure that the activities are designed on a participatory basis. In the past, many restoration projects and programmes did not reach their full potential because of inadequate design, planning and/or implementation (Gann et al., 2019). The governance challenges connected with restoration interventions are wide-ranging and are determined by global, national and local political conditions and local socio-economic contexts. Local governments, for example, face ongoing challenges in the integration of new knowledge and new governance approaches. Reasons for this include entrenched silo thinking, resistance to innovation and

political fragmentation (Mahmoud et al., 2021). Using the NbS concept for planning and implementation of ecosystem restoration can strengthen cross-disciplinary approaches and participatory methods, bringing together policy makers, practitioners, researchers and the private sector. NbS that protect and restore native ecosystems – such as grassland, peatland, forests and mangroves – and/or rewild different species should be emphatically supported and extended as a key measure in carbon capture, climate change adaptation and biodiversity conservation (Naumann & Davis, 2020). However, they cannot replace the urgent and rapid decarbonisation of global economies and infrastructure. NbS must ultimately be part of the widescale transformation of current socio-economic systems. To halt the climate and biodiversity crisis, transformative changes are needed that address the direct⁹ and indirect¹⁰ drivers which have caused most of the degradation in the last 50 years. The UN Decade for Ecosystem Restoration should also promote this transformative change.

⁹ Changes in land and marine use, overexploitation of many plants and animals, climate change, environmental pollution and the spread of invasive species (IPBES, 2019)

¹⁰ Globally prevalent economic practices, the economic models behind them, and associated economic, socio-cultural, demographic, political, institutional, and technological drivers of ecosystem degradation.

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