

ECOSYSTEM RESTORATION

Science Brief for Target 2 of the
Post-2020 Global Biodiversity Framework



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SCIENCE BRIEFS ON TARGETS, GOALS AND MONITORING IN SUPPORT OF THE POST-2020 GLOBAL BIODIVERSITY FRAMEWORK NEGOTIATIONS

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ECOSYSTEM RESTORATION IN THE POST-2020 GLOBAL BIODIVERSITY FRAMEWORK: A FOCUS ON LAND DEGRADATION AND TERRESTRIAL ECOSYSTEM RESTORATION

Background and objectives

This brief was prepared as a follow-up to the "Science briefs on targets, goals and monitoring in support of the post-2020 global biodiversity framework negotiations" that were coordinated by Future Earth and GEO BON in support of the WG2020-4 meeting in Nairobi, Kenya in June 2022 (CBD/WG2020/4/INF/2/Rev.2). Specifically, the objective of this brief is to extract and refine key messages from the "Ecosystems" brief (Ecosystems Area and Integrity; <https://geobon.org/science-briefs/>) to provide concise messages concerning ecosystem restoration and land degradation. This is in response to informal discussions held with Parties to the UN Convention on Biological Diversity (CBD), the CBD Secretariat, the OEWG Co-Chairs and stakeholders. In particular, the "Ecosystem Area and Integrity" section of the science briefs was considered to provide important scientific background for negotiations, but it was also found to be too complex to directly apply to negotiation of targets related to restoration.

Structure of this brief

- 1) Summary – a concise, one page summary of overarching messages
- 2) "At a glance" – one-page digests of three key topics:
 - Restoration: contributions to goals of the GBF at a glance
 - Land degradation: definition and key numbers at a glance
 - Restoration: key numbers at a glance
- 3) In-depth analysis – an eight-page synthesis of the role of land degradation and terrestrial ecosystem restoration in the global biodiversity framework.

List of contributors:

Paul Leadley – Paris-Saclay University, France; past chair, bioDISCOVERY (coordinator of this note)
Barbara Bendandi – Coordinator UN Decade on Ecosystem Restoration, WWF, Germany
Jeannine Cavender-Bares – University of Minnesota, USA; bioDISCOVERY SSC
Fabrice DeClerck – EAT Forum and Alliance of Bioversity & CIAT, CGIAR, France; Earth Commission
George Gann – Society for Ecological Restoration, USA
Emily Gonzales – University of Victoria, Australia; Society for Ecological Restoration
Cornelia Krug – University of Zürich, Switzerland; Executive Officer, biodiscovery; GEO BON IC
Emily Nicholson - Deakin University, Australia; IUCN Commission on Ecosystems Management
Ülo Niinemets – Estonian University of Life Sciences, Estonia; bioDISCOVERY SSC
David Obura – CORDIO East Africa, Kenya; bioDISCOVERY SSC; Earth Commission
Bernardo Strassburg - Pontifical Catholic University of Rio de Janeiro, Brazil
Bob Tansey – Degraded Lands and Restoration, The Nature Conservancy, USA
James Watson – University of Queensland, Australia
Stephen Woodley – IUCN World Commission on Protected Areas, Canada
Peter Verburg – Vrije Universiteit Amsterdam, Netherlands; past chair, Global Land Programme
Adriana Vidal – Senior Policy Advisor, Climate Change, IUCN, USA
Moriaki Yasuhara – The University of Hong Kong, China; bioDISCOVERY SSC

Note: bioDISCOVERY and the Global Land Programme are part of Future Earth while the Earth Commission is hosted by Future Earth, an international research program that aims to build knowledge and find solutions for sustainable development.

Summary

Restoration of degraded ecosystems is essential for improving biodiversity and nature's contributions to people (NCP) and therefore for achieving the objectives of the post-2020 Global Biodiversity Framework (GBF), although restoration should not be used as a substitute for ambitious goals to reduce degradation and conserve natural ecosystems. This brief focuses on providing scientific background on restoration in terrestrial ecosystems and on land degradation, describing how these relate to the goals and targets of the GBF, and placing this in the context of other international restoration initiatives.

Ecosystem restoration halts and reverses degradation, resulting in improved ecosystem function, nature's contributions to people and biodiversity. There are many types of ecosystem restoration including reduction of pressures such as pollution and overexploitation, remediation to remove sources of degradation, rehabilitation and ecological restoration, all of which contribute to the objectives of the GBF. These actions can be found throughout the GBF Action Targets. This brief focuses on two types of restorative actions of particular importance for the goals of the GBF:

Type of restoration	Description	Contributions to Goals A and B of the GBF
Rehabilitation <i>also known as “regeneration” in the agricultural community</i>	The primary objective is to improve ecosystem functions and NCP in transformed ecosystems, such as agricultural or managed forest ecosystems. Rehabilitation often includes improving some aspects of biodiversity.	Contributes to: <ul style="list-style-type: none"> ● NCP objectives in Goal B ● ecosystem function in the managed ecosystems element of Goal A ● may or may not contribute to biodiversity objectives in the managed ecosystems element of Goal A
Ecological restoration	The objective is to put ecosystems on a path towards a state of high integrity ¹ using a natural state as a reference, taking into account climate change and natural ecological dynamics when setting objectives.	Contributes to: <ul style="list-style-type: none"> ● NCP objectives in Goal B ● natural ecosystem <u>integrity</u> objective of Goal A ● natural ecosystem <u>area</u> objective of Goal A, but only if it involves restoration of a transformed ecosystem towards a natural state

Explicit qualitative and quantitative restoration objectives for terrestrial ecosystems can potentially be integrated into targets of the GBF in several possible ways including but not limited to:

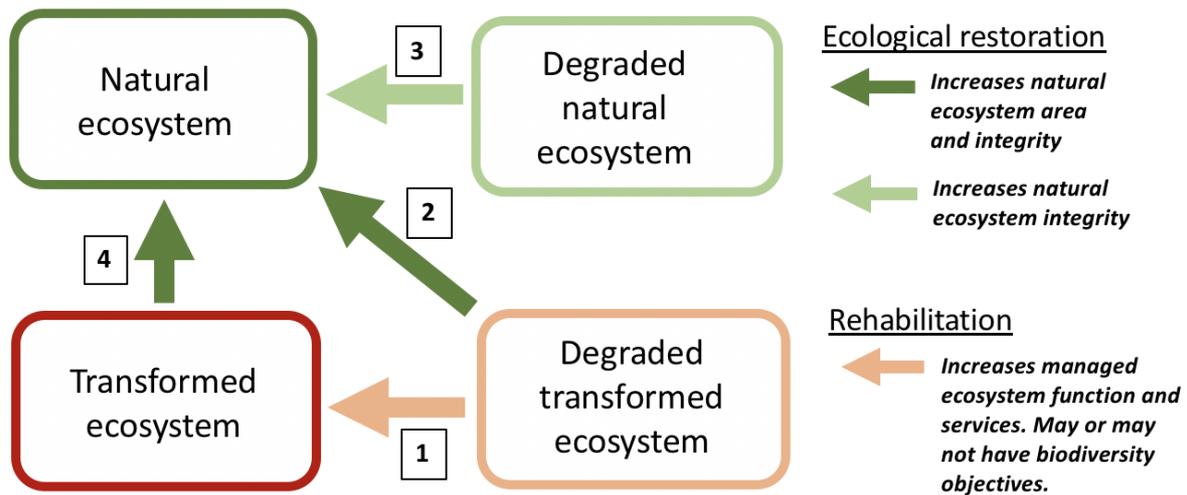
- an **all-encompassing restoration** objective in Target 2 that includes both ecological restoration and rehabilitation, but does not distinguish between these types of restoration;
- clearly **distinguishing ecological restoration and rehabilitation** objectives in Target 2, potentially with separate quantitative objectives.
- **focusing solely on an ecological restoration** objective in Target 2 and including rehabilitation objectives in other targets, such as rehabilitation/regeneration in Target 10 for agricultural and managed forest ecosystems.

Restoration objectives in other international initiatives, such as the 1 billion hectares of ecosystem restoration by 2030 for the UN Decade on Ecosystem Restoration or Land Degradation Neutrality for the UN Convention to Combat Desertification (UNCCD), can be taken into account when setting objectives for the GBF. However, different types of restoration are not explicitly distinguished in these initiatives, nor in currently proposed targets and monitoring framework of the GBF. Current commitments to ecological restoration are insufficient to meet natural ecosystem objectives in Goal A, so adopting objectives and indicators that account for the distinct contributions of different types of restoration to the objectives of the GBF is critical.

¹ High ecosystem integrity for natural ecosystems is typically defined as having composition, structure, function, and ecological processes close to that of a natural reference ecosystem (CBD/SBSTTA/24/3/Add.2/Rev.1).

Restoration: contributions to goals of the GBF at a glance

The figure below illustrates the contributions of ecological restoration to increasing natural ecosystem integrity and area, as well as rehabilitation to improving ecosystem function and services in managed ecosystems (Goals A and B of the GBF). The figure is based on the four main restorative pathways in terrestrial ecosystems simplified from the IPBES Land Degradation and Restoration Assessment (2018).² All of these actions contribute to restoring and improving ecosystem functions and services (Goal B), but the degree and type of contribution depends on the specific nature of the restorative action. Most transformed terrestrial ecosystems are managed for agriculture or forestry, and the term “regeneration” is often used as an equivalent for rehabilitation in these ecosystems.



Examples of these four restorative pathways for forest restoration and regeneration can be found in the main strategies countries are using to meet the Bonn Challenge (numbers below correspond to those in the figure above).

- 1) Degraded agricultural lands are planted with commercially valuable trees, often in single species stands, or rehabilitated with agroforestry.
- 2) Degraded agricultural lands are abandoned or protected from further use and allowed to naturally regenerate towards forest. Less commonly, restoration is facilitated by planting a diversity of native tree species.
- 3) Degraded forests are protected from pressures such as fire or harvesting of wood and allowed to naturally regenerate towards a more natural state. Less commonly, restoration is facilitated by planting a diversity of native tree species.
- 4) Productive agricultural land or productive managed forests are abandoned or actively restored to a more natural forested state.

These examples cover only a small part of the wide variety of rehabilitation/regenerative and ecological restoration actions found in international commitments to ecosystem restoration.

² This simplified view of ecosystem restoration provides a broad-brush view of the contribution of restoration to the GBF and does not include many of the important subtleties of the continuum of restorative actions, nor take into account that many ecosystems are not easily classified as natural versus transformed.

Land degradation: definition and key numbers at a glance

Land degradation is the result of human-caused processes that drive the decline in biodiversity, ecosystem functions, ecosystem resilience or ecosystem services in any terrestrial and associated aquatic ecosystems.

Because land degradation takes many forms, is measured in many different ways and is often subjective, there is little consensus on the extent of land degradation, and therefore the scope of restoration actions needed.

Key numbers (all numbers approximate)

- **2700 to 5400 million hectares (Mha):** In its recent Global Land Outlook 2 (GLO2), the UNCCD indicated that 20-40% of global land area is considered degraded.
- **Less than 1000 to over 6000 million hectares (Mha):** This larger range was reported in the synthesis of Gibbs & Salmon (2015).
- **10,000 million hectares (Mha):** An even greater fraction of land, approximately three quarters of terrestrial ecosystems, has been significantly altered by human activities and could be considered degraded from their natural state.

Notes: 1000 million hectares (Mha) = 1 billion hectares = 10 million km², which is roughly the area of Canada. Percent land area was converted to millions of hectares (Mha) using a value of 13400 Mha for the total global ice-free land area throughout this brief.

Restoration: key numbers at a glance

Examples of key global restoration objectives for 2030 relevant to the GBF either as existing international commitments or as proposed in Target 2 following the Nairobi WG2020-4 meeting (CBD/WG2020/4/CRP.6).

Objective or commitment	Mha and equivalent in % global land area	Source of objective	Comment
1000 Mha total restoration	1000 Mha 7.5%	Objective of UN Decade on Ecosystem Restoration for 2030. Approximate current total commitment to land restoration. One of the proposals for Target 2 in WG2020-4 CRP.	Puts emphasis on filling the large gap between commitments and implementation. Includes all types of restoration.
350 Mha forest restoration	350 Mha 2.6%	Bonn Challenge for 2030. This is an important subset of the 1000 Mha of committed restoration.	Focus is on forest restoration. Includes all types of restoration.
Restore 20% of degraded land, assuming 40% degraded globally.	1100 Mha 8.2%	Proposal for Target 2 for 2030 in the first draft of the GBF. Note: ≈1650 Mha for 30% proposal in WG2020-4 CRP.	Allocation to different types of restorative actions is not specified.
Restore 20% of degraded land, assuming 20% degraded globally.	550 Mha 4.1%	Proposals for Target 2 for 2030 in the first draft of GBF. Note: ≈775 Mha for 30% proposal in WG2020-4 CRP.	Allocation to different types of restorative actions is not specified.
Land degradation neutrality (LDN)	unspecified ³	UNCCD goal for 2030 (also SDG Target 15.3).	Area restored should be at least equivalent to newly degraded area, based on no net loss principles.

³ Scenarios developed for the Global Land Outlook 2 (UNCCD 2022) suggested that 5000 Mha of land would need to be restored by 2050 to achieve a "nature-positive and climate-resilient future" compatible with the objectives of the UNCCD.

In-Depth Analysis

1) Overview

Ambitious objectives for restoration were set in the CBD's Strategic Plan for Biodiversity 2011-2020, in particular Aichi Biodiversity Target 14, which aimed to restore and safeguard ecosystems that provide essential services⁴, and Target 15 which called for the restoration of at least 15 percent of degraded ecosystems by 2020. In 2016, Parties to the CBD laid out a "short-term action plan on ecosystem restoration" that outlines the guiding principles for ecosystem restoration in support of achieving the restoration objectives of the Strategic Plan for Biodiversity (CBD/COP/DEC/XIII/5). Unfortunately, the objectives for restoration were only partially achieved by 2020 (SCBD 2020). The post-2020 Global Biodiversity Framework (GBF) provides an important opportunity for Parties to the CBD to renew calls for ambitious restoration objectives and to learn from past successes and failures. This is particularly important because "the SDGs are unlikely to be met unless ecosystem degradation is stopped and ecosystem restoration is undertaken at cumulative scales of hundreds of millions of hectares globally⁵." (FAO et al. 2021, see also IPBES 2018 and UNCCD 2022).

Restoration actions and objectives appear explicitly in Target 2 of the post-2020 Global Biodiversity Framework (GBF) but are not restricted to this target since restoration actions that support the biodiversity and ecosystem services objectives of GBF permeate the entire framework. **The objective of this brief is to provide an overview of the scientific background on restoration in terrestrial ecosystems and on the closely related issue of land degradation, and then describe how these relate to the goals and targets of the GBF.** Freshwater and marine ecosystems are strongly connected with terrestrial ecosystems, but restoration of freshwater and marine ecosystems is not explicitly treated in this brief due to the very different conceptual basis and indicators for freshwater and marine systems compared to land. Separate briefs are also in preparation for freshwater and marine systems.

The GBF is being negotiated and will be implemented in the context of a rich suite of policies at local to global scales to slow land degradation and scale up restoration actions. Some of the key international processes related to restoration, primarily in terrestrial ecosystems, and land degradation are as follows (see Sewell et al. 2020 for more complete analysis):

- UN Decade on Ecosystem Restoration 2021–2030 (Resolution 73/284, UN General Assembly) is an ambitious agenda that calls on countries to deliver on about 1 billion hectares of commitments to restoration in terrestrial ecosystems (Sewell et al. 2020, FAO et al. 2021).
- The Bonn Challenge, which underpins the UN Decade on Ecosystem Restoration, is a global effort to restore 350 million hectares of the world's degraded and deforested lands by 2030. It was launched by Germany and the International Union for Conservation of Nature (IUCN) in 2011.
- The UNCCD goal of land degradation neutrality (LDN) aims to slow degradation and increase restoration efforts so that "the amount and quality of land resources necessary to support ecosystem functions and services to enhance food security remain stable, or increase" over time.
- The REDD+ framework for "Reducing emissions from deforestation and forest degradation" created by the UN Framework Convention for Climate Change (UNFCCC) focusses on contributions of forests to climate mitigation, but includes objectives for biodiversity and many ecosystem services. This commitment was reaffirmed by 145 countries in the Glasgow Climate Pact on the margins of the UNFCCC COP26 in 2021.

⁴ The terms "ecosystem services" and "nature's contributions to people" are used interchangeably throughout this brief.

⁵ 1 billion hectares = 1000 million hectares (Mha) = 10 million km². For an idea of scale, the area of China is about 960 Mha and Kenya 58 Mha. Global ice-free land area is about 13400 Mha.

2) Definitions of ecosystem degradation and restoration

Ecosystem Degradation

Ecosystem restoration needs to be understood in the context of ecosystem degradation, because the objective of restoration is to reverse the impacts of degradation (CBD 2016).⁶ “‘**Land degradation**’ is the result of human-caused processes that drive the decline or loss in biodiversity, ecosystem functions or ecosystem services in any terrestrial and associated aquatic ecosystems. ‘**Degraded land**’ is defined as the state of land which results from the persistent decline or loss in biodiversity and ecosystem functions and services that cannot fully recover unaided within decadal time scales. ‘Degraded land’ takes many forms: in some cases, all biodiversity, ecosystem functions and services are adversely affected; in others, only some aspects are negatively affected while others have been increased.” (IPBES 2018, see also UNCCD 2022). Not all land that is under human influence is considered degraded land. Humans have been influencing and interacting with landscapes around the world for millennia, sometimes leading to the establishment of biodiverse semi-natural or traditional ecosystems (IPBES 2018, 2019, Gann et al. 2019).

Very broadly, land degradation can be summarized as three main processes shown in Figure 1:

- Loss of biodiversity and diminished ecosystem function and services in natural ecosystems without a change in land use classification (arrow 1); for example, through overexploitation of wild species;
- Loss of biodiversity and diminished ecosystem function and services in transformed ecosystems (arrow 3), for example, through farming crops on marginal land leading to desertification and loss of soil fertility; and
- Conversion of natural ecosystems to non-natural transformed ecosystems (arrows 2 and 4); for example, by cutting down forests or draining wetlands to grow crops or graze livestock (this is not considered degradation by some people).

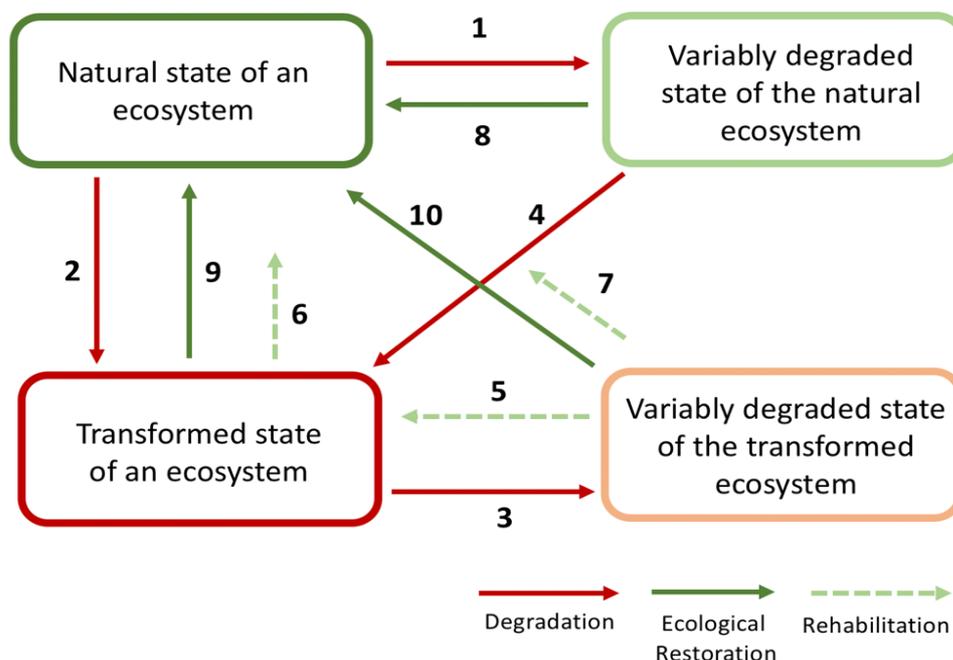


Figure 1. Main processes and states in land degradation and ecosystem restoration in terrestrial systems (adapted from IPBES 2018). See text for explanation of figure elements. To be consistent with the terminology in this brief, 'ecological restoration' is used to indicate restoration on a trajectory towards a natural state.

⁶ See also the Action Plan for the UN Decade on Ecosystem Restoration: https://wedocs.unep.org/bitstream/handle/20.500.11822/40514/ActionPlan_UNDER.pdf?sequence=3

Because land degradation takes many forms, is measured in many different ways and is often subjective, there is little consensus on the extent of land degradation, and therefore the scope of restoration actions needed (IPBES 2018, UNCCD 2022). This also complicates the quantification of the restoration needed when expressed as a percentage of degraded land (SCBD 2014 and CBD Information document CBD/WG2020/4/INF/2/Rev.2 subsequently referred to as the "Ecosystem Brief").

In its recent Global Land Outlook 2 (GLO2), the UNCCD indicated that 20-40% of global land area is considered degraded (UNCCD 2022), which equals about 2700-5400 million hectares (Mha) of land. An even larger range of less than 1000 to over 6000 Mha was reported in the synthesis of Gibbs & Salmon (2015). An even greater fraction of land, approximately three quarters of terrestrial ecosystems (approximately 10 billion hectares), has been significantly altered by some form of industrial level activity and could be considered degraded from their natural state (IPBES 2019, Riggio et al. 2020).

Ecosystem Restoration

Ecosystem restoration (frequently referred to simply as 'restoration') is broadly defined as "the process of halting and reversing degradation, resulting in improved ecosystem services and recovered biodiversity, depending on local conditions and societal choice" (FAO et al. 2021, UNEP 2021). Within the context of the GBF, ecosystem restoration has been further described as "restoration may include: (a) restoring converted areas back to natural states; (b) improving the ecological integrity of degraded natural areas; and (c) rehabilitating converted and degraded areas (e.g., degraded agricultural lands) to improve both productivity and integrity." Ecosystem restoration is, therefore, an all-encompassing term that covers a wide variety of restorative actions and can be summarized as follows (UN Decade on Ecosystem Restoration, FAO et al. 2021; see also see also IPBES 2018, Gann et al. 2019, UNCCD 2022, see Appendix 1 for a diagram of the restorative continuum):

- **Reduction of the direct and indirect drivers of degradation**, such as pollution and unsustainable use of biodiversity across all transformed and natural ecosystems;
- **Remediation** by the removal of contaminants, pollutants and other threats particularly in badly degraded ecosystems;
- **Rehabilitation** of ecosystem functions and services in transformed ecosystems such as degraded production systems where the objective is to restore to a less degraded transformed state, and where the restoration towards the natural state is not the primary objective (Figure 1: arrows 5-7, where in some cases rehabilitation includes partial recovery towards a natural state indicated by arrows 6 and 7). This is also often referred to in agricultural systems as 'regeneration'.
- **Ecological restoration** are actions where the objective is to put ecosystems on a path towards a state of high integrity using a natural state as a reference, taking into account climate change and natural ecological dynamics when setting objectives. (Figure 1: arrows 8, 9 and 10). This definition acknowledges that complete restoration to a fully natural state can rarely be achieved. It is important to note that 'ecological restoration' is a subset of 'ecosystem restoration' and the two terms should not be used interchangeably.

This brief focuses on the contributions of rehabilitation and ecological restoration to the objectives of the GBF. The use and definition of these terms varies in the scientific literature and in policy. The descriptions above are intended to clarify how existing definitions relate to the GBF. They are consistent with those used for the UN Decade on Ecosystem Restoration and are suggested based on a consensus of the contributors of this brief as being the best adapted to the needs of the GBF.

A core principle of restoration is that it should be undertaken only after all efforts to minimize harm and avoid degradation have been exhausted. **The potential for ecological restoration should never be invoked as a justification for destroying or damaging existing native ecosystems** (Gann et al. 2019, FAO et al. 2021, UNCCD 2022).

3) Actions along the restoration continuum contribute in different ways to the goals of the GBF

If properly done, all of the restoration actions highlighted above contribute to the overall objectives of the GBF (see Gann et al. 2019, FAO et al. 2021, UNCCD 2022 for key actions, principles and contributions to biodiversity and ecosystem services). However, restoration actions differ substantially in how they contribute to the 2050 Goals and intermediate 2030 objectives of the GBF. Table 1 provides a simplified view of restoration and its contribution to the GBF.

The key messages from Table 1 are that:

- Rehabilitation of transformed ecosystems can play a critical role in increasing the integrity of managed ecosystems and in supporting biodiversity and ecosystem service objectives of the GBF, but this role is highly dependent on the type of restoration action, some of which contribute in different degrees to Goal A and Goal B. Rehabilitation or regeneration does not contribute to the objective of increasing natural ecosystem area in Goal A;
- Ecological restoration of transformed ecosystems, such as agricultural lands, to a trajectory towards a natural state is the only means of achieving the ambitious goals of increasing natural ecosystem area in Goal A and can make very large contributions to improving a wide range of ecosystem services; and
- Ecological restoration of degraded natural ecosystems is critical for improving their integrity and for achieving this objective in Goal A.

In order for restoration activities to be most effective in conserving and restoring biodiversity and thus contribute to Goal A, they should be located in areas that are important for biodiversity (Mappin et al. 2016), and at the same time contributions to ecosystem services in Goal B need to be accounted for (Strassburg et al. 2020). There are science-based tools that can optimize the choice of location, maximizing contributions to GBF and other targets while minimizing costs (e.g., Strassburg et al. 2020, Ecosystem Brief). These costs are dependent on the price of land, ease of restoration, land tenure conditions and social impacts of those dependent on the land. The choice of locations for restoration will to a large extent determine the contributions of restoration to the GBF objectives and links strongly to the spatial planning objectives of Target 1 of the GBF (Ecosystem Brief). Poorly chosen locations may, with the same area requirements, not deliver sufficiently on the biodiversity and ecosystem service goals, while well-chosen areas can help to minimize costs and help reach multiple targets at the same time (Strassburg et al. 2020). Particularly high priority should be given to small, rare habitats with a risk of irreversible biodiversity loss (Ecosystem Brief).

4) Ecosystem restoration objectives in the GBF: the relationships to targets and goals of the GBF

Given the large range of actions that contribute to ecosystem restoration such as land use planning, improvements in ecological integrity in protected areas, reductions in pollution, sustainable agriculture and sustainable forestry, most of the actions in targets 1-10 contribute directly to restoration, and most of the remaining targets contribute indirectly.

Given that restoration actions are found throughout the GBF, what is the role of Target 2 in terms of setting objectives for restoration for terrestrial ecosystems? Deciding on the intended objectives for Target 2 is essential for the wording, numerical objectives and implementation of Target 2, and the GBF as a whole.

Table 1. Three key types of restorative actions in terrestrial ecosystems and their contributions to the objectives of the GBF (Ecosystem Brief).

Restoration Action	Examples	Contributions to GBF	Key issues
Degraded natural -> Natural = Ecological restoration (arrow 8, Figure 1)	Degraded natural forest, grassland, wetland -> natural forest, grassland or wetland of higher integrity	<ul style="list-style-type: none"> • Contributes to the natural ecosystem <u>integrity</u> element of Goal A. • Does not contribute to gain in the natural ecosystem <u>area</u> element of Goal A. • Contributes to ecosystem services objectives of Goal B, but contribution to food provisioning may be limited. 	<ul style="list-style-type: none"> • Ecological restoration is aimed at establishing appropriate species composition and structural diversity of the target natural system as well as supporting ecological processes, beneficial connectivity, and associated ecosystem services. • The target reference ecosystem for ecological restoration is generally the ecosystem that would have been at the site had degradation not occurred. • Long time periods are usually needed for ecological restoration: generally decades to centuries. • Ecological restoration often does not attain full recovery of integrity of natural systems. • The restoration of degraded remnant natural ecosystems is critical for halting continued loss of biodiversity and recovering depleted species, including threatened species.
Transformed (including degraded transformed) -> Natural = Ecological Restoration (arrows 9 & 10, Figure 1)	cropland and pasture -> natural forest, shrubland and grasslands	<ul style="list-style-type: none"> • Contributes to increasing <u>natural ecosystem area</u> (Goal A). • Contributes to natural ecosystem integrity (Goal A) • Contributes to many ecosystem services (Goal B), but may reduce food provision if agriculturally productive land is restored to natural. 	<ul style="list-style-type: none"> • Ecological restoration often does not attain full recovery of integrity of natural systems. • The restoration of degraded remnant natural ecosystems is critical for halting continued loss of biodiversity and recovering depleted species, including threatened species.
Degraded transformed -> Transformed = Rehabilitation (often referred to as ‘regeneration’ in agricultural systems) (arrows 5-7, Figure 1)	Agricultural and managed forest systems with reduced soil health and productivity -> productive cropland and pasture & healthy managed forest	<ul style="list-style-type: none"> • Does not contribute directly to natural ecosystem area or integrity elements of Goal A. • Usually contributes to increasing ecosystem integrity and sustainability in managed ecosystems (Goal A and Target 10). • Often contributes to improving a wide range of ecosystem services (Goal B) including food or fiber production (Target 10). 	<ul style="list-style-type: none"> • Generally positive for productivity and some ecosystem services in agricultural systems, but can have very limited biodiversity value. • Biodiversity value depends heavily on the type of restoration action. For example monoculture plantations of non-native tree species often contribute very little biodiversity value. • Rehabilitation is by far the largest fraction of the approximately 1 billion hectares of currently committed restoration actions (see Appendix 2, Sewell et al. 2020, UNCCD 2022). • Rehabilitation of degraded farmlands and pastures can improve their production capacity indirectly leading to less pressure on natural lands.

This brief focuses on three distinct possibilities for formulating the objectives of Target 2 and highlights their pros and cons:

- 1) *Target 2 includes a single objective that is a ‘catch-all’ for all restoration actions in terrestrial ecosystems in the GBF, in which different types of restoration actions are not distinguished.* If so, the restoration objective in Target 2 could encompass restoration of degraded lands in protected areas (Target 3), lands undergoing remediation by de-pollution (Target 7), rehabilitation of degraded agricultural lands and managed forests (Target 10), ecological restoration of transformed to natural ecosystems (implied in Goal A), etc. **Pros:** This type of formulation would be consistent with most international objectives for restoration that do not distinguish between different types of restoration (Table 2). This is also consistent with the proposed variants of Target 2 coming out of the Nairobi

WG2020-4 negotiations (Table 2). In addition, a single overarching restoration objective is easy to communicate. Cons: The strong focus on rehabilitation of managed ecosystems in current restoration commitments, and the lack of commitments to ecological restoration, especially the restoration of transformed ecosystems towards natural states, creates a substantial risk that the ambitious objectives for gains in natural ecosystem area and integrity in Goal A will not be met (Strassburg et al. 2020, UNCCD 2022, Ecosystem Brief, and see Appendix 2).

- 2) *Target 2 clearly distinguishes different types of restoration and potentially provides quantitative targets for these different types of restoration.* Target 2 could, for example, explicitly distinguish between rehabilitation and ecological restoration, and potentially between different types of ecological restoration (Figure 1). Pros: This type of formulation would allow for much more direct relationships between Target 2, Goal A and Goal B of the GBF as outlined in the Ecosystem Brief, and provide greater clarity in terms of ambitions for ecological restoration. In particular, Strassburg et al. (2020) and the Ecosystem Brief provide evidence for the levels of ecological restoration that would be necessary to meet ambitious ecosystem and species objectives of Goal A. This includes roughly 350-450 Mha of restoration of transformed, mostly agricultural lands, to natural ecosystems by 2030. A complementary objective of rehabilitation/regeneration on 18-33% of agricultural lands globally would support more productive and resilient production, albeit not contributing to increasing integrity or area of natural ecosystems (Sustainable Agriculture Brief). Cons: Target 2 would need to be reworded in order to clearly indicate the objectives of different restoration actions, and this would add complexity to the wording of the target (Ecosystem Brief).
- 3) *Target 2 focuses on ecological restoration.* In this case, the focus of Target 2 would be on actions that restore natural ecosystem area and integrity. Pros: The biodiversity objectives in Goal A at ecosystem, species and genetic levels cannot be met without significant increases in ecological restoration of degraded natural ecosystems and of transformed ecosystems towards natural states (Strassburg et al. 2020, UNCCD 2022, Ecosystem Brief). This type of formulation would highlight the need for these actions and would be easy to communicate. Cons: Rehabilitation is also essential for achieving the objectives of the GBF. It is unclear where rehabilitation would be addressed in the GBF if not in Target 2, but rehabilitation/regeneration of agricultural and managed forest ecosystems could potentially be addressed in Target 10.

Quantitative objectives for Target 2 will depend on which types of ecological restoration it includes, whether or not it clearly distinguishes different types of restoration and whether it is expressed on the basis of land area or on percent restoration of degraded land. Table 2 provides an overview of key international quantitative goals (see Sewell et al. 2020 for a more exhaustive list). First, most international quantitative objectives are expressed as land area to be restored (e.g., UN Decade on Ecosystem Restoration, Bonn Challenge; see comprehensive list in Sewell et al. 2020) or zero net degradation (UNCCD LDN, SDG Target 15). Formulation in terms of percent restoration of degraded land is consistent with the wording of Aichi Target 15, but means that the numerical objective has high uncertainty and creates difficulties in monitoring and reporting since it's not coherent with most other reporting mechanisms (Sewell et al. 2020). Second, none of the major international goals differentiate between rehabilitation and ecological restoration in their quantitative goals (see above for discussion of pros and cons). Third, current commitments to ecosystem restoration, the goal of the UN Decade on Ecosystem Restoration, and a goal of 20% restoration of degraded terrestrial ecosystems assuming that 40% of land is degraded are all roughly equal to 1 billion hectares.

Irrespective of the formulation of ecosystem restoration objectives in the targets of the GBF, it will be critical to distinguish different types of restoration in the implementation, monitoring and reporting. A catch-all formulation of Target 2 will, in particular, shift the burden to monitoring and reporting to ensure the necessary balance between types of restoration actions. In any case, the adoption and further development of indicators that can be used to report on different types of restoration, especially rehabilitation/regeneration and ecological restoration, is vital to the success of the GBF.

Table 2. Examples of key global restoration objectives for 2030 relevant to the GBF either as existing international commitments or as proposed in Target 2 following the Nairobi WG2020-4 meeting (CBD/WG2020/4/CRP.6).

Objective or commitment	Mha and equivalent in % global land area	Source of objective	Comment
a) 1000 Mha total restoration	1000 Mha 7.5%	Objective of UN Decade on Ecosystem Restoration (FAO et al. 2021) Approximate current total commitment to land restoration (Sewell et al. 2020, UNCCD 2022) Proposal for Target 2 in WG2020-4 CRP (CBD/WG2020/4/CRP.6)	UN Decade puts emphasis on filling the large gap between commitments and implementation. Current commitments have a strong geographical imbalance. Commitments to restoration from transformed to natural state are not well defined, but are a small fraction of total (Sewell et al. 2020, Appendix 2).
b) 350 Mha forest restoration	350 Mha 2.6%	Bonn Challenge for 2030. This is an important subset of the 1000 Mha of committed restoration globally.	Restoration commitments include regeneration of natural forest; a large fraction of tree plantations, many of them with non-native species; and a substantial fraction of agroforestry (SCBD 2020).
c) restore 20% of degraded land, assuming 40% degraded globally.	1100 Mha 8.2%	Proposal for Target 2 for 2030 in the first draft of the GBF. Note: add 550 Mha for 30% proposal in WG2020-4 CRP.	Contribution to GBF goals unclear since the allocation to types of restoration is undefined. Degraded area must be defined.
d) restore 20% of degraded land, assuming 20% degraded globally.	550 Mha 4.1%	Proposal for Target 2 for 2030 in the first draft of GBF. Note: add 225 Mha for 30% proposal in WG2020-4 CRP.	Substantially less ambitious than UN Decade on Ecosystem Restoration objective. Contribution to GBF goals unclear. Degraded area must be defined.
e) Land degradation neutrality (LDN)	unspecified	UNCCD goal for 2030 (also SDG Target 15.3). Area restored should be at least equivalent to newly degraded area and is based on a principle of "no net loss."	The LDN hierarchy is: first and foremost, avoid new degradation of land; second, reduce existing degradation by adopting sustainable management practices; and third, ramp up efforts to restore degraded lands to natural or more productive states.

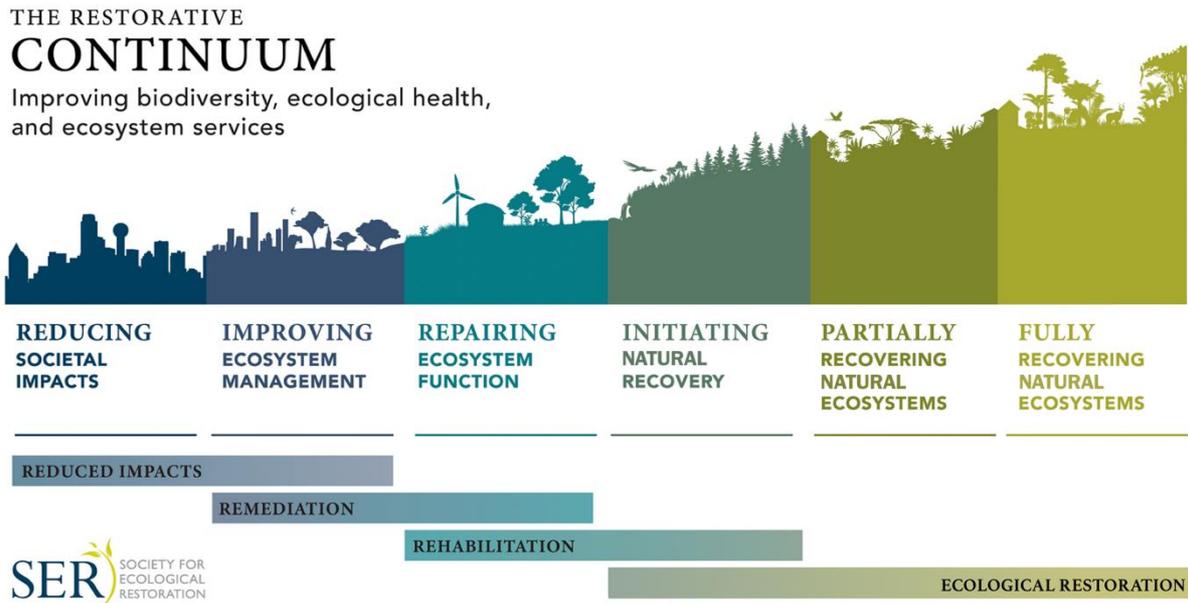
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Appendix 1

The Restorative Continuum, from the Society of Ecological Restoration's International Principles & Standards for the Practice of Ecological Restoration (<https://www.ser.org/page/SERStandards>, Gann et al. 2019). The continuum covers all of the actions that contribute to ecosystem restoration and therefore to the UN Decade on Ecosystem Restoration. Note that restorative actions at the left of the diagram can make important contributions and are often essential for restorative actions on the right of the diagram.



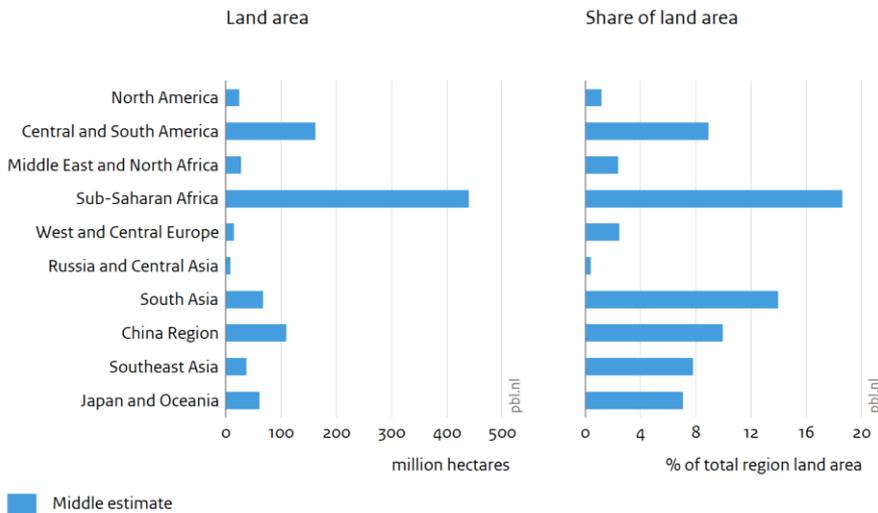
Note: this figure has been modified from the original to change "native" to "natural" in order to be consistent with the terms used in this brief.

Appendix 2

Geographical distribution and typology of global terrestrial restoration commitments as of 2020 (from Sewell et al. 2020). Note that Figure 2.4 only takes into account terrestrial ecosystem commitments (including freshwater, but excluding marine) and only counts the quantitative commitments on an area basis made by countries. The commitments are “divided almost equally between restoring native ecosystems and conserving intact ones, and the sustainable management and rehabilitation of agricultural and production lands. They cover roughly one-fifth of global cropland, one-tenth of all forest areas, and a small share of grasslands (UNCCD 2022).

Figure 2.2

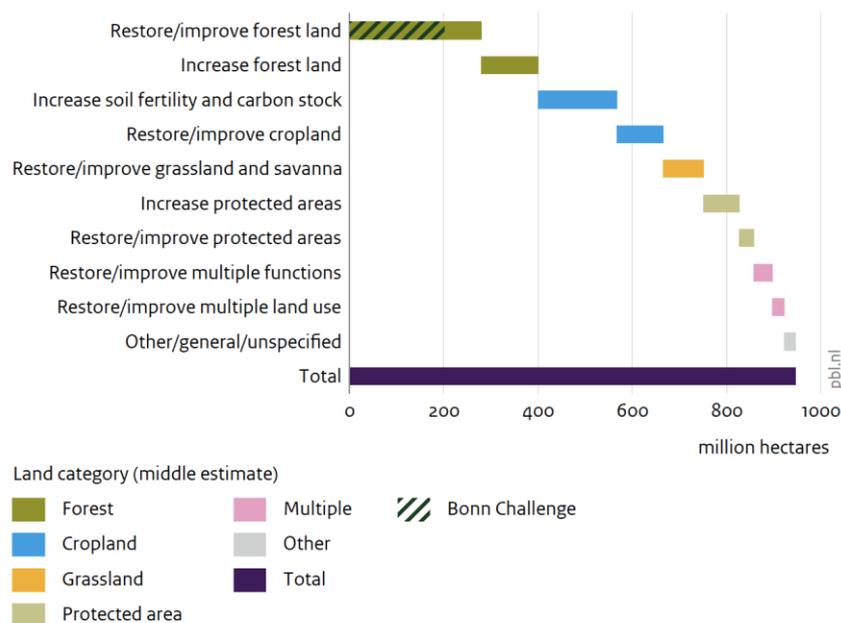
Total restoration commitments per region, 2020



Source: UNCCD, UNFCCC, CBD, Bonn Challenge, FAO; collected and adapted by PBL for Global Restoration Commitments database, August 2020

Figure 2.4

Global restoration commitments, per restoration measure category, 2020



Source: UNCCD, UNFCCC, CBD, Bonn Challenge; collected and adapted by PBL for Global Restoration Commitments database, August 2020