



Food and Agriculture
Organization of the
United Nations

2026

THE STATE OF **THE WORLD'S FORESTS**

**RESTORING FORESTS AND LANDSCAPES
THE WAY FORWARD
FOR A SUSTAINABLE FUTURE**

This flagship publication is part of **The State of the World** series of the Food and Agriculture Organization of the United Nations.

Required citation:

FAO. 2026. *The State of the World's Forests 2026 – Restoring forests and landscapes: The way forward for a sustainable future*. Rome. <https://doi.org/10.4060/ce0633en>

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ISSN 1020-5705 (print)
ISSN 2521-7542 (online)
ISBN 978-92-5-140871-1
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GERMANY. Aerial view of living and dead trees.

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Food and Agriculture Organization of the United Nations
Rome, 2026

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FOREWORD

Forests cover 4.14 billion ha, which is about 32 percent of the Earth's land surface, store 714 gigatonnes of carbon and host up to 80 percent of the world's terrestrial biodiversity. They are also fundamental for resilient agrifood systems, with nearly one-third of the global population depending on forests and trees for food security and livelihoods.

Yet deforestation and land degradation persist. Although the rate of loss has slowed, an estimated 489 million ha of forests has been lost worldwide through deforestation since 1990. Today, 1.56 billion ha of land is degraded globally, including 460 million ha of forest lands. At the same time, disturbances are intensifying globally: every year, around 127 million ha of forest is affected by fires, and insects, diseases and severe weather events damaged at least 50 million ha of forests.

Given the continued loss and degradation of forest ecosystems, as well as growing global demand for land-based products and services, there is an urgent need to scale up effective restoration.

The State of the World's Forests 2026 focuses on forest and landscape restoration as an essential response to the global interconnected challenges of food insecurity, climate change, biodiversity loss and land degradation. Drawing on global evidence and practical experience, this report presents the latest data and innovations in this domain and explores integrated pathways to support Members and partners of the Food and Agriculture Organization of the United Nations (FAO) in planning, implementing, monitoring and scaling up restoration.

Forest and landscape restoration has become a central pillar of sustainable development strategies worldwide. Building on the momentum of the United Nations Decade on Ecosystem Restoration 2021–2030, *The State of the World's Forests 2026* highlights how high-quality and integrated restoration offers a unifying approach

for environmental recovery, resilient livelihoods and sustainable development. Restoration is a cost-effective and high-impact solution, which, under favourable conditions, can generate returns of up to USD 30 for every dollar invested. The cost of inaction exceeds that of restoration, including significant social and cultural losses. Restoration, therefore, needs to be scaled up through people-centred, well-governed and adequately financed action.

Progress is being made. Countries have reported nearly 44 million ha of forest under restoration through FAO's Global Forest Resources Assessment 2025 (FRA 2025) and more than 206 million ha of terrestrial ecosystems under restoration towards Target 2 of the Kunming–Montreal Global Biodiversity Framework. Yet this progress is uneven, and it is insufficient to meet growing global needs and to close the gap between commitments and long-term impact.

Forest and landscape restoration operates across landscapes, balancing conservation and production. This integrated approach recognizes the crucial role of inland aquatic ecosystems, such as rivers and floodplains, which are functionally connected to forest and landscape systems and which, in many regions, underpin food security, livelihoods and ecosystem resilience.

The State of the World's Forests 2026 reflects the vision of FAO's Strategic Framework 2022–2031 and underscores that forest and landscape restoration contributes directly to the four betters – better production, better nutrition, a better environment and a better life, leaving no one behind – while supporting progress towards the 2030 Agenda and its Sustainable Development Goals.

Evidence presented in this report points to four mutually reinforcing pathways, in line with the FAO Science and Innovation Strategy, as well as FAO's Forestry Roadmap – From Vision to Action 2024–2031, which are essential for scaling up

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high-quality restoration. First, people must be at the centre, ensuring that Indigenous Peoples as well as local communities are recognized as key actors and that their rights, knowledge and priorities shape restoration outcomes. Second, restoration must be planned and implemented at the landscape scale, balancing conservation, production and livelihoods through context-specific approaches. Third, financing must be aligned with the realities of restoration; public and private resources need to be mobilized to support long-term, high-quality outcomes. And fourth, coherent policy, legal and institutional frameworks are crucial for enabling restoration at scale and ensuring its sustainability over time.

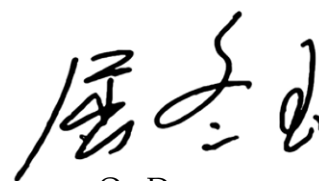
Moving from ambition to impact requires a clear shift in priorities.

Countries are encouraged to pursue long-term, high-quality restoration rather than quantity alone to ensure lasting socioeconomic and ecological benefits, in alignment with internationally agreed principles. Restoration should be embedded as a

central pillar of national development strategies, including the climate, biodiversity, food diversity, land-use and agrifood systems agendas, supported by coherent legal, enabling policies and financing frameworks, together with strong monitoring systems.

The State of the World's Forests 2026 makes clear that forest and landscape restoration is more than an environmental priority – it is a strategic investment in resilient agrifood systems and rural development. The window for action is narrowing, and delayed or poorly designed restoration will increase long-term costs, exacerbate inequalities and risk locking landscapes into unsustainable trajectories.

The remaining years to 2030 must be defined by high-quality implementation – scaling up forest and landscape restoration that is people-centred, science-based and supported by coherent policies. I am confident that through collective action and shared commitment we can restore degraded lands at scale and build a better future for all.



Qu Dongyu
FAO Director-General

METHODOLOGY

The State of the World's Forests 2026 combines multiple sources of quantitative data, policy analysis and case-based evidence to assess global progress and opportunities for forest and landscape restoration. FAO's Global Forest Resources Assessment 2025^a provided core evidence on forest extent, degradation trends, restoration commitments and reported progress.

Commitment and progress information was complemented by national reporting on indicators under the United Nations Convention to Combat Desertification's (UNCCD) land degradation neutrality, nationally determined contributions (NDCs) under the Paris Agreement, national biodiversity strategies and action plans (NBSAPs) in the context of the Convention on Biological Diversity (CBD), and restoration platforms. These include the International Union for the Conservation of Nature (IUCN) Restoration Barometer official tracking platform for the Bonn Challenge, and the Framework for Ecosystem Restoration Monitoring (FERM), which was established as the official platform for tracking global progress and disseminating good practices in the context of the United Nations Decade on Ecosystem Restoration and supporting parties to report on progress in implementation of Target 2 of the Kunming–Montreal Global Biodiversity Framework (KMGBF).

Quantitative analysis was supplemented by:

- ▶ a literature review of peer-reviewed and grey sources;
- ▶ policy and legal framework analyses at the global, regional and national levels;
- ▶ a synthesis of restoration cost–benefit evidence;
- ▶ several case studies illustrating impactful implementation of restoration efforts on the ground;^b and
- ▶ expert input from Food and Agriculture Organization of the United Nations (FAO) teams, key partner organizations, such as the Global Partnership on Forest and Landscape Restoration (GPFLR) and the scientific community, including the Society for Ecological Restoration (SER). The report was prepared at FAO by a technical writing team comprising coordinators, internal and external contributing authors, reviewers and an editor. A taskforce of senior FAO staff guided content development and reviewed chapter drafts. The report was then peer reviewed by FAO experts – including staff from FAO Regional and Subregional Offices – and a panel of recognized external experts on forest and landscape restoration.

Since definitions, reporting methods and coverage may differ across platforms, the report uses a comparative and interpretive approach to analyse restoration data. Where relevant, limitations related to data harmonization, spatial comparability and socioeconomic indicators are clearly highlighted.

^a See <https://doi.org/10.4060/cd6709en>

^b These case studies were pre-selected from a pool of restoration initiatives identified through ongoing global and regional processes and partnerships, taking into consideration the balance of geographic coverage and ecosystem diversity as key selection criteria. The World Restoration Flagships under the United Nations Decade on Ecosystem Restoration, and major initiatives registered within the FERM were considered in the first instance, and additional cases were proposed by restoration experts to address any geographical gaps. The case studies published in this edition of the report were ultimately all selected based on their novelty, demonstrated or potential impacts, scalability and relevance to forest conservation, restoration and sustainable use.

ACKNOWLEDGEMENTS

The State of the World's Forests 2026 was prepared under the overall direction of Zhimin Wu, Assistant Director-General/Director, Food and Agriculture Organization of the United Nations (FAO) Forestry Division, Tiina Vähänen, Deputy Director, FAO Forestry Division and a core technical team coordinated by Christophe Besacier and Valentina Garavaglia with the support of Nelly Bourlion and Bianca Sipala (Forest and Landscape Restoration team).

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China's Green Great Wall: a great endeavour for the harmonious coexistence of humanity and nature

This case study was developed by the National Forestry and Grassland Administration of China.

ACKNOWLEDGEMENTS

Building with nature in Indonesia: restoring an eroding coastline

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Restoring banksia woodlands: world-class post-mining rehabilitation in Western Australia

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Effective governance is key to restoring forest landscapes as part of the Trinational Atlantic Forest Pact in Argentina, Brazil and Paraguay

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Translations were delivered by the Language Branch of the FAO Governing Bodies Servicing Division. Christophe Besacier, Nelly Bourlion, Houria Djoudi, Qiang Ma, Leticia Pina and Zuzhang Xia provided a technical review of the translated versions.

The Publications and Library Branch of the FAO Office of Communications provided editorial support, design and layout, as well as production coordination, for editions in all six official languages. The contribution of Christine Legault (FAO Forestry Division) to the editorial support and production of these editions is gratefully acknowledged.

Graphic design team: Monica Umena (team leader, FAO) and Simone Morini (design & layout, FAO) with support from Roberto Cenciarelli (graphics preparation, FAO).

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The preparation of *The State of the World's Forests 2026* greatly benefited from the technical input, knowledge resources and convening power of the Global Partnership on Forest and Landscape Restoration (GPFLR). As a leading global platform for restoration, the GPFLR brings together a diverse coalition

ACKNOWLEDGEMENTS

of governments, international organizations, research institutions, civil society organizations and private-sector actors committed to advancing forest and landscape restoration worldwide.

The partnership now officially comprises 39 member organizations spanning global, regional and national levels. By mobilizing this broad community of practice, the GPFLR serves as a key hub for cutting-edge expertise, field experience and policy innovation on restoration. Its members collectively contribute scientific knowledge, implementation experience, monitoring tools and financing insights that help strengthen the global evidence base for high-quality forest and landscape restoration.

The GPFLR supported the development of this publication by providing knowledge products, technical guidance and collaborative platforms. It also made contributions to conceptual framing, writing, data collection, analysis and interpretation. The partnership's ability to bridge science, policy and practice was instrumental in ensuring that *The State of the World's Forests 2026* reflects the latest thinking and operational experience in the field. The GPFLR was established in 2003 to catalyse and support the scaling-up of forest and landscape restoration globally.

Its core objective is to promote restoration at scale that delivers ecological integrity, enhanced human well-being and resilient landscapes. To achieve this, the partnership works to:

- ▶ foster collaboration across sectors and regions;
- ▶ strengthen the knowledge base and share good practices;
- ▶ support countries and stakeholders in planning and implementing restoration;
- ▶ mobilize political commitment and financing for restoration; and
- ▶ track progress towards global restoration goals.

It defines forest and landscape restoration as a process that aims to regain ecological functionality and enhance human well-being in deforested or degraded landscapes.

The GPFLR believes that this goal is best achieved by applying a landscape approach to sustainable development where the use of natural resources, such as forests, energy, agriculture and water, and environmental conservation and human livelihoods within a given area are considered in an integrated manner. In 2018, it developed and adopted six guiding principles for forest and landscape restoration described later in this report and continues to be a recognized authoritative source on forest and landscape restoration. By convening leading organizations and experts, the GPFLR continues to play a pivotal role in advancing restoration from commitments to implementation and impact.

ABBREVIATIONS

AFR100	African Forest Landscape Restoration Initiative
ANR	assisted natural regeneration
BTR	biennial transparency reports
BUR	biennial update reports
CBD	Convention on Biological Diversity
CIFOR-ICRAF	Center for International Forestry Research and World Agroforestry
cm	centimetre(s)
COP	Conference of the Parties
ECCA30	Europe, the Caucasus and Central Asia initiative
EX-ACT	Environmental eXternalities ACcounting Tool
FAO	Food and Agriculture Organization of the United Nations
FERM	Framework for Ecosystem Restoration Monitoring
FLR	forest and landscape restoration
FPIC	free, prior and informed consent
FRA	Global Forest Resources Assessment
FSC	Forest Stewardship Council
GDP	gross domestic product
GEF	Global Environment Facility
GGW	Great Green Wall
GHG	greenhouse gas
GIS	Geospatial Information System
GPFLR	Global Partnership on Forest and Landscape Restoration
ha	hectare(s)
IFAD	International Fund for Agricultural Development
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature
km	kilometre(s)

KMGBF	Kunming–Montreal Global Biodiversity Framework
LDN	land degradation neutrality
m	metre(s)
m²	square metres
m³	cubic metres
Mha	million hectares
NBSAP	national biodiversity strategies and action plans
NDC	nationally determined contributions
NGO	non-governmental organization
NRP	National Restoration Plan
REDD	reducing emissions from deforestation and forest degradation
REDD+	reducing emissions from deforestation and forest degradation in developing countries, and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks
RESULT	Restoring and Sustaining Landscapes Together
ROAM	restoration opportunities assessment methodology
SDG	Sustainable Development Goals
SER	Society for Ecological Restoration
SLPF	Sustainable Landscape Production Framework
TEER	The Economics of Ecosystem Restoration (initiative)
UNCCD	United Nations Convention to Combat Desertification
UN Decade	United Nations Decade on Ecosystem Restoration 2021–2030
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNSPF	United Nations Strategic Plan for Forests
WWF	World Wide Fund for Nature

GLOSSARY

Afforestation. Establishment of forest through planting and/or deliberate seeding on land that, until then, was under a different land use, implies a transformation of land use from non-forest to forest.¹

Agrifood systems. Cover the journey of food from farm to table – including when it is grown, fished, harvested, processed, packaged, transported, distributed, traded, bought, prepared, eaten and disposed of. They also encompass non-food products that constitute livelihoods and all of the people, activities, investments and choices that play a part in making available these food and agricultural products.²

Agroecology. The science of applying ecological concepts and principles to manage interactions between plants, animals, humans and the environment for food security and nutrition.³

Agroforestry. Agroforestry is a collective term for land management systems where woody perennials (trees, shrubs, palms, bamboos, etc.) are deliberately integrated with agricultural crops and/or animals, in some form of spatial arrangement or temporal sequence. In agroforestry systems there are both ecological and socioeconomic interactions between the different components.⁴ Agroforestry is a collective term for land-use systems and technologies in which woody perennials (e.g. trees, shrubs, palms or bamboos) and agricultural crops or animals are used deliberately on the same parcel of land in some form of spatial and temporal arrangement.⁵

Deforestation. The conversion of forest to other land use independently, whether human-induced or not.¹

Degradation (of an ecosystem). A persistent deterioration of the attributes of an ecosystem (e.g. abiotic condition, species composition, ecosystem structure and function, external exchanges) relative to reference conditions, due to direct (e.g. unsustainable resource use, land use change, overexploitation, contamination) or indirect (e.g. climate change) human intervention, which affects the ecosystem's capacity to provide benefits to people and nature.⁶

Ecological restoration. One of a broad array of restorative management activities that are considered ecosystem restoration under the United Nations Decade on Ecosystem Restoration. Ecological restoration is broadly defined as the process of assisting in the recovery of an ecosystem that has been damaged, degraded or destroyed.⁷ It differs from other ecosystem restoration activities in that it aims to recover a natural ecosystem or landscape to the condition it would be in had degradation not occurred, while allowing for environmental change (such as increases in temperature or variation in precipitation patterns caused by climate change). Ecological restoration seeks to recover biodiversity and ecosystem integrity, while delivering ecosystem service and ensuring human well-being. The conservation and restoration of biological diversity is a primary goal.

Ecosystem restoration. The process of halting and reversing degradation, resulting in improved ecosystem services and recovered biodiversity. Ecosystem restoration encompasses a wide continuum of practices, depending on local conditions and societal choice.⁸

Food security. Food security is a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life.¹⁰

Forest. According to the FAO Global Forest Resource Assessment 2025, land spanning more than 0.5 ha with trees higher than 5 metres and a canopy cover of more than 10 percent, or trees able to reach these thresholds *in situ*. It does not include land that is predominantly under agricultural or urban land use.¹

Forest and landscape restoration. According to the Global Partnership on Forest and Landscape Restoration, it is a process that aims to regain ecological functionality and enhance human well-being in deforested or degraded landscapes. Rather than just planting trees, forest and landscape restoration combines approaches like agroforestry, natural regeneration and improved

land management to restore landscapes, benefiting both people and biodiversity.

Forest landscape restoration. A process that aims to regain ecological integrity and enhance human well-being in deforested or degraded forest landscapes.⁹

Free, prior and informed consent. Free, prior and informed consent (FPIC) is defined as a collective right granted to Indigenous Peoples to provide or withhold consent at any point regarding projects affecting their lands, territories or resources. It ensures they can engage in negotiations to shape project design, implementation and evaluation.

High-quality forest and landscape restoration.

High-quality forest and landscape restoration refers to restoration that results in sustained and resilient ecological and social outcomes over time, achieved through the effective application of restoration principles and the strengthening of governance, monitoring, and stakeholder engagement, while advancing long-term goals of biodiversity conservation, meeting human needs, and the provision of ecosystem services.

Indigenous Peoples. Indigenous Peoples are characterized rather than defined. This characterization draws primarily on the Martinez Cobo study, the Indigenous and Tribal Populations Convention, 1957 (No. 107) of the International Labour Organization, and the Indigenous and Tribal Peoples Convention, 1989 (No. 169) of the International Labour Organization. These sources also informed discussions leading to the United Nations Declaration on the Rights of Indigenous Peoples, adopted in 2007, which provides a common reference point for the use of the term across the United Nations system. FAO reflected this international consensus in the FAO Policy on Indigenous and Tribal Peoples, 2010, which states that, when considering Indigenous Peoples, FAO will abide by the following criteria: a. priority in time, with respect to occupation and use of a specific territory; b. the voluntary perpetuation of cultural distinctiveness, which may include aspects of language, social organization, religion and spiritual values, modes of production,

laws and institutions; c. self-identification, as well as recognition by other groups, or by State authorities, as a distinct collectivity; and d. an experience of subjugation, marginalization, dispossession, exclusion or discrimination, whether or not these conditions persist.

Disclaimer on the conflation of the term local communities with Indigenous Peoples

In 2023, the three United Nations mechanisms on Indigenous Peoples asked the United Nations system to avoid using the term “Indigenous Peoples” in conjunction with “local communities”, stating that “the term Indigenous Peoples has been used in conjunction with other ambiguous terms and groups such as ‘local communities.’ In fact, the characteristics, nature, and origins of the rights of Indigenous Peoples are very different from other groups. Therefore, Indigenous Peoples should not be grouped with an undefined set of communities that may have very different rights and interests.” They further asked United Nations Member States that are parties to treaties related to the environment, biodiversity and climate to “cease using the term ‘local communities’ alongside ‘Indigenous Peoples,’ so that the term ‘Indigenous Peoples and local communities’ is no longer used”.¹¹

In 2024, the United Nations Permanent Forum on Indigenous Issues reiterated this position, urging “all United Nations entities and States parties to treaties concerning the environment, biodiversity and climate change to eliminate the use of the term ‘local communities’ in conjunction with Indigenous Peoples, and to distinguish between the terms, in ongoing processes, policies and new international agreements at all levels”.¹²

Indigenous Peoples are distinct collective rights holders under international human rights law, as recognized in the United Nations Declaration on the Rights of Indigenous Peoples and other international instruments, including the Indigenous and Tribal Peoples Convention, 1989 (No. 169) of the International Labour Organization. Unlike Indigenous Peoples, the term “local communities” is not associated with a specific international rights framework, dedicated United Nations mechanism or

GLOSSARY

formal consideration by the United Nations General Assembly.

Any exceptional reference in this publication to Indigenous Peoples and local communities together does not imply that the two groups are the same.

Landscape. A landscape is a product of the interaction of human beings with the natural environment often over a period of many centuries that reflects the impacts of social, economic and political changes on the natural environment.¹³

Landscape level. In contrast to landscape scale, *level* refers to the position of landscapes with respect to the structure of living systems – from cells and organisms to populations, ecosystems, landscapes and the biosphere.¹⁴

Landscape scale. *Scale* refers to the spatial or temporal dimensions at which management actions occur.¹⁴

National biodiversity strategy and action plan.

Principal instruments for implementing the Convention on Biological Diversity at the national level, through which Parties establish national priorities, targets and actions to conserve biological diversity, promote its sustainable use and ensure the fair and equitable sharing of benefits, while mainstreaming biodiversity across sectors.

Nationally determined contribution. United Nations Framework Convention on Climate Change commitment through which a Party to the Paris Agreement outlines its plans for reducing greenhouse gas emissions. See Article 4 of the Paris Agreement for more information.¹⁵

Net forest gain/loss/no change. “Forest area net change” is the difference in forest area between two Global Forest Resources Assessment reference years. It can be positive (gain), negative (loss) or zero (no change).¹

Other wooded lands. Land not classified as “Forest”, spanning more than 0.5 ha; with trees higher than 5 metres and a canopy cover of 5–10 percent, or trees able to reach these thresholds *in situ*; or with a combined cover of shrubs, bushes and

trees above 10 percent. It does not include land that is predominantly under agricultural or urban land use.¹

Production ecosystems. Systems that society relies on for food, feed and fibre production. In these systems ecosystem restoration is primarily seen as contributing to healthy and stable ecosystems, which in turn support human needs for sustainable food production and livelihoods.¹⁶

Reforestation. Re-establishment of forest through planting and/or deliberate seeding on land classified as forest.¹

Rehabilitation. Management actions that reinstate attributes of some physical properties (e.g. soils, water) and a level of ecosystem functioning on degraded or transformed sites, along with renewed and ongoing provision of a level of ecosystem services. Native biodiversity and ecosystem integrity are supported but actions do not achieve substantive recovery of a natural ecosystem.

Restoration. Any intentional activity that initiates or accelerates the recovery (for example, of an ecosystem) from a degraded state.¹⁷

Restorative continuum. The range of ecosystem restoration activities ordered based on the degree to which they recover biodiversity, ecosystem health and integrity, and human well-being. At one end of this continuum are management activities aimed at reducing societal impacts, such as runoff into urban streams and mitigating threats such as contaminated soils. The other end of the continuum includes ecological restoration, which aims to both remove degradation and recover ecosystems to the condition that they would be in had degradation not occurred, while allowing for environmental change.^{6, 7}

OUTLINE

The State of the World's Forests 2026 is designed to guide readers from a global diagnosis of forest and land degradation to practical pathways for scaling up high-quality restoration. Each chapter builds progressively on the introductory framing, moving from evidence and global commitments to implementation models, governance frameworks and innovation mechanisms.

Chapter 1 has set the global context for FLR, drawing on the latest degradation trends, rising demand for forest products and the role of restoration in meeting international commitments under the SDGs, the Rio Conventions, the KMGBF and the UNSPF. It introduces the restoration continuum and provides an overview of the global and regional restoration momentum, setting the conceptual, analytical and policy foundations for the report.

Chapter 2 presents the latest data on deforestation, degradation and restoration based on the FAO Global Forest Resources Assessment (FRA) 2025, UNCCD's national reports, UNFCCC's nationally determined contributions, CBD's national biodiversity strategies and action plans, and seventh national reports, the Bonn Challenge and data from the FERM. It offers a global and regional assessment of degradation trends, restoration commitments and major achievements, while also reviewing policy and legal frameworks that shape national restoration action.

Chapter 3 examines restoration as a cost-effective nature-based solution and ecosystem-based approaches that merge conservation, sustainable use and production objectives. It documents environmental benefits (climate change mitigation and adaptation, biodiversity recovery, water and soil regulation) and socioeconomic outcomes (livelihoods, food security, employment and health), supported by evidence across forest, agricultural and agroforestry systems.

Chapter 4 focuses on implementation. It presents four integrated restoration pathways – people, land, finance and business, and policy coherence and law – aligned with the principles of the UN Decade and GPFLR standards, with an emphasis on balancing production and conservation, diversifying landscape-level approaches, recognizing Indigenous Peoples as distinct collective rights holders and strengthening the roles of local communities and other actors in restoration.

Chapter 5 addresses recent advances, as well as challenges and required innovations, for scaling up and accelerating FLR. It explores three pillars – knowledge systems, standards and capacity infrastructure, and monitoring and adaptive learning – that provide the foundational layers for this work and enable transformational change. These pillars, in conjunction with the four key pathways, can help improve, accelerate and scale up effective FLR during the remaining years of the UN Decade and beyond.

The collection of case studies describes practical restoration cases from diverse countries, regions and ecosystems. Drawing on initiatives promoted by the UN Decade and recognized as World Restoration Flagships, and others, it proposes replicable lessons and scalable models for high-impact restoration.

Across all chapters, climate resilience, biodiversity recovery, sustainable production, inclusive governance and agrifood systems transformation are treated as cross-cutting thematics, reinforcing the central message that high-quality FLR is a unifying pathway for sustainable development, environmental recovery and resilient livelihoods.

CORE MESSAGES

- ▶ High-quality forest and landscape restoration is a unifying approach for sustainable development, environmental recovery and resilient livelihoods.
- ▶ Forest and landscape restoration is a cost-effective, high-impact solution to global environmental and development challenges, but only if scaled rapidly through people-centred, well-governed and adequately financed action.

DEGRADATION IS INTENSIFYING – RESTORATION IS ESSENTIAL

- ▶ Over 460 million ha of forests and 1.56 billion ha of land are degraded globally, driven by population growth, land-use change and resource demand.
- ▶ Rising demand for forest products and competing land uses are widening the gap between ecological capacity and human needs.
- ▶ Restoring degraded forests and landscapes at scale is urgent to meet climate, biodiversity, land and food security goals.

FOREST AND LANDSCAPE RESTORATION IS A STRATEGIC INVESTMENT, NOT AN OPTION

- ▶ Forest and landscape restoration delivers multiple benefits across climate mitigation and adaptation, biodiversity conservation, food security and socioeconomic resilience.
- ▶ Under favourable conditions, restoration can generate returns of up to USD 30 per USD 1 invested, although actual benefits vary depending on the context, intervention type and time horizon.
- ▶ The cost of inaction exceeds the cost of restoration, including social and cultural losses.

RESTORATION STRENGTHENS ECONOMIES AND RESILIENCE

- ▶ Healthy ecosystems underpin over half of global gross domestic product and are fundamental to economic stability.
- ▶ Restoration creates jobs, revitalizes production systems and supports resilient, shock-resistant growth.
- ▶ Benefits extend beyond income to improved well-being, stronger social cohesion and the preservation of cultural identity and knowledge systems.

PEOPLE ARE CENTRAL, BUT BENEFITS ARE UNEVEN

- ▶ Local communities are essential to restoration success, as their knowledge and active participation enhance livelihoods, biodiversity and resilience when benefits are equitably shared.
- ▶ Indigenous Peoples play a key role in restoration, with their rights, knowledge, priorities, and the application of free, prior and informed consent contributing to biodiversity conservation, cultural values and ecosystem resilience.
- ▶ Effective forest and landscape restoration requires rights-based approaches, equitable benefit-sharing and governance systems that respect local rights, knowledge and self-determined priorities.

FOREST AND LANDSCAPE RESTORATION IS AN INTEGRATED SOLUTION

- ▶ Forest and landscape restoration operates across landscapes, balancing conservation and production while improving livelihoods and productivity.
- ▶ Forest and landscape restoration requires managing trade-offs; no single intervention achieves all outcomes.
- ▶ Integrating local, traditional and scientific knowledge is essential for context-specific and effective restoration.

GLOBAL COMMITMENT IS STRONG, BUT SCALE AND IMPACT LAG BEHIND

- ▶ Forest and landscape restoration is central to the Sustainable Development Goals, Rio Conventions and global frameworks.
- ▶ Countries report growing areas under restoration and stronger policy frameworks, but current progress is insufficient – we need to restore 470 million ha to meet 2030 targets.

BETTER MEASUREMENT, ALIGNMENT AND QUALITY STANDARDS ARE CRITICAL

- ▶ Progress tracking is fragmented due to different definitions, metrics and reporting systems across frameworks.
- ▶ Current data focuses on area restored, not impacts.
- ▶ Restoration must follow standards-based, high-quality practices.
- ▶ Scaling impact requires harmonized monitoring systems and standards-based, high-quality restoration supported by robust reporting and adaptive learning.

SCALING FOREST AND LANDSCAPE RESTORATION REQUIRES SYSTEMIC ALIGNMENT AND ENABLING CONDITIONS

- ▶ Coherent, evidence-based policies and strong governance systems are critical to drive implementation, align sectors and incentives, and deliver restoration at scale.
- ▶ Finance must be reoriented to match long-term restoration needs, reach local actors and shift incentives away from business-as-usual land use.
- ▶ Proven models should be scaled through inclusive, bankable approaches supported by strong institutions and capacity development.

EXECUTIVE SUMMARY

FOREST AND LANDSCAPE RESTORATION IS CENTRAL TO ADDRESSING GLOBAL ENVIRONMENTAL AND DEVELOPMENT CHALLENGES

More than 10 percent of the world's land area is degraded, including approximately 460 million ha of forest lands. Together with the growing demand for forest products and ecosystem services, these trends are widening the gap between what ecosystems can provide and what societies require. Forest and landscape restoration has emerged as a critical approach for achieving climate, biodiversity, land degradation and food security objectives. Restoring degraded forests and landscapes at scale – through integrated, people-centred, standards-based action supported by coherent policies, sustainable finance and robust monitoring – is no longer optional. A decisive investment to close the growing gap between ecological limits and development needs would deliver climate, biodiversity, food security and economic resilience goals for far less than the cost of continued inaction.

FOREST AND LANDSCAPE RESTORATION REQUIRES AN INTEGRATED LANDSCAPE APPROACH

Forest and landscape restoration places forest recovery within the broader framework of ecosystem restoration and aims to regain ecological functionality while enhancing human well-being. This requires an integrated perspective that considers interactions between forests and broader biological and geophysical systems, including biodiversity, water, soils and climate, and that also considers the communities and initiatives operating within these landscapes.

Forest and landscape restoration operates across mosaics of land uses, integrates conservation and production objectives, and is guided by six agreed principles developed by the Global Partnership

on Forest and Landscape Restoration^c in 2018 and is fully aligned with the ten principles for ecosystem restoration in all biomes guiding the United Nations Decade on Ecosystem Restoration 2021–2030.^d

Forest and landscape restoration is a winning option to achieve agrifood systems transformation when it builds on the development of profitable value chains. It demonstrates the relevance of restoration options aimed at enhancing the productive capacity of forested and agricultural landscapes, including in production and planted forests, and agroforestry systems. Agroecological approaches and agroforestry practice are critical enablers of restoration outcomes. By restoring soil health through increased organic matter inputs, enhanced biological activity and improved soil structure, these approaches strengthen ecosystem functionality and productivity. Integrating trees, crops and livestock within diversified systems supports nutrient cycling, reduces erosion and enhances resilience, thereby contributing to both ecological integrity and sustainable livelihoods. Across contexts, combining restoration approaches and aligning them with local conditions can enhance cost-efficiency, reduce risks and improve long-term sustainability of outcomes.

COMMITMENTS TO RESTORATION ARE EXPANDING BUT TRANSLATING COMMITMENTS INTO SUSTAINED AND APPROPRIATE ACTIONS REMAINS UNEVEN

Over the past two decades, countries, and regional and global initiatives have pledged to place more than 1 billion ha of land under restoration. New data and analysis from the Food and Agriculture Organization of the United Nations' Global Forest Resources Assessment 2025 and complementary platforms show measurable

c See <https://www.forestlandscaperestoration.org/>

d See <https://openknowledge.fao.org/handle/20.500.14283/cb6591en>

progress, including millions of hectares of degraded land reported to be undergoing restoration. However, significant gaps remain between political ambition and on-the-ground implementation, reflecting constraints in finance, governance, monitoring and technical capacity. Also, longer-term impact and restoration success ultimately depend on sustained engagement and appropriate management after the initial restorative intervention, which is often challenging. The effectiveness of restoration initiatives varies significantly across contexts, depending on enabling conditions, including governance frameworks, access to finance, technical capacity and stakeholder engagement. Forest and landscape restoration strengthens the resilience of forests and landscapes, enhancing their capacity to endure and recover from environmental, economic and social pressures.

MAJOR DATA AND MONITORING CHALLENGES PERSIST

Differences in definitions, reporting and methodological approaches limit the comparability and aggregation of restoration data. Most current reporting focuses on area-based indicators, with insufficient attention to socioeconomic outcomes and long-term biodiversity impacts. Strengthening harmonization, spatial reporting and interoperability across platforms is a key priority, as is developing indicators for ecological outcomes (e.g. species recovery and habitat connectivity) and qualitative factors, such as forest health, to complement area and socioeconomic metrics.

SCALING HIGH-QUALITY RESTORATION REQUIRES COMBINED ACTIONS ALONG FOUR ENABLING PATHWAYS

Effective and durable forest and landscape restoration depends on the combination of four mutually reinforcing pathways that foster commercial viability and ensure societal benefits:

- ▶ **people** – secure rights, meaningful engagement and legitimate, inclusive governance;
- ▶ **land** – spatial prioritization and landscape-level planning;
- ▶ **finance and business** – fit-for-purpose and risk-appropriate financing mechanisms; and
- ▶ **policy coherence and law** – coherent policies, legal frameworks and institutional coordination (especially land-tenure rights and consistent fiscal policies and incentives).

For the successful implementation of any forest and landscape restoration initiative, all four pathways of action are necessary, and each must interact with the others. By focusing on a single pathway, a restoration intervention risks creating gaps in inclusiveness, efficiency and sustainability. Ensuring coherence across these pathways is essential to achieving integrated, landscape-scale restoration that balances ecological, social and economic objectives.

INNOVATION IS ACCELERATING BUT MUST BE SCALED

Emerging innovations in standards of practice, monitoring tools, including information and geospatial data, blended finance, restoration accelerators and digital platforms are helping overcome existing barriers. However, many initiatives remain fragmented or locally focused. Sustained investments in knowledge systems, capacity development and policy coherence are essential to achieving restoration at the necessary scale. Scaling up restoration, therefore, will require stronger alignment across sectors, policies and initiatives to ensure that restoration delivers integrated outcomes for climate, biodiversity and sustainable development.



MADAGASCAR

Ecological functions,
production systems and
livelihoods interact in
mosaic landscapes.

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Nicholas Oloo

CHAPTER 1

FORESTS AND LANDSCAPE RESTORATION IN THE 2020–2030 DECADE: CONTEXT, TRENDS AND OPPORTUNITIES FOR GLOBAL IMPACT

1.1 INTRODUCTION

More than 10 percent of the world's land area is degraded due to human impacts.¹⁸ Although over 60 percent of degraded land is agricultural (Figure 1.1), including 480 million ha of cropland and 560 million ha of pastureland, human-induced land degradation also affects 460 million ha of forested land, on which people rely for their livelihoods. Forests^e cover 32 percent of the Earth's land area and are essential for food security and nutrition, livelihoods, and the supply of renewable biomaterials and energy.¹⁹

Forests harbour a large share of global biodiversity, play a key role in regulating the carbon and water cycles, and help reduce the risk and impacts of drought, desertification, soil erosion, landslides and floods.²⁰

The Global Forest Resources Assessment (FRA) 2025 shows that the loss of forest cover and the degradation of forest ecosystems are continuing on a global scale, though with regional differences in trends and drivers (Figure 1.2). Forest loss and degradation undermine ecological integrity,

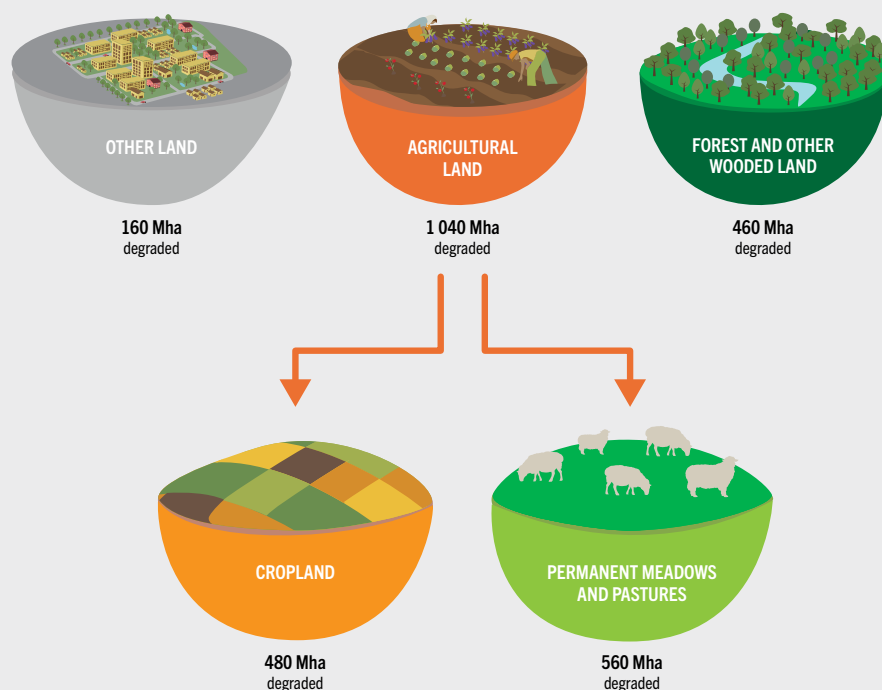
threaten habitat connectivity, drastically reduce observed precipitation^{21, 22} and weaken the capacity of forests to deliver critical ecosystem services.²¹ These trends have direct socioeconomic consequences, particularly for the populations whose livelihoods, food security and cultural identity are closely linked to forest landscapes.

At the same time, global demand for forest products continues to rise,²⁰ driven by population growth, urbanization (Box 1.1), infrastructure development, energy needs and the expanding bioeconomy. This growing demand is intensifying pressure on remaining forest resources and increasing the risk of unsustainable harvesting and land-use conversion. This widening gap between demand and sustainable supply highlights a structural imbalance that threatens both ecological integrity and the long-term viability of forest-based economies.

Forest ecosystems and landscapes are facing threats on several fronts: climate change, biodiversity loss, pollution and natural resource extraction such as mining and fossil fuel exploitation in forested areas. Together with unsustainable forest management and use, these pressures are making forests more vulnerable and exacerbating land degradation processes. Against this backdrop, agrifood systems are under unprecedented pressure from escalating environmental, economic and social stressors.

^e In this publication, the terms “forestry”, “forests” and “forests and trees” generally refer to “forests”, “other wooded land” and “other land with tree cover” as defined in FAO, thus encompassing trees outside forests. See <https://openknowledge.fao.org/items/43aca42c-3ead-4747-9a48-0b20ae248a5e>

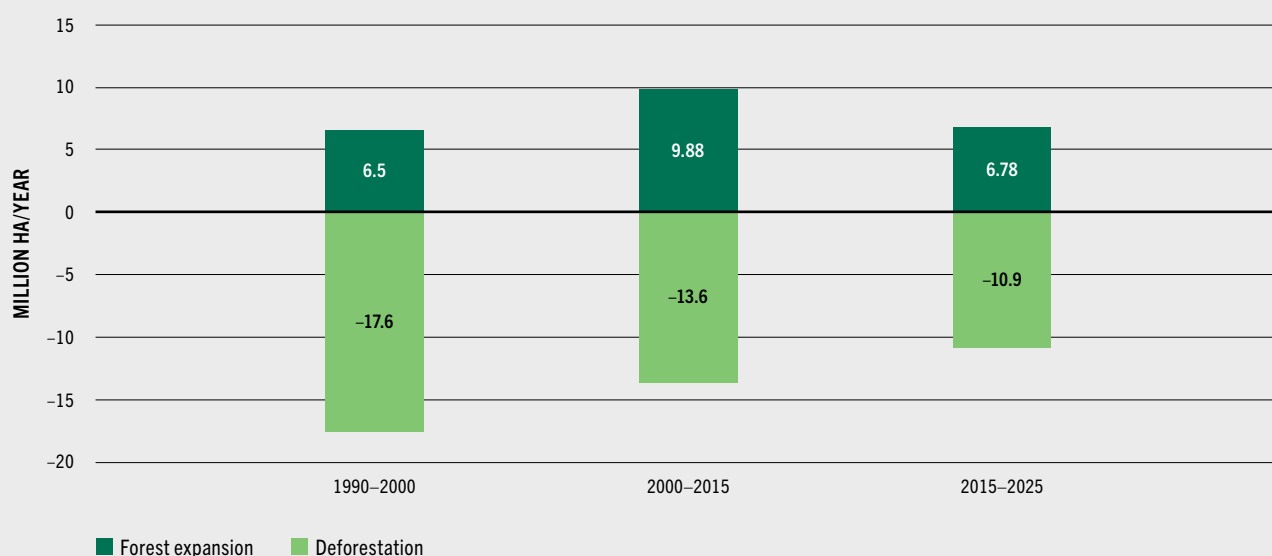
FIGURE 1.1 AREA OF DEGRADED LAND BY LAND USE



NOTES: Human-induced land degradation is severely undermining the productive capacity of forests and agrifood systems, pushing them towards unsustainable trajectories that threaten global food security and nutrition, environmental sustainability and social stability. More than 60 percent of human-induced degradation occurs on agricultural land, while nearly 30 percent takes place in areas covered by trees and forests, highlighting the critical vulnerability – and strategic importance – of forest ecosystems in addressing land degradation. Mha = million hectares.

SOURCE: FAO. 2022. *The State of the World's Land and Water Resources for Food and Agriculture 2021 – Systems at breaking point*. Rome. <https://doi.org/10.4060/cb9910en>

FIGURE 1.2 ANNUAL RATE OF FOREST EXPANSION AND DEFORESTATION, 1990–2025



NOTES: Since 1990, 489 million ha of forest have been lost to deforestation. The annual rate of deforestation decreased from 17.6 million ha in 1990–2000 to 13.6 million ha in 2000–2015 and then to 10.9 million ha in 2015–2025. Annual forest expansion also declined from 9.88 million ha in 2000–2015 to 6.78 million ha in 2015–2025. In the Global Forest Resources Assessment 2025, “natural forest expansion” is calculated by “subtracting known afforestation and deforestation from the net forest area change”.

SOURCE: FAO. 2025. *Global Forest Resources Assessment 2025*. Rome. <https://doi.org/10.4060/cd6709en>

BOX 1.1 CITIES AS DRIVERS OF FOREST AND LANDSCAPE RESTORATION

Urbanization is one of the most significant global trends shaping landscapes in the twenty-first century. As cities expand, they often contribute to land degradation, ecosystem fragmentation and increased pressure on forest resources through land conversion, infrastructure development and growing demand for materials, food and energy. In this sense, urbanization can be a major driver of degradation. At the same time, cities are increasingly recognized as key actors in forest and landscape restoration (FLR). Urban populations depend on surrounding and often distant landscapes for essential ecosystem services, including water regulation, food supply, air quality, biodiversity, climate mitigation and adaptation, and human health. These dependencies create strong incentives for cities to support and invest in restoration beyond their boundaries. However, making these interconnections visible, governable and financially viable remains a major challenge. It requires coordination across sectors and levels of governance, integrated territorial planning, as well as mechanisms to translate urban demand for ecosystem services into sustained investments in landscape management. Emerging approaches at the urban–rural

interface illustrate how cities can act as catalysts for restoration. These include: watershed financing mechanisms linking urban water users with upstream land management; urban heat adaptation strategies centred on greening and increasing tree cover; peri-urban agroforestry systems that strengthen food security, livelihoods and resilience; and governance frameworks that support natural regeneration and landscape stewardship. Initiatives such as the Food and Agriculture Organization of the United Nations' (FAO) Green Cities Initiative* aim to foster actions that bring large-scale transformative changes to improve food security, nutrition and the well-being of people in and around cities. It envisions healthier, more resilient and inclusive cities, where urban forestry, urban agriculture and bioeconomy are strategically integrated into the fabric of urban life and further demonstrate how such integrated actions can mobilize investment, strengthen stakeholder engagement and reconnect urban and rural areas. Harnessing urbanization as a driver of FLR will require integrated planning, intersectoral policy and governance, and innovative financing mechanisms that link urban demand with sustainable land management.

NOTE: * See <https://www.fao.org/green-cities-initiative/en/>

Securing the future of agriculture and sustainably using natural resources requires the transformation of agrifood systems for “better production, better nutrition, a better environment and a better life for all, leaving no one behind”.^f Forests and trees are indispensable in this effort, as they provide climate-related benefits and multiple ecosystem services including for agriculture. Their sustainable management underpins resilient ecosystems, food security and long-term agricultural productivity.²³ ■

^f See <https://www.fao.org/strategic-framework/en>

1.2 RATIONALE FOR FOREST AND LANDSCAPE RESTORATION

While this chapter focuses primarily on forest and landscape restoration (FLR), it is important to consider FLR within the broader framework of ecosystem restoration as defined under the United Nations Decade on Ecosystem Restoration 2021–2030 (the UN Decade). Ecosystem restoration encompasses the recovery of degraded terrestrial, freshwater and coastal ecosystems, with the aim of rebuilding ecological integrity and enhancing human well-being. Forest and landscape

restoration represents a terrestrial-based application of this broader approach, focusing on forested and mosaic landscapes where ecological functions, production systems and livelihoods interact. This chapter thus refers to FLR as being part of the wider global framework of ecosystem restoration, while still maintaining the focus on forests and tree-based landscapes.

This chapter traces the evolution of the concept of ecosystem restoration from early sectoral approaches to integrated FLR and presents the most recent guidance developed under the UN Decade to support coherent restoration planning, implementation and monitoring. All key definitions of the multiple concepts and terms used in this chapter are available in the glossary. Encouragingly, the momentum for restoration is growing. Since 2000, several initiatives have been launched to restore degraded forests and unproductive, deforested landscapes.²⁴ This has given rise to multiple approaches to forest restoration, covering a wide range of interventions, including sustainable forest management, silvicultural interventions, forest and agroforestry plantations, natural and assisted regeneration, and ecological restoration.

Over time, these approaches have changed scales, moving from the “forest plot and population” to whole territories and more recently landscapes. This shift has involved considering agricultural and other non-forest areas as part of a more systemic concept called “forest and landscape restoration”, which better reflects ecological processes, land-use interactions over time and place, and socioeconomic realities. In this context, FLR offers concrete opportunities to reverse degradation, recover biodiversity and ecological integrity, and move towards more sustainable and resilient agrifood systems. In particular, restoring degraded lands, promoting landscape connectivity and focusing on placing the right crops and tree species on the most suitable land can help to narrow the current yield gap, strengthen ecosystem services and contribute to the transformation of agrifood systems in support of people and nature.¹⁶

However, to achieve the potential benefits of FLR at scale, there is an urgent need to increase an understanding of the concept and actions that

make restoration effective. There is also an urgent need for political leadership and substantial investments both in implementing on-the-ground activities and in monitoring their outcomes. Large-scale restoration is increasingly recognized as crucial for achieving global targets in support of land degradation neutrality (LDN), climate change mitigation and adaptation, biodiversity conservation, and eradicating hunger.²⁵

Within the diversity of forest and landscape restoration approaches, some intervention types are particularly effective at linking ecological recovery with productive land use. Among these approaches, agroforestry and broader agroecological systems are particularly significant because they directly address the underlying processes of land degradation at the level of soil function. Increasing organic inputs through leaf litter and root biomass, enhancing microbial activity in the rhizosphere, and improving soil structure and water infiltration contribute to the recovery of soil fertility and long-term productivity. As such, these systems provide a critical bridge between ecological restoration and agricultural production, enabling restoration efforts to generate immediate and sustained benefits for rural livelihoods. Soil health represents a critical nexus through which forest and landscape restoration links climate change mitigation and adaptation, biodiversity conservation and land degradation neutrality. Agroecological and agroforestry systems contribute to this nexus by increasing soil carbon stocks, enhancing below-ground biodiversity and improving the efficiency of water and nutrient use. By restoring soil functions, these approaches strengthen the resilience of both natural and production systems, thereby supporting the integrated objectives of these three Rio Conventions.²⁶

In addition to urgent global action, ecosystem restoration must be elevated to a national priority, which includes prerequisites, clearly defined targets, financial commitments, institutional mechanisms and integration into planning processes to ensure long-term implementation and measurable progress. This process – including the integration of restoration goals into national policy frameworks – is consistently identified as essential for the long-term recovery of degraded

ecosystems and achieving global sustainability objectives.^{24, 27} In recognition of this, United Nations Member States have been called upon to integrate restorative activities, including FLR, into national policies, strategies and budgets as part of their commitments under the UN Decade and the Kunming–Montreal Global Biodiversity Framework (KMGBF), ensuring that restoration is an official national priority with dedicated domestic targets and financing.

Reversing forest and land degradation through ecosystem restoration investments at the landscape scale represents an effective option for achieving global commitments, such as: (i) the Sustainable Development Goals (SDGs) and particularly SDG 15, Life on Land, with regard to restoring degraded forests; and (ii) the three Rio Conventions (on biodiversity, climate change and desertification), notably KMGBF Target 2, which aims to restore 30 percent of all degraded ecosystems and KMGBF Target 10, which aims to ensure that areas used for agriculture, aquaculture, fisheries and forestry are managed sustainably. However, for FLR to be effective and sustainable, it must deliver net gain for both people and nature. Despite ambitious targets, past restoration efforts have sometimes fallen short of delivering lasting gains because they focused on quantity (number of hectares under restoration) over quality (provision of long-term benefits both for people and nature). For example, large-scale, single-species tree plantations, or afforestation of grasslands, often yielded limited biodiversity recovery and sometimes led to unintended consequences, such as reduced water availability or increased fire risk.

These cases underscore that FLR must prioritize ecological integrity (e.g. using native species and restoring diverse plant communities) over the number of hectares planted. Adhering to ecosystem restoration standards of practice will ensure that restoration provides genuine long-term benefits for nature and people. Historically, approaches to restoration have evolved in parallel across different domains, from carbon-focused interventions under the United Nations Framework Convention on Climate Change (UNFCCC) to land-based approaches supporting LDN under the United Nations Convention to Combat Desertification (UNCCD).

The pursuit of these different agendas has resulted in fragmented perspectives and competing restoration goals, which fail to maximize the potential for net gain. While these parallel approaches have been unsuccessful in aligning climate, biodiversity and production objectives across scales, they have also highlighted the need for stronger integration and coherence. Responding to this need, the UN Decade has established a common vision, shared language, and agreed principles and standards of practice for ecosystem restoration across UN entities, sectors and biomes. Through its unified framework, it aims to provide clear guidance to help practitioners and decision makers harness synergies, manage trade-offs more effectively and deliver measurable, long-term benefits for both people and nature. ■

1.3 LAND DEGRADATION, ECOSYSTEM RESTORATION AND FOREST AND LANDSCAPE RESTORATION: CONCEPTS, THE CONTINUUM AND FRAMEWORKS

While humans have long played a role in repairing degraded landscapes, ecological restoration emerged as a distinct and increasingly influential approach in the 1970s, gaining recognition as a viable means of addressing widespread land degradation.²⁸ In the 1980s, both the practice of ecological restoration and the scientific discipline of restoration ecology formally emerged as identifiable fields. Towards the end of the decade, in 1988, the Society for Ecological Restoration was created. In contrast to other ecosystem management activities, ecological restoration aims to remove degradation and recover a native ecosystem to the condition it would have been in the present if it had not been degraded. Thus, ecological restoration is not about recovering past ecosystems but about regaining ecological trajectories that account for environmental change.⁷

While ecological restoration was gaining steam as an approach for conserving biodiversity, and improving ecological integrity and human well-being, there was increasing recognition that repairing degraded ecosystems is essential not just for recovering native ecosystems but also for improving ecological integrity and human well-being across all types of land uses – from urban areas to production landscapes. For instance, restorative actions are needed to halt and reverse land degradation, which the UNCCD defines as the “reduction or loss of the biological or economic productivity and complexity of rainfed cropland, irrigated cropland, or range, pasture, forest and woodlands resulting from a combination of pressures, including land-use and management practices.”^g

Agroecological approaches and agroforestry practices are critical enablers of restoration outcomes. By restoring soil health through increased organic matter inputs, enhanced biological activity and improved soil structure, these approaches strengthen ecosystem functionality and productivity. Integrating trees, crops and livestock within diversified systems supports nutrient cycling, reduces erosion and enhances resilience, thereby contributing to both ecological integrity and sustainable livelihoods.

Land degradation is commonly understood as a “persistent decline” in the goods and services that an ecosystem provides, including biological and water-related goods and services, as well as land-related social and economic goods and services.²⁹

In the forest context, degradation denotes a reduction in the ability of forest ecosystems to supply these goods and services particularly in terms of regulating erosion and flood control, air purification and pollination. Ongoing degradation of land and forests is in fact a major constraint to eradicating poverty and hunger and halting biodiversity loss in many regions of the world. It intensifies competition over increasingly scarce natural resources and may trigger conflicts among users. Such pressures

threaten the livelihoods and well-being of millions of people, as well as their food, water and energy security as well as their resilience, which is understood as their ability to adapt to the impacts of climate change.

The approaches to restoration that arose in response to the range of global challenges, from loss of native ecosystems and biodiversity, food insecurity and declining ecosystem goods and services, to the climate crisis, led to two persistent issues within the global restoration community. First, communication about restoration actions was undermined by the lack of terminology to identify different restorative approaches. For example, the term “restoration” was equally applied to ecological restoration and afforestation. Second, the lack of principles and standards for truly effective restoration approaches was limiting the achievement of net gain for both people and nature.

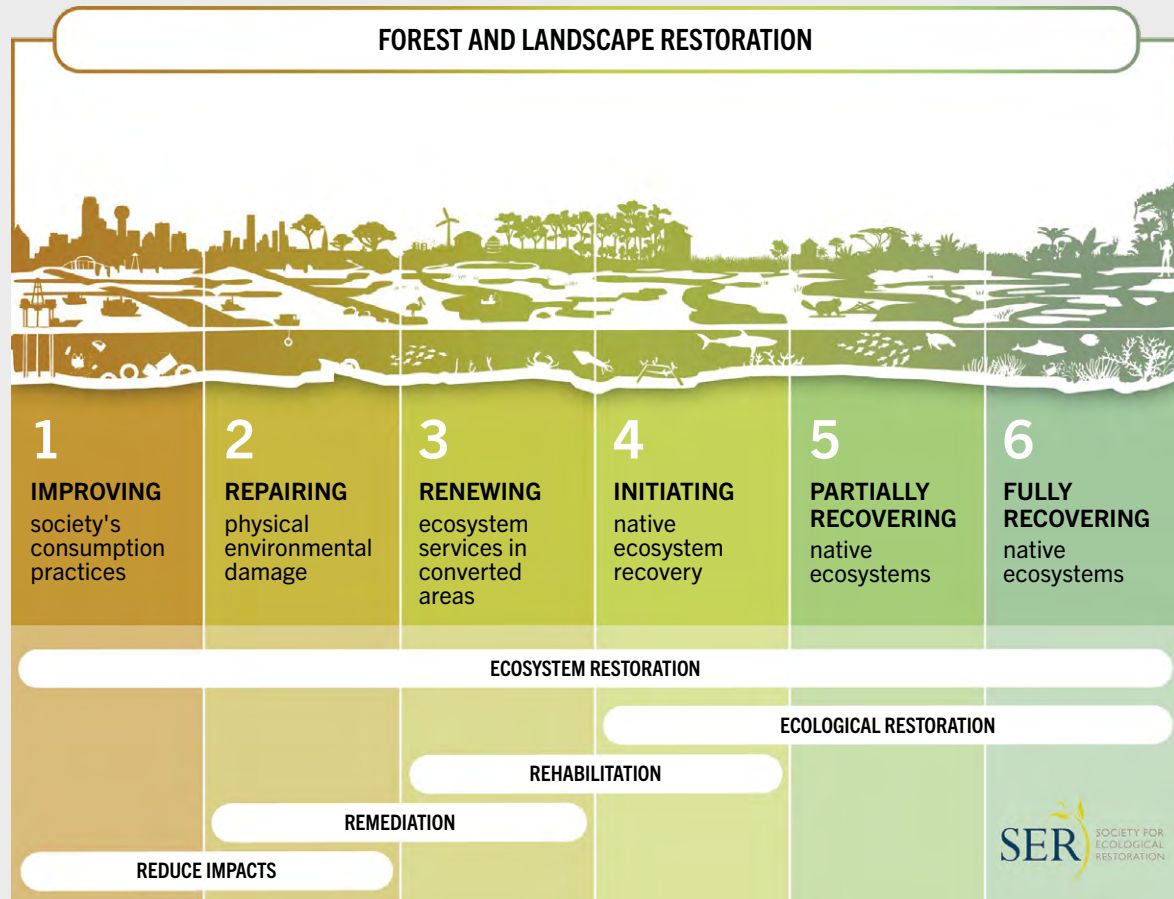
The UN Decade played a strategic role in bringing the global restoration community together to co-develop a shared lexicon about the restoration concept. The UN Decade defines ecosystem restoration as “the process of halting and reversing degradation, resulting in improved ecosystem services and recovered biodiversity”. Importantly, it clarifies that ecosystem restoration includes a broad array of ecosystem management activities, from reducing societal impacts in cities to repairing ecosystem functions in production landscapes, to ecological restoration, which involves restoring native ecosystems to the condition they would have been in the absence of degradation.²⁵

These approaches fall along the restorative continuum (Figure 1.3) and can occur in diverse terrestrial, freshwater and marine landscapes, from natural, semi-natural and production ecosystems, and densely populated urban and agricultural landscapes, to intact landscapes within protected and conserved areas, including Indigenous Peoples’ lands and territories.

While the restorative continuum includes a wide range of ecosystem restoration approaches, restoration is a complex task, and not all ecosystem management activities are restorative.

^g See UNCCD (1994), Article 1(f). <https://www.unccd.int/article-1-use-terms>

FIGURE 1.3 THE RESTORATIVE CONTINUUM SHOWING THE RANGE OF RESTORATION INTERVENTIONS WITHIN AN OVERARCHING FOREST AND LANDSCAPE RESTORATION FRAMEWORK



SOURCE: Gann, G.D., McDonald, T., Walder, B., Aronson, J., Nelson, C.R., Hallett, J.G., Guariguata, M.R. *et al.* 2026. International principles and standards for the practice of ecological restoration. Third edition. *Restoration Ecology*, 34: e70441. <https://doi.org/10.1111/rec.70441>

To be considered restorative (i.e. on the continuum), the approaches must achieve a net gain for nature and people. For this reason, promoting effective ecosystem restoration required a shared vision of the principles and standards of practice underpinning all restoration approaches along the continuum. In other words, there was a need for guidance on how to set restorative approaches apart from ecosystem management activities that are not restorative. To this end, the UN Decade's Task Force on Best Practices led an effort to co-develop principles⁸ and standards of practice⁶ in collaboration with hundreds of experts from more than 57 countries. These documents provide the tenets of, and set the standard for, effective restoration under the UN Decade, the SDGs and all the Rio Conventions.

According to the Global Partnership on Forest and Landscape Restoration (GPFLR), FLR is defined as “a process that aims to regain ecological functionality and enhance human well-being in deforested or degraded landscapes”.

The FLR concept originated in the late 1990s and early 2000s, driven by the International Union for Conservation of Nature (IUCN) and the World Wide Fund for Nature (WWF) as a response to the failures of narrow, traditional conservation methods. At that time, the international forest agenda focused on forest protection, though it was clear that degraded, non-protected lands needed to be restored.

TABLE 1.1 CONCEPTUAL RELATIONSHIPS BETWEEN ECOLOGICAL RESTORATION, ECOSYSTEM RESTORATION, AND FOREST AND LANDSCAPE RESTORATION

Dimension	Ecological restoration	Ecosystem restoration	Forest and landscape restoration
Core definition	The process of partially or fully recovering native ecosystems to the condition they would have been in without degradation (the reference condition), accounting for environmental change	The process of repairing degraded ecosystems to recover ecological functionality and integrity, and the delivery of ecosystem services through a wide range of restorative approaches	The process of regaining ecological integrity and enhancing human well-being across forested and multifunctional landscapes
Spatial scale	From site (e.g. forest stand, wetland, riparian zone) to landscape scale	From site (e.g. forest stand, wetland, riparian zone) to landscape scale	Explicitly landscape scale and level, focusing on mosaics of forests, farms, settlements and watersheds
Objectives	Recover biodiversity and ecological integrity (remove threats and restore native species composition, ecological structure, ecological functions, environmental conditions, external exchanges) and improve human well-being	Achieve net gain for biodiversity, ecosystem integrity and human well-being	Restore ecological integrity and improve livelihoods, productivity, food security and resilience; does not imply restoring native ecosystems
Production systems	Usually conservation-oriented, the main objective being to recover native ecosystems	Can include productive systems if agroecosystem functioning is restored	Includes multiple types of production and native systems (agroforestry, mosaic landscapes, sustainable forestry and value chains)
Relationship to others	Specific approach along the restorative continuum	Umbrella concept that includes all approaches along the restorative continuum, including ecological restoration, and forest and landscape restoration	Landscape-scale approach to ecosystem restoration in forested areas, integrating multiple activities along the restorative continuum

SOURCE: Authors' own elaboration.

The focus on planting trees shifted to restoring ecological function and improving human well-being across entire landscapes. Key milestones were the creation of the GPFLR in 2003, and the launch of the Bonn Challenge by Germany in 2011, with its goal to restore 150 million ha by 2020, later increased to 350 million ha by 2030.

Since FLR is implemented at the landscape scale, it often encompasses a heterogeneous mosaic of land uses and restoration objectives, including agriculture, forestry, soil protection, water supply and distribution, biodiversity conservation and pasture provision, across a large area of land or a watershed; different approaches will thus be used in different locations, depending on the ultimate objectives and societal needs (Figure 1.4).

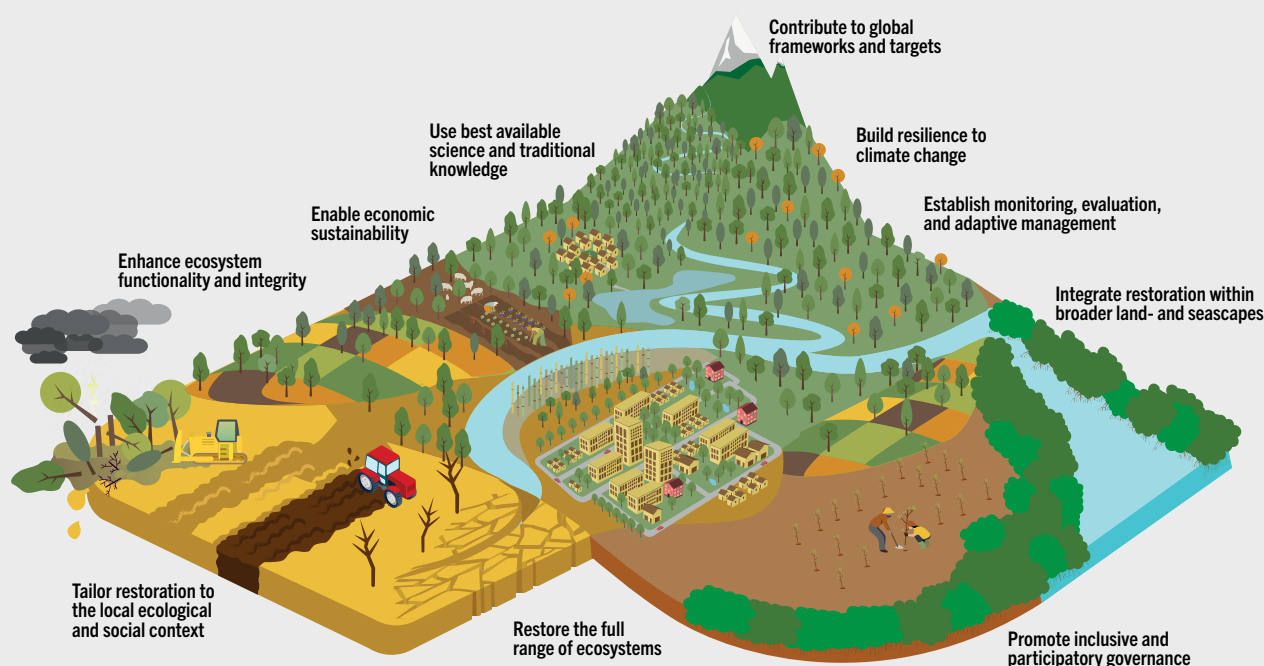
Forest and landscape restoration is a principle-based approach that engages stakeholders across all affected land-use

sectors through participatory decision-making processes. It encompasses a range of interventions from rehabilitation (repairing selected ecosystem functions) to ecological restoration (fully restoring native ecosystems).

Importantly, restoring forest ecosystems goes *beyond* the planting or assisted natural regeneration of trees. Forest and landscape restoration integrates ecological recovery with social, economic and governance dimensions to ensure long-term sustainability,^{8, 30, 31} and it emphasizes people-centric approaches.³²

A landscape approach seeks to better understand and recognize the interactions between various land uses and stakeholders by including them in an integrated management process (Figure 1.5). Landscape approaches are now seen as essential in developing sustainable land-use and livelihood strategies in rural areas (Box 1.2).

FIGURE 1.4 FOREST AND LANDSCAPE RESTORATION AS AN INTEGRATED APPROACH AT THE LANDSCAPE SCALE



SOURCE: Adapted from Garrett, L., Lévyte, H., Besacier, C., Alekseeva, N. & Duchelle, M. 2022. *The key role of forest and landscape restoration in climate action*. Rome, FAO. <https://doi.org/10.4060/cc2510en>

To be successful, restoration needs to address the key drivers of degradation. The causes of deforestation and forest degradation are well documented and include unsustainable agricultural practices, demographic pressure, infrastructure development and over-harvesting of resources.^{41, 42} While combatting these drivers and the dynamics they create remains necessary, the international community has expressed a growing interest in FLR,^{8, 43} recognizing that healthy and productive landscapes and the vital benefits they provide are part of the solution.

Forest and landscape restoration can contribute:

- (i) to the socioeconomic development of communities at the local level, through value production in the agriculture and forestry sectors, job creation, and dialogue and inclusion; and
- (ii) to the environmental objectives set

by the major international conventions at the global and national levels – mitigating and adapting to climate change, maintaining and restoring biodiversity, combating desertification, and achieving the 2030 Agenda for Sustainable Development.

Forest and landscape restoration can simultaneously address social, economic, environmental and forestry objectives, which makes it appealing to diverse stakeholders who have reflected upon failures in conservation and forest management approaches and are seeking to bridge the worlds of conservation and development, including agriculture and forestry. It is clear, however, that moving beyond good intentions and the evolution of FLR and its principles towards achieving the integration of ecological and social objectives

FIGURE 1.5 FRAMEWORK OF FOREST AND LANDSCAPE RESTORATION OPTIONS ACROSS KEY LAND USES AND SUBTYPES

Land use	Land subtype	General category of forest and landscape restoration option		Description
Forest land Land where forest is, or is planned to become, the dominant land use → Suitable for wide-scale restoration	If the land is without trees, there are two options:		1. Planted forests and woodlots	Planting trees on formerly forested land. Native or introduced species planted for various purposes, fuelwood, timber, building, poles, fruit production, etc.
			2. Natural regeneration	Natural regeneration of formerly forested land. The site may be highly degraded and no longer able to fulfil its past function, e.g. agriculture. If the site is heavily degraded and no longer has native seeds, some planting will probably be required.
	If the land consists of degraded forests:		3. Silviculture	Enhancement of existing forests and woodlands and stocking, e.g. by reducing fire and grazing and by liberation thinning, enrichment planting, etc.
Agricultural land Land that is managed to produce food → Suitable for mosaic restoration	If the land is under permanent management:		4. Agroforestry	Establishment and management of trees on active agricultural land, either through planting or favouring natural regeneration, to improve crop productivity, provide dry season fodder, increase soil fertility, enhance water retention, etc.
	If the land is under intermittent management:		5. Improved fallow	Establishment and management of trees on fallow agricultural lands to improve productivity, e.g. through fire control, extending the fallow period, etc., with the intention of eventually reverting this land back to active agriculture.
Protective land and buffers Land that is vulnerable to, or critical in safeguarding against, catastrophic events → Suitable for mangrove restoration, watershed protection and erosion control	If the land is degraded mangrove:		6. Mangrove restoration	Establishment or restoration of mangroves along coastal areas in estuaries.
	If it is used as a protective land and buffer:		7. Watershed protection and erosion control	Establishment and restoration of forests on very steep sloping land, along water courses, in areas that naturally flood and around critical water bodies.

SOURCE: Reproduced from Sabogal, C., Besacier, C. & McGuire, D. 2015. Forest and landscape restoration: Concepts, approaches and challenges for implementation. *Unasylva*, 66(245): 3–10. <https://openknowledge.fao.org/handle/20.500.14283/j5212e>

still requires further work.⁴³ In particular, there is a need to better understand how synergies and trade-offs between conservation and productive dimensions play out across different contexts and timescales, and how restoration options may tip the balance in favour of one or the other.⁴⁴ Filling these knowledge and implementation gaps is today a major focus of restoration research and development initiatives

worldwide, such as Regreening Africa, Landscape Partnership Asia, the African Forest Landscape Restoration Initiative (AFR100), and Initiative 20x20 in Latin America and the Caribbean. ■

BOX 1.2 THE ARAL SEA BASIN: A CRITICAL CASE FOR LANDSCAPE-SCALE ECOSYSTEM RESTORATION ACROSS FIVE RIPARIAN COUNTRIES

The Aral Sea Basin illustrates both the need for and complexity of applying a landscape approach to ecosystem restoration at scale. In this region, upstream–downstream dynamics, water governance, land degradation, biodiversity loss and local livelihoods are deeply interconnected and cannot be addressed in isolation. Effectively restoring the basin, therefore, requires coordinated transnational cooperation, integrated water and land management, and long-term collaboration among countries sharing the same resources. The Aral Sea Basin is a complex landscape of high mountains and lowland drylands, encompassing five Central Asian countries (Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan), and part of Afghanistan. The basin features two major rivers originating from glaciers in Tajikistan and Kyrgyzstan, flowing from east to west across Central Asia, and discharging into the remnants of the Aral Sea.³³ Excessive water uptake for irrigation has been a major driver of degradation, which is exacerbated by climate change. The area of riparian forest in Central Asia has diminished by 90 percent,³⁴ and the Aral Sea, formerly the fourth largest inland lake in the world, has shrunk drastically, leading to the formation of the Aralkum Desert, which covers more than 5.5 million ha and generates more than 100 million tonnes of dust and poisonous salts every year.³⁵ More than 73 million inhabitants are affected by contaminated freshwater, air pollution, the spread of desertification and biodiversity loss.

Restoring the Aral Sea to its former state is unanimously considered impossible by experts, as it would require the cessation of essential economic activities in Central Asia for at least 30 to 40 years.³⁶ The only viable option is a landscape approach to ecosystem restoration over the whole basin to mitigate the consequences of this ecological disaster. The conjunction of environmental, institutional and socioeconomic factors makes it difficult for countries to redress the situation, whether by planting native shrubs to mitigate salt and dust storms at the dried seabed, restoring riparian forests or establishing halophytic grasslands on solonchaks – saline soils, often found in arid and semi-arid regions, with a high concentration of soluble salts.³³ The lack of freshwater and the unequal access by basin countries to water resources are major issues that are projected to worsen in the coming decades due to climate change

and rising water demand from agriculture.³⁵ Ecosystem restoration at the seabed and in the river floodplains is thwarted by the high levels of soil salinity and silt content,³⁷ as well as the lack of seeds, seedlings and nurseries, frequent pest and disease outbreaks, and gaps in monitoring and professional capacities.

The governments of Central Asian countries have come together to strengthen regional efforts across the Aral Sea Basin landscape, with financial and capacity-building assistance from intergovernmental organizations, development banks and the private sector.³⁸ While countries downstream are leading work on ecosystem restoration at the dried Aral seabed and in river floodplains, those upstream are heading up action on joint water management and glacier conservation.³⁸ In 2021, the Aral Sea region was declared a “zone of ecological innovations and technologies” by a United Nations General Assembly special resolution.³⁹

Despite growing international attention to the Aral Sea crisis and ongoing national and regional efforts, the challenges persist. Critical decisions remain to be taken regarding where, when and how restoration interventions could be implemented across the dried bed of the Aral Sea. Applying state-of-the-art knowledge, solid science and best restoration practices as part of an integrated landscape approach is a prerequisite for progress to happen in the Aral Sea Basin, with the potential to offer unique and valuable lessons – and renewed hope – for large-scale ecosystem restoration worldwide.⁴⁰



Aral Sea region landscape.
© FAO Uzbekistan

1.4 FOREST AND LANDSCAPE RESTORATION IN GLOBAL COMMITMENTS AND FRAMEWORKS

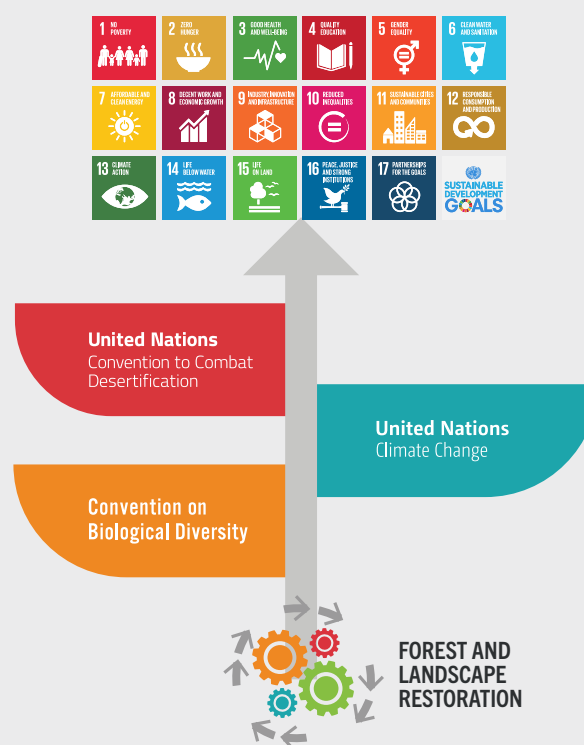
Forest and landscape restoration has become a central pillar of the global sustainability agenda and enables a unifying response to the three interlinked planetary crises of climate change, biodiversity loss and land degradation. The three Rio Conventions – the UNFCCC, the Convention on Biological Diversity (CBD) and the UNCCD – provide the core international policy framework in which restoration has emerged as a strategic priority.^{44, 45}

Across these conventions, FLR serves as a shared operational approach to enhance carbon sinks and climate resilience, restore ecosystems and species habitats, and achieve LDN through the rehabilitation of degraded lands, particularly in vulnerable regions.

Within the UNFCCC, FLR contributes to mitigation and adaptation objectives by increasing forest carbon sequestration, reducing climate-related risks and strengthening the resilience of agrifood systems and forested landscapes. Under the CBD and its KMGBF Target 2, restoration is a mechanism for reversing biodiversity loss and restoring ecosystem integrity and connectivity. Under the UNCCD, FLR is central to achieving LDN targets by restoring soil fertility, productivity and ecosystem services critical for rural livelihoods and food security (Figure 1.6).

By linking ecological recovery with social and economic objectives, FLR provides an operational entry point through which countries can advance multiple global commitments in a coherent and mutually reinforcing manner. Within the 2030 Agenda for Sustainable Development, FLR contributes directly to SDG 15, Life on Land, which calls for protecting, restoring and sustainably using terrestrial ecosystems, halting biodiversity loss and reversing land degradation.⁴⁶ At the same time, FLR enhances

FIGURE 1.6 CONTRIBUTION OF FOREST AND LANDSCAPE RESTORATION TO THE THREE RIO CONVENTIONS ON CLIMATE, BIODIVERSITY AND LAND DEGRADATION, AND THE SUSTAINABLE DEVELOPMENT GOALS



SOURCE: Adapted from Garrett, L., Lévy, H., Besacier, C., Alekseeva, N. & Duchelle, M. 2022. *The key role of forest and landscape restoration in climate action*. Rome, FAO. <https://doi.org/10.4060/cc2510en>

soil fertility, water regulation and land productivity, thereby supporting SDG 2 on Zero Hunger, and strengthening climate resilience in line with SDG 13 on Climate Action.^{47, 48} By improving watershed functions, promoting sustainable biomass production and generating rural employment, FLR also contributes to SDGs 6, 7 and 8, respectively Clean Water and Sanitation, Affordable and Clean Energy, and Decent Work and Economic Growth, illustrating its cross-cutting role in advancing sustainable development.⁴⁴

BOX 1.3 BRIDGING THE UNITED NATIONS DECADE ON ECOSYSTEM RESTORATION 2021–2030: FROM ECOSYSTEM RESTORATION TO AFFORESTATION AND REFORESTATION

Ensuring effective links between the United Nations Decade on Ecosystem Restoration 2021–2030 and the forthcoming United Nations Decade for Afforestation and Reforestation in line with Sustainable Forest Management 2027–2036 provides a strategic opportunity to reinforce and scale up forest and landscape restoration (FLR) globally. Far from representing separate agendas, the two decades can be considered complementary phases along a longer-term restoration continuum, from restoring degraded ecosystems towards sustainably expanding and managing forest resources to meet rising global demand. Global demand for wood products is projected to increase by roughly one-third by 2050, particularly in emerging economies.²⁰

Standing natural forests alone are unlikely to meet this demand, nor can they meet the growing expectations for ecosystem services such as carbon sequestration. Estimates suggest that by the middle of the century, an additional 20–40 million ha of productive planted forests may be required globally, including approximately 33 million ha to meet projected demand for industrial roundwood. In sub-Saharan Africa alone, more than 300 000 ha per year of newly planted forests may be needed by 2030. These figures underscore the urgency of aligning restoration and afforestation, and reforestation within a coherent global framework.

The UN Decade is generating substantial momentum and advancing methodologies, data systems, coalitions and financing platforms that complement and build on initiatives such as the Bonn Challenge. The forthcoming UN Decade for Afforestation and Reforestation will offer a platform to consolidate these gains and channel them into a renewed, long-term scaling phase. Bridging the two decades can ensure policy coherence, institutional continuity and sustained political visibility for FLR, effectively extending the restoration horizon by another 10 years. However, this transition must be managed

carefully. Afforestation and reforestation should be embedded within integrated landscape approaches and guided by established FLR principles. This includes: prioritizing diverse, locally adapted or endemic species to deliver multiple ecological and socioeconomic benefits; developing inclusive business models and value chains; and ensuring equitable market access for producer organizations and small and medium enterprises. Equally important is the proactive management of risks, including weak governance, unintended land-use change, negative impacts on local communities and unequal benefit distribution.

By consciously linking restoration and sustainable forest expansion, the two decades can form a coherent policy evolution: from halting and reversing ecosystem degradation to building resilient, productive and inclusive forest landscapes able to meet future environmental and economic demands. Bridging the decades in this way is not just a matter of timing, but a strategic step towards transforming restoration commitments into long-term, sustainable forest stewardship at scale. To support the effective implementation of the forthcoming UN Decade for Afforestation and Reforestation, it will be important to ensure that interventions align with established FLR principles and avoid unintended shifts towards large-scale monoculture plantations.

This will require robust monitoring and accountability mechanisms that go beyond area-based targets to also capture socioeconomic outcomes, including livelihoods, equity and community benefits, alongside ecological integrity and biodiversity. Clear safeguards and reporting frameworks, aligned with existing international standards and best practices, can help ensure that restoration efforts contribute to resilient, multifunctional landscapes. Strengthening transparency in reporting and linking restoration commitments to nationally determined priorities will also be critical to maintaining both quality and credibility in implementation.

The United Nations Strategic Plan for Forests (UNSPF) 2017–2030 stresses the role of FLR as a primary mechanism for achieving the Global Forest Goals, particularly Global Forest

Goal 1, which calls for reversing forest loss and increasing global forest area by 3 percent by 2030.⁴⁹ The UNSPF emphasizes the restoration of degraded forests and landscapes and calls

for strengthened governance, financing and multisectoral coordination. In this regard, FLR provides a practical framework for translating the UNSPF's strategic objectives into integrated, landscape-level action.⁵⁰ Forest and landscape restoration has been recognized as a critical approach for mitigating and adapting to climate change.⁵¹ The role of afforestation and reforestation in lowering greenhouse gas (GHG) emissions was first formally acknowledged in the Kyoto Protocol's Clean Development Mechanism. Building on this foundation, the UNFCCC later introduced the concept of reducing emissions from deforestation and forest degradation (REDD) as an international mechanism to curb carbon emissions and safeguard forest ecosystems through funding or carbon credits.⁵² This framework subsequently evolved into REDD+, which encompasses "policy approaches and positive incentives on issues relating to REDD in developing countries; and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries".⁵³ The UNFCCC's emphasis on increasing carbon stocks and enhancing carbon sequestration led to restoration approaches that focused on tree planting, including afforestation in areas where growing trees might be at odds with biodiversity conservation.^{54, 55}

The focus on ecosystems and biodiversity in the targets for achieving the Paris Agreement's global goal on adaptation could bolster the role of restoration in supporting adaptation action. Forest and landscape restoration is also closely aligned with the KMGBF, adopted under the Convention on Biological Diversity. KMGBF Target 2 commits countries to restoring at least 30 percent of degraded terrestrial, inland water, and coastal and marine ecosystems by 2030, positioning restoration as a central pillar of global biodiversity policy.⁵⁶ By restoring habitat connectivity and ecological functionality while integrating productive land uses such as agroforestry, FLR supports biodiversity recovery without undermining food production and rural livelihoods. The UN Decade provides a global platform to accelerate restoration at scale and explicitly recognizes restoration as a key solution to climate change, biodiversity loss and land degradation.⁴¹ By emphasizing partnerships, financing, knowledge sharing and inclusive governance, the UN Decade creates

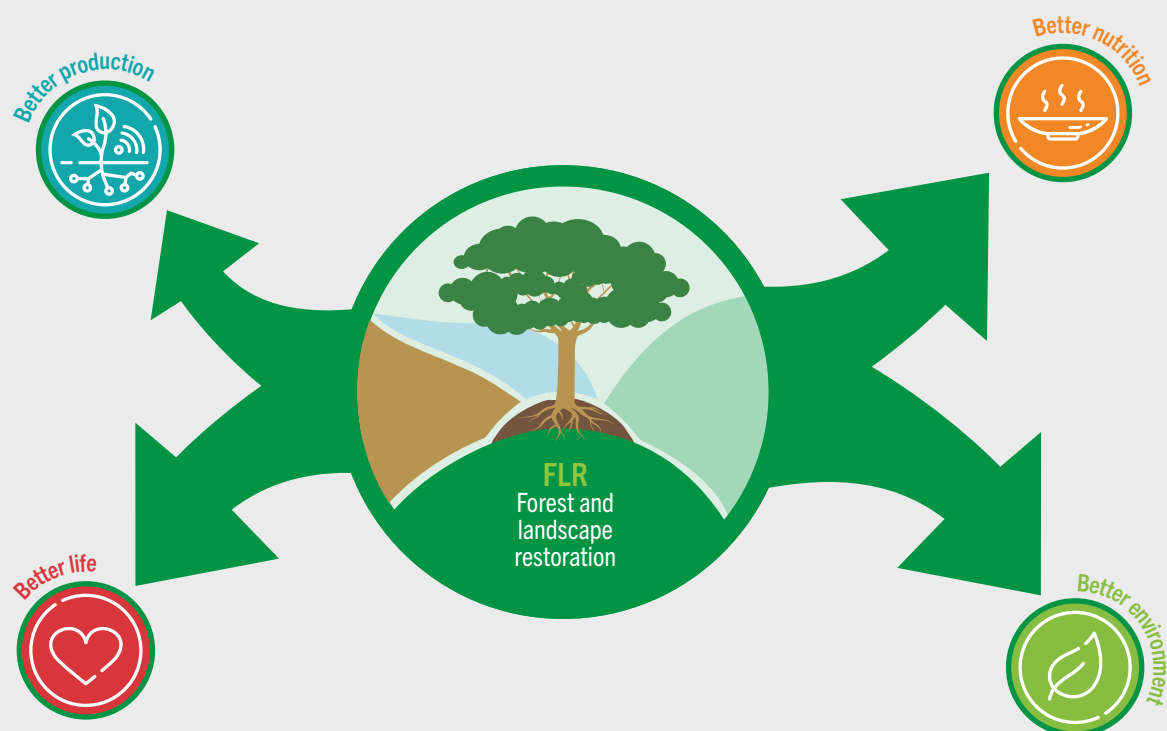
enabling conditions for mainstreaming FLR into national development plans, climate commitments and biodiversity strategies. The United Nations states that it is intended to "promote a concerted, holistic landscape-focused approach to the interdependence of ecosystems, human needs and biodiversity," and to "build a common vision, prioritizing ecosystem restoration from the global to the local level,"⁵⁷ implying that restoration will remain a continuing global priority beyond the designated decade.

The proclamation of the United Nations Decade for Afforestation and Reforestation in line with Sustainable Forest Management (2027–2036) reflects this commitment. It aims to build on and complement ongoing global restoration efforts, with a particular focus on increasing forest cover, strengthening sustainable wood supply and maximizing climate and biodiversity benefits at scale.

Forest and landscape restoration is a relevant option for advancing the Food and Agriculture Organization of the United Nations (FAO) Strategic Framework 2022–2031 in line with the transformation of agrifood systems and the effective implementation of the four betters (Figure 1.7). Beyond its environmental benefits, FLR is also critical for addressing the rapidly rising global demand for wood, fibre and bio-based materials associated with population growth, urbanization and the transition to low-carbon economies, and to growing the global bioeconomy as recognized under the UNFCCC Conference of the Parties (COP) 30 bioeconomy challenge. By restoring degraded forests and establishing productive, sustainably managed forest landscapes, FLR can expand the supply of renewable forest products while reducing pressure on remaining natural forests, thereby helping to reconcile growing demand with the long-term sustainability objectives embedded in the Global Forest Goals.

Initiatives to restore degraded forests and deforested land have expanded over the past two decades, giving rise to a range of restoration options (Figure 1.5), including sustainable forest management, natural or assisted regeneration, silvicultural interventions, and forest and agroforestry plantations.

FIGURE 1.7 FOREST AND LANDSCAPE RESTORATION CONTRIBUTIONS TO THE FAO STRATEGIC FRAMEWORK 2022–2031 AS A KEY OPTION TO ADVANCE THE FOUR BETTERS



SOURCE: Authors' own elaboration.

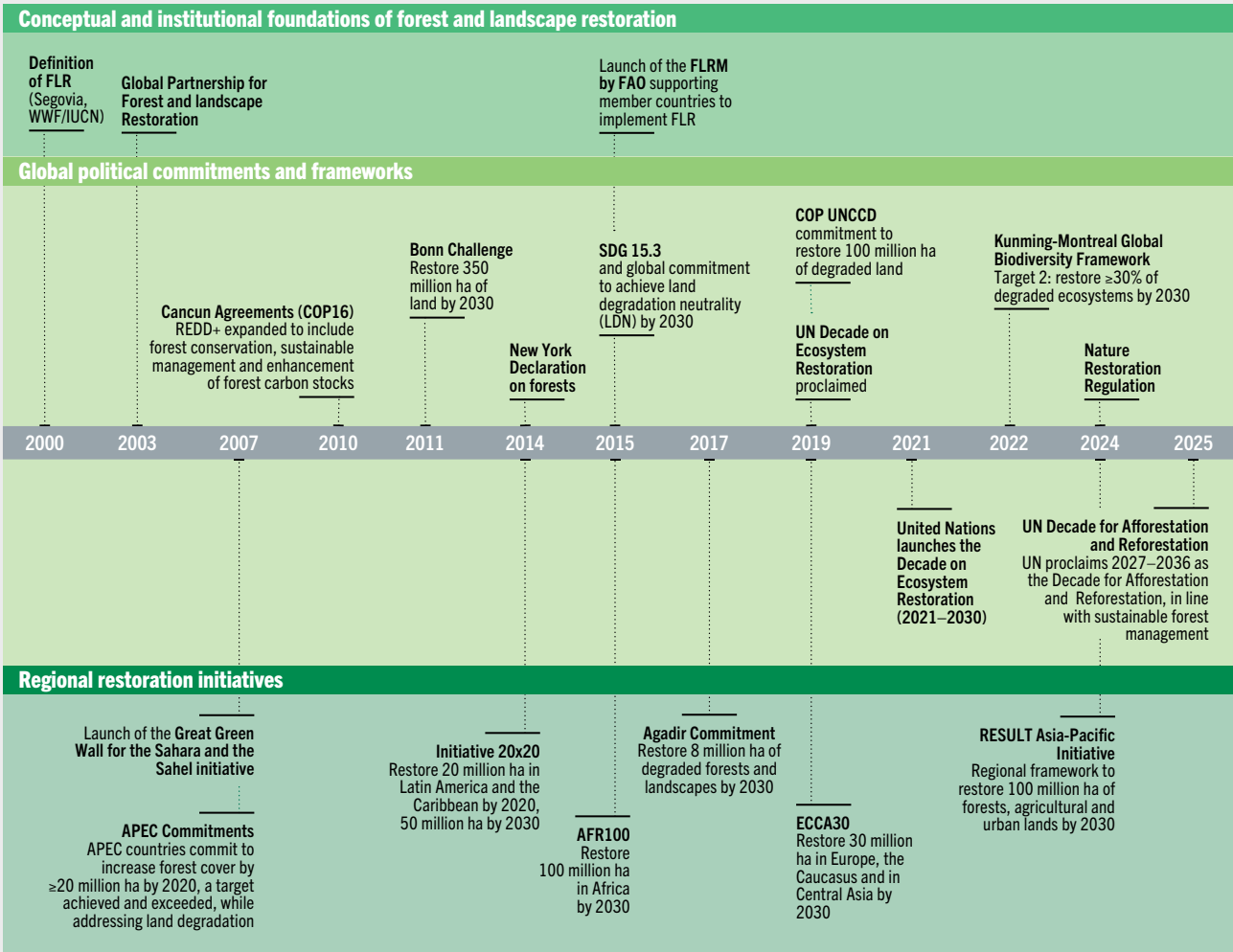
Over time, these restoration options have evolved from site-level interventions to broader territorial and landscape-scale strategies, integrating agricultural and non-forest areas into a more systemic concept of FLR. Over the past two decades, FLR has evolved from a technical concept into a central pillar of international environmental and development policy, supported by an expanding set of global and regional commitments with targets set for 2030 expressed in thousands or even millions of hectares and billions of trees (Figure 1.8).

The formal recognition of FLR as policy framework began in 2000, when IUCN and WWF defined the concept as a landscape-scale approach to restoring ecological functionality while supporting human well-being. This conceptual adoption was reinforced from an institutional

point of view in 2003 with the establishment of the GPFLR, which created an international platform for promoting restoration principles, mobilizing partners and scaling up action.

The following decade marked a transition towards quantified political commitments. A major global milestone was reached in 2011 with the launch of the Bonn Challenge by the Government of Germany and IUCN, calling for the restoration of 150 million ha of degraded and deforested land by 2020, later increased to 350 million ha by 2030. In 2014, the New York Declaration on Forests reaffirmed restoration commitments towards the target of 350 million ha by 2030, while linking forest restoration with broader climate and development objectives. The momentum culminated in 2021 with the proclamation of the UN Decade, which

FIGURE 1.8 GLOBAL POLITICAL MILESTONES AND REGIONAL INITIATIVES SHAPING THE FOREST AND LANDSCAPE RESTORATION AGENDA (2000–2025)



NOTES: AFR100 = African Forest Landscape Restoration Initiative; APEC = Asia-Pacific Economic Cooperation; COP16 = Sixteenth Conference of the Parties; ECCA = Europe, the Caucasus, and Central Asia; FLR = forest and landscape restoration; FLM = Forest and Landscape Restoration Mechanism; REDD+ = reducing emissions from deforestation and forest degradation in developing countries, and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks; SDG = Sustainable Development Goal; and UNCCD = United Nations Convention to Combat Desertification.

SOURCE: Adapted from Mallet, B. 2023. *Implementing the Forest Landscape Restoration approach: analysis and outlook*. Policy brief no. 2. Scientific and Technical Committee on Forests. Montpellier, CIRAD. <https://agritrop.cirad.fr/605296/>

positioned restoration as a central global priority under the leadership of FAO and the United Nations Environment Programme (UNEP).

In parallel, large-scale regional restoration initiatives emerged as key delivery platforms

for the implementation of global commitments. These include Bonn Challenge regional platforms (e.g. AFR100, Initiative 20x20, the Europe, the Caucasus and Central Asia initiative [ECCA30] and the Agadir Commitment) alongside the Great Green Wall (GGW) for the Sahara and Sahel

Initiative, and its World Restoration Flagship, the GGW for Ecosystem Restoration and Peace in Burkina Faso and the Niger (**Case study 1**).

There are four Bonn Challenge regional platforms: (i) Initiative 20x20, which is a country-led effort that aims to change the dynamics of land degradation in Latin America and the Caribbean by bringing 50 million ha under restoration by 2030; (ii) AFR100, which is a pan-African, country-led effort to restore 100 million ha of land across Africa by 2030; (iii) the Agadir Commitment, which is a Mediterranean initiative to bring 8 million ha under restoration by 2030 under the umbrella of the Committee on Mediterranean Forestry Questions – *Silva Mediterranea*; and (iv) ECCA30, a country-led initiative aiming to restore 30 million ha of degraded and deforested land in Europe, the Caucasus and Central Asia by 2030. In 2022, the European Union further integrated restoration commitments into its regional legislation by proposing the European Union Nature Restoration Regulation, which was adopted by the European Parliament on 27 February 2024, and formally entered into force on 18 August 2024 (**Case study 13**).

In December 2024, the Restoring and Sustaining Landscapes Together (RESULT) Asia-Pacific Initiative in Asia and the Pacific, was launched in Bangkok. The RESULT Asia-Pacific Initiative is a regional programmatic framework for FLR, convened by partners including FAO. It aims to achieve a consolidated regional restoration target of at least 100 million ha of degraded forests, forestland, agriculture, urban and other lands across Asia and the Pacific by 2030. The framework was designed in line with the Asia-Pacific Regional Strategy and Action Plan on Forest and Landscape Restoration and the UN Decade.

Across these platforms, a diverse set of stakeholders plays complementary roles in advancing FLR. International organizations provide normative guidance, technical standards, science and knowledge advances and systematization, convening power and global monitoring frameworks, enabling coordination across scales and actors. National governments anchor restoration in policy formulation, land-use planning, tenure reforms and public investment, and by integrating FLR into national climate, biodiversity and land degradation strategies, as illustrated by analyses of nationally determined contributions (NDCs), national biodiversity strategies and action plans (NBSAPs) and LDN targets. The private sector contributes through sustainable commodity commitments, responsible supply chains and innovative financing, such as impact investments and blended finance.

Indigenous Peoples, as well as local communities, are central actors as rights holders and long-term custodians of landscapes. Their traditional knowledge, governance and livelihood priorities are essential for legitimacy, equity and sustainable outcomes. Civil society organizations provide facilitation, social awareness, advocacy, safeguards and accountability, ensuring that restoration activities are inclusive and equitable. At the same time, research institutions strengthen evidence-based decision-making through monitoring, evaluation and the development of scalable restoration approaches promoting adaptive management. ■

UZBEKISTAN

Nursery-grown seedlings are used for forest and landscape restoration.

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CHAPTER 2

RESTORING THE WORLD'S FORESTS: FROM COMMITMENTS TO PROGRESS

2.1 SETTING THE SCENE

The urgency and opportunity of advancing forest and landscape restoration in 2020–2030, as highlighted in **Chapter 1**, positions restoration as central to achieving climate, biodiversity, land degradation and the Sustainable Development Goals (SDGs). As part of these global objectives, restoration is increasingly recognized as an important element of food security and nutrition, underpinning the transformation of agrifood systems by restoring land productivity, ecosystem services and resilience across landscapes. Forest and landscape restoration is a cost-effective nature-based solution, delivering important climate mitigation benefits through carbon sequestration while enhancing climate adaptation by strengthening ecosystem resilience and reducing climate-related risks.⁵⁸

As global commitments are implemented, there is a growing need for reliable, comparable data to understand where degradation is ongoing, where restoration is underway, and whether current efforts meet restoration targets and the global need for healthy and functioning ecosystems in the face of multiple planetary crises. Effective forest and landscape restoration (FLR) requires action across landscapes, anchored in policies and legal mandates. In this context, the Food and Agriculture Organization of the United Nations

(FAO) Global Forest Resources Assessment (FRA) 2025 provides a critical foundation: it assesses approximately 50 forest-related variables across 236 countries and areas^h over the period 1990 to 2025 and, for the first time, includes country-reported data on forest restoration.¹⁹ This new dataset contributes to tracking progress on forest restoration towards the global restoration target, Target 2ⁱ of the Kunming–Montreal Global Biodiversity Framework (KMGBF) and its headline indicator, area under restoration, and the efforts under the United Nations Decade on Ecosystem Restoration 2021–2030 (UN Decade)^j, both aligned with the 2030 Agenda for Sustainable Development.^k

Throughout this chapter, references are made to land degradation, based on data reported to the United Nations Convention to Combat Desertification (UNCCD), as it is the best available approximation of global degradation and there are no official global estimates of ecosystem degradation, including forests and landscapes. The terms forest restoration, forest and landscape restoration, and terrestrial ecosystem restoration are used in this chapter, reflecting differences in the scope of restoration data available through

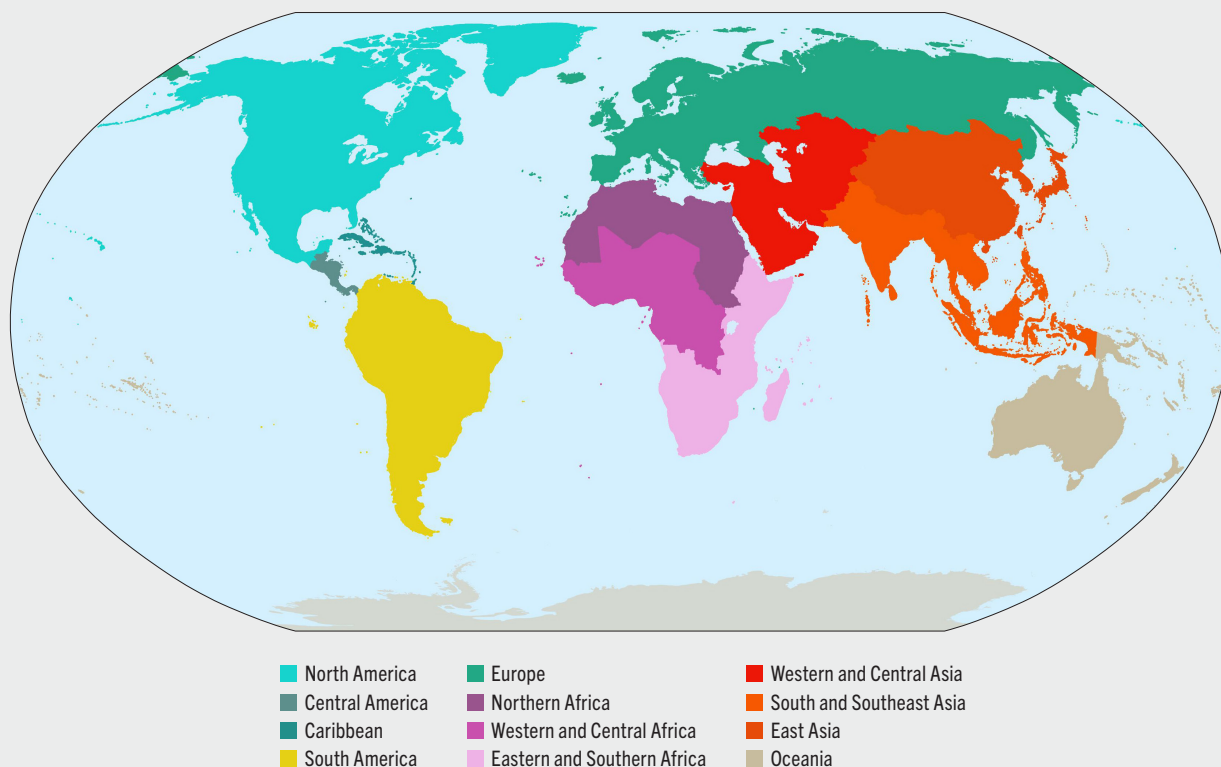
^h Based on the United Nations Statistics Division Standard country or area codes for statistical use (M49), covering 197 countries and 39 areas.

ⁱ See <https://www.cbd.int/gbf/targets/2>

^j See <https://www.decadeonrestoration.org/>

^k See <https://sdgs.un.org/goals>

FIGURE 2.1 REGIONS AND SUBREGIONS USED IN CHAPTER 2 TO AGGREGATE DATA ACROSS FRAMEWORKS



Refer to the disclaimer on the copyright page for the names and boundaries used in this map.

SOURCE: FAO. 2025. *Global Forest Resources Assessment 2025*. Rome, FAO. <https://doi.org/10.4060/cd6709en>

global reporting frameworks. In the absence of harmonized, ecosystem-specific restoration data, forest restoration and terrestrial ecosystem restoration represent the proxies for capturing restoration efforts relevant to FLR.

This chapter presents the latest global and regional data on forest and landscape changes, from deforestation, restoration commitments and restoration progress. These data come from (1) FRA 2025; (2) the UNCCD's national reports; (3) the United Nations Framework Convention on Climate Change's (UNFCCC) nationally determined contributions (NDCs); (4) the Convention on Biological Diversity's (CBD) national biodiversity strategies and action plans (NBSAPs), and seventh national reports;

(5) the UN Decade's Framework for Ecosystem Restoration Monitoring (FERM); and (6) the Bonn Challenge. The chapter first reviews recent trends and patterns of land degradation and forest loss and then examines international restoration commitments, assessing the scale and characteristics of ongoing restoration progress towards their achievement across regions, including different legal frameworks. For consistency, this chapter uses the six FRA regions to aggregate data by regions across all frameworks (Figure 2.1). It concludes by highlighting key challenges and opportunities to strengthen monitoring frameworks for effective implementation during the UN Decade and beyond.

TABLE 2.1 AREA OF LAND DEGRADED BETWEEN 2015 AND 2019 AGGREGATED ACROSS THE SIX GLOBAL FOREST RESOURCES ASSESSMENT REGIONS

Region	Total degraded land area in 2015 (million ha)	Total degraded land area in 2019 (million ha)	Increase in land degradation, 2015–2019 (million ha)
Africa	174	334	160
Asia	482	583	101
Europe	58	75	18
North and Central America	206	253	47
Oceania	68	73	5
South America	183	245	62
Global	1 171	1 563	392

NOTE: The reported increase in degraded land between 2015 and 2019 should be interpreted with caution. The magnitude of change is likely influenced not only by underlying biophysical dynamics but also by methodological developments between United Nations Convention to Combat Desertification reporting cycles, including revisions to baseline assessments, improved data availability and advances in remote sensing and mapping techniques, which may result in more comprehensive identification of degraded areas over time.

SOURCE: Based on data from UNCCD. 2019. *UNCCD Data Dashboard: Sustainable Development Goal (SDG) Indicator 15.3.1*. [Accessed on 27 March 2026]. <https://data.unccd.int/land-degradation?grouping=SDG>. CC BY-NC 2.0.

Under the UNCCD, countries assess the extent of degraded land through the land degradation neutrality (LDN) framework, operationalized under SDG Indicator 15.3.1, which integrates three subindicators measuring land-cover change, land productivity dynamics and soil organic carbon stocks. Based on country-reported data and estimates generated by UNCCD, the proportion of degraded land for all reported land area increased from approximately 11 percent in 2015 to 15 percent (more than 1.56 billion ha) in 2019 (Figure 2.2).

In Africa, around 12 percent of land area, corresponding to approximately 334 million ha, was classified as degraded in 2019, reflecting the significant contribution of forest loss and land degradation to regional land degradation dynamics (Table 2.1).

In Asia, degraded land accounted for approximately 19 percent of land area, corresponding to about 583 million ha, reflecting the combined impacts of land-use change, agricultural expansion and forest degradation across diverse ecosystems. In South America, degraded land accounted for approximately 14 percent of land area, equivalent to approximately 245 million ha, consistent with persistent pressures from deforestation

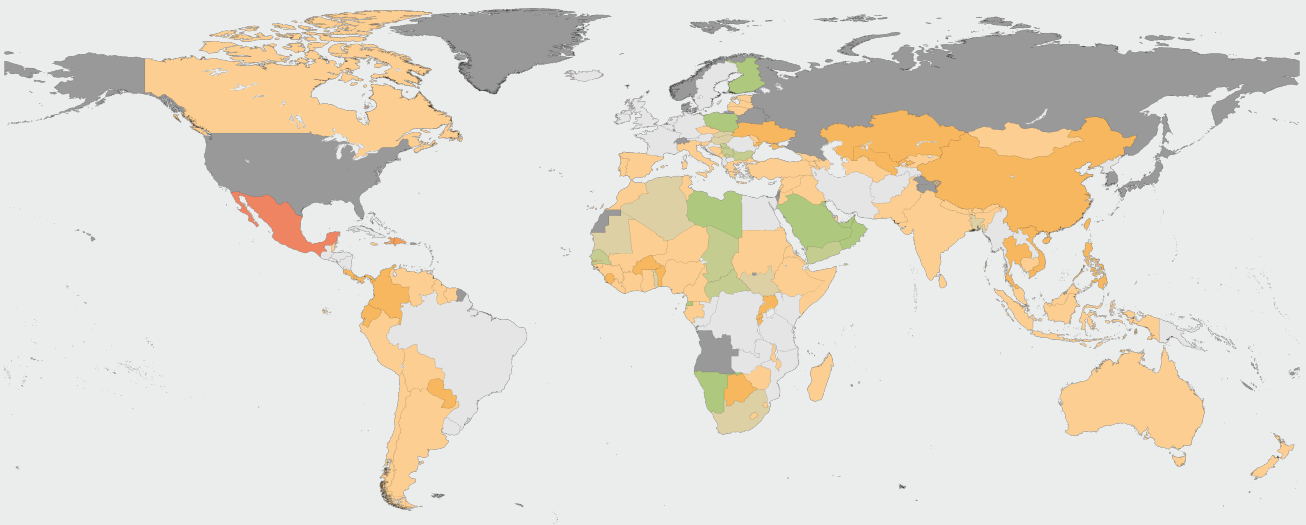
and land-use conversion. Forest loss and forest degradation are recognized as core components of land degradation through this framework, as they directly contribute to land degradation by altering land cover, reducing ecosystem productivity and diminishing terrestrial carbon stocks.

The global forest area in 2025 is estimated at 4.14 billion ha, representing 32 percent of the total land area. Deforestation and forest degradation remain major global challenges, and have negative impacts on biodiversity, climate stability and land productivity. Since 1990, an estimated 489 million ha of forest have been lost worldwide through deforestation.¹⁹ Primary forests, among the most biodiverse and ecologically valuable forest ecosystems, have been particularly affected, with their global area decreasing by 110 million ha between 1990 and 2025.¹⁹ This loss has contributed significantly to species decline, ecosystem fragmentation and the erosion of critical ecosystem services.

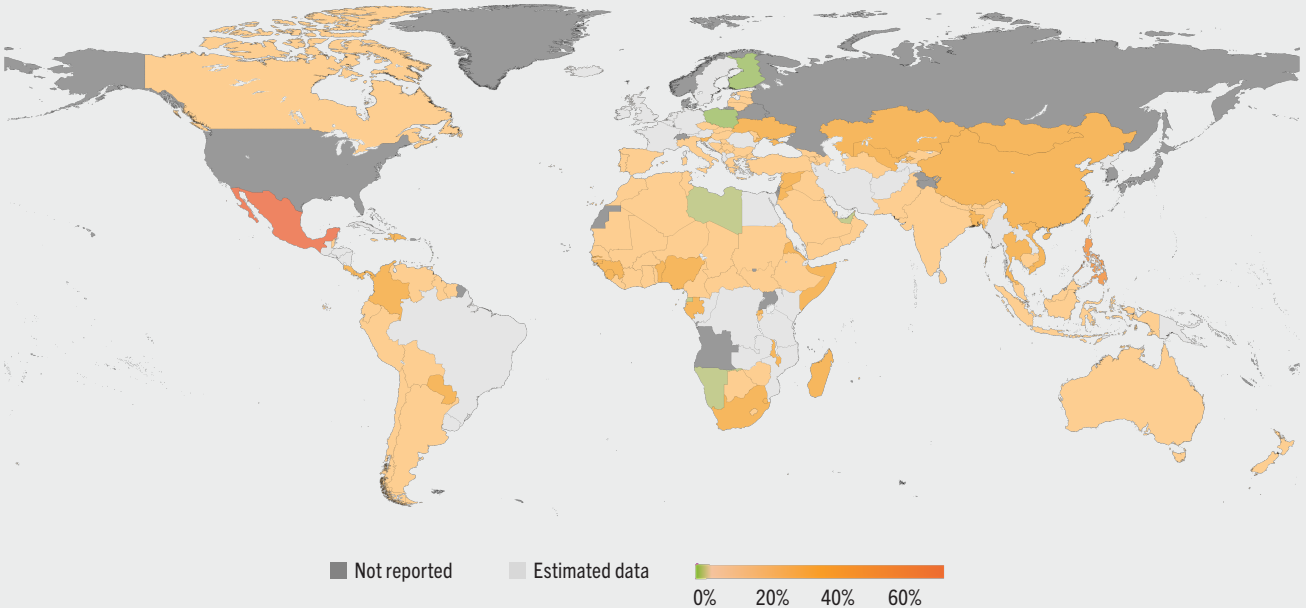
While global forest loss remains substantial, the overall rate of net forest loss declined significantly from 10.7 million ha per year in 1990–2000 to 3.68 million ha per year in 2000–2015 (Figure 1.2, Chapter 1), largely driven by forest area gains in countries such

FIGURE 2.2 PROPORTION OF DEGRADED LAND BY TOTAL LAND AREA, PERCENT

A) Proportion of degraded land over total land area – 2015

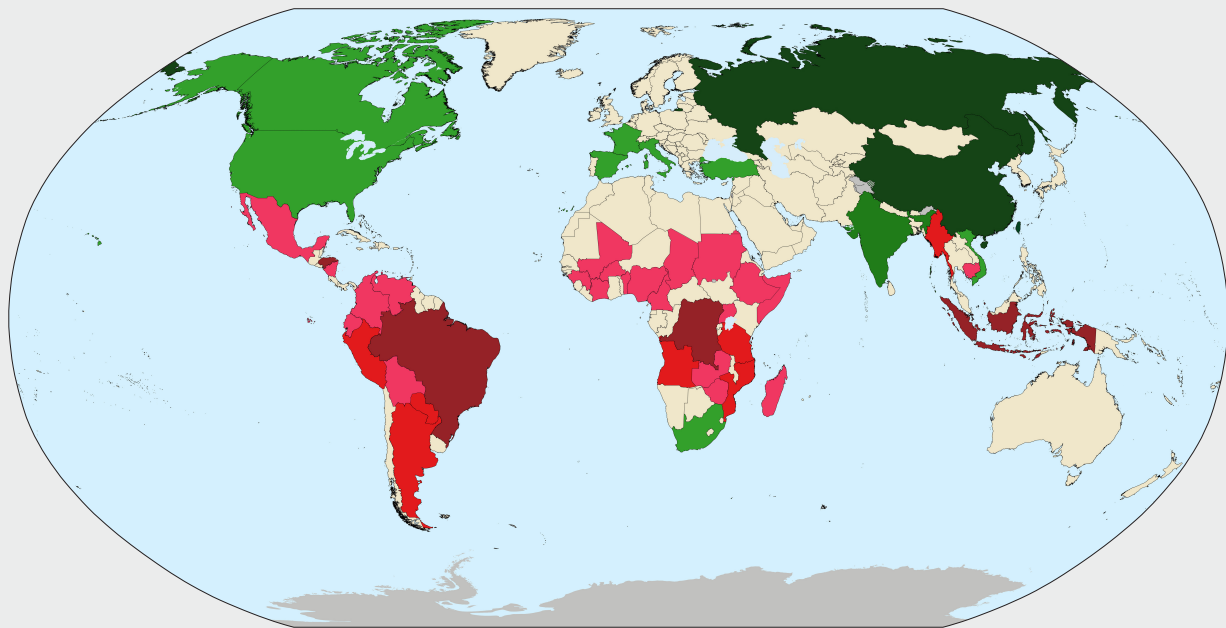


B) Proportion of degraded land over total land area – 2019



Refer to the disclaimer on the copyright page for the names and boundaries used in these maps. Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties. Final boundary between the Republic of Sudan and the Republic of South Sudan has not yet been determined. Final status of the Abyei area is not yet determined.

SOURCE: Adapted from UNCCD. 2019. *UNCCD Data Dashboard: Sustainable Development Goal (SDG) Indicator 15.3.1*. [Accessed on 27 March 2026]. <https://data.unccd.int/land-degradation?grouping=SDG>. CC BY-NC 2.0.

FIGURE 2.3 ANNUAL FOREST AREA NET CHANGE PER COUNTRY AND AREA, 1990–2025

1 000 ha/year

Net gain: ■ >501 ■ >251–500 ■ >51–250 Small changes: □ ±50 Net loss: ■ >501 ■ >251–500 ■ >51–250 ■ No data

Refer to the disclaimer on the copyright page for the names and boundaries used in this map. Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties. Final boundary between the Republic of Sudan and the Republic of South Sudan has not yet been determined. Final status of the Abyei area is not yet determined.

NOTE: Net forest area gains are shown in green and net losses in red.

SOURCE: FAO. 2025. Global Forest Resources Assessment. In: FAO. Rome. [Cited 5 January 2026]. <https://fra-data.fao.org/assessments/fra/2025/>

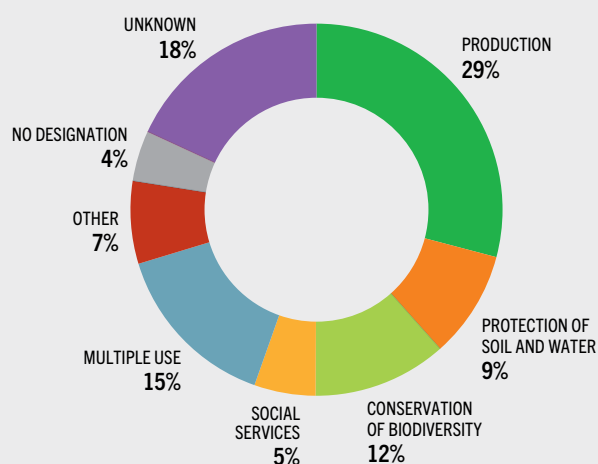
as Canada, China, the Russian Federation and the United States of America.¹ However, in 2015–2025, the annual net forest loss rose to 4.12 million ha (Figure 1.2, Chapter 1), primarily due to a reduced rate of forest gains (i.e. afforestation and natural forest expansion). For instance, China's net forest gain decreased from 2.22 million ha per year in 2000–2015 to 1.69 million ha per year in 2015–2025, Canada's from 513 000 ha to 82 500 ha per year and the United States of America shifted from a net

gain of 437 000 ha per year in 2000–2015 to a net forest loss of 120 000 ha per year in 2015–2025.

Between 1990 and 2025, net forest area increased in Asia and Europe, and to a lesser extent in North and Central America, while Africa and South America continued to experience net forest loss, albeit at a slower rate in 2015–2025 than in the previous decade (Figure 2.3). Despite these improvements, pressures on the world's most ecologically valuable forests persist. Naturally regenerating forests, accounting for approximately 92 percent of global forest area, declined by 324 million ha between 1990 and 2025, underscoring the continued vulnerability of forest ecosystems and the need for sustained efforts to halt degradation and support forest recovery.

¹ In the Global Forest Resources Assessment 2025, forest area net change is calculated as the difference between the area that is deforested in a given period and the area of forest expansion in that period. Additional information is needed to understand how much forest has been lost due to conversion to other land uses and how much has been gained due to forest restoration, natural expansion and afforestation.¹⁹

FIGURE 2.4 MANAGEMENT OBJECTIVES OF THE WORLD'S FORESTS



NOTE: Percentages might not tally to 100 due to rounding.

SOURCE: FAO. 2025. Global Forest Resources Assessment. In: FAO. Rome. [Cited 5 January 2026]. <https://fra-data.fao.org/assessments/fra/2025/>

The regional patterns shown in [Figure 2.3](#) can be further understood when combining this data with information on the drivers of deforestation. The FRA 2025 Remote Sensing Survey indicates that these drivers vary across regions.⁵⁹ For instance, cropland expansion is the dominant driver in Eastern, Western and Central Asia as well as across Africa, while extensive livestock systems are the main driver across South, Central and North America and the Caribbean as well as in Oceania. Cropland expansion together with oil palm development are the main pressures in Southern and South-east Asia. In Europe, forest conversion is associated with urban and infrastructure development. These regional differences provide insight into where land-use pressures cause deforestation to exceed gains from restoration actions as well as from afforestation or natural forest expansion. The trend of increasing deforestation, particularly in regions where cropland and livestock expansion are the main drivers, points to the need for forest-related investments and development interventions to be better aligned to tackle the drivers of forest loss, including through

wider action on agrifood systems, land-use governance, value chains and incentives for sustainable production.

These pressures are also linked to the continuing role of forests in meeting economic and social needs, including the growing demand for wood and non-wood forest products. Despite advances in sustainable forest and landscape management and certification, the growing global population and rising living standards continue to drive the growing demand for forest products. This underscores the urgent need to balance economic development with the conservation, sustainable production and restoration of forests and landscapes.

Forests serve multiple purposes and can be designated for a range of primary management objectives, from the production of wood and non-wood forest products to biodiversity conservation and the provision of social, cultural and environmental services. According to FRA 2025 data from 236 countries and areas, production is the most common primary management objective, applying to 29 percent of the world's forest area ([Figure 2.4](#)).

Production objectives apply not only to planted forests^m but also to naturally regenerating forests. This has important implications for restoration, as it highlights the need to account for production objectives when designing and implementing restoration efforts. This reflects the importance of production-designated forests in supplying wood and non-wood forest products to meet global demand. Other primary management objectives include multiple use, biodiversity conservation, soil and water protection, and the provision of social services.

The volume of wood extracted from forests serves as a key indicator of the economic and social importance of forests for national economies and the communities that depend on them. In most countries, income from harvested wood represents the primary source of forest-related revenue. Data on wood removals also supports the monitoring of forest and tree resource use, since actual extraction levels can be compared

^m Planted forests account for 8 percent of the world's forest area.¹⁹

with sustainable potential. In 2023, the most recent year for which data are available, global wood removals were estimated at 3.86 billion m³, roughly split between industrial roundwood and fuelwood (including removals from forests, other wooded lands and trees outside forests).⁶⁰ Regional differences in the share of wood harvest used as fuelwood are significant, ranging from 90 percent in Africa and 61 percent in Asia to 41 percent in South America and less than 25 percent in Europe, North America and Oceania.¹⁹ Overall, wood removals have been increasing globally as demand and consumption of wood products grow in line with population and income growth, a trend that is expected to continue in the coming decades.

Slowing forest gains, persistent net losses and rising demand for wood products, taken together, highlight the urgent need to scale up restoration efforts alongside protection and sustainable use. The next section explores how countries are defining the areas in need of restoration (section 2.2), and the chapter then turns to national restoration commitments (section 2.3), restoration progress made so far (section 2.4), how restoration is framed in national policies (section 2.5), and the challenges and opportunities in tracking restoration progress (section 2.6). ■

2.2 NATIONALLY IDENTIFIED AREAS IN NEED OF RESTORATION

2.2.1 Country-reported areas in need of restoration

Planning FLR requires identifying and prioritizing where restoration interventions are most needed and most feasible. For this edition of *The State of the World's Forests*, FAO conducted an additional qualitative analysis based on the restoration data and metadata from FRA 2025 country reports to provide a synthesis of how countries and areas identify forests in need of restoration.

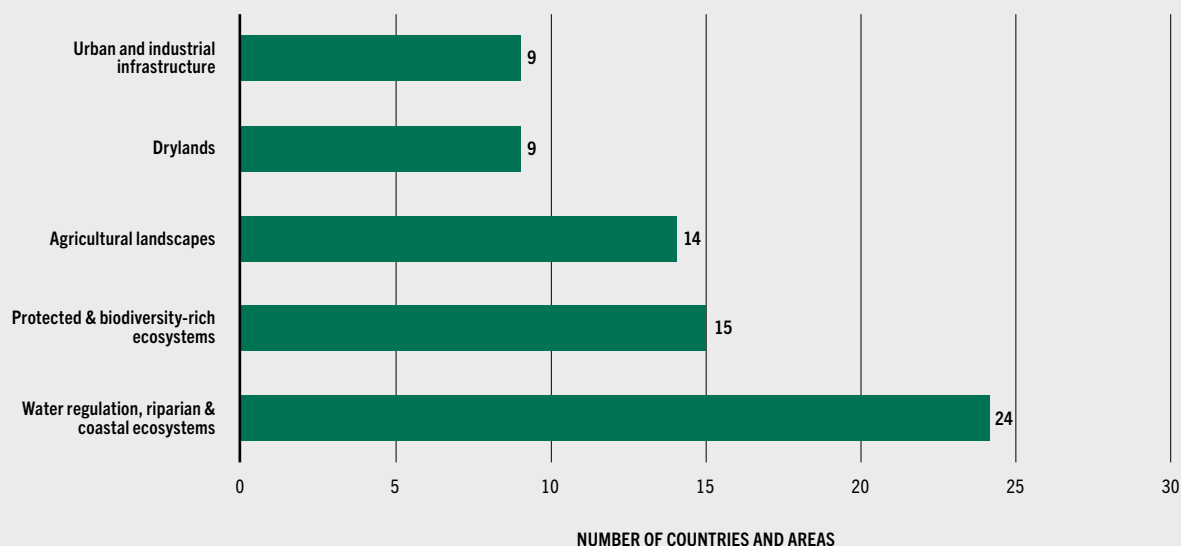
The additional analysis for the 2026 edition of this report found that 93 countries and areas had identified areas in need of restoration. Forest degradation was prevalent when identifying areas in need of restoration and is frequently characterized using a combination of condition-, disturbance- and process-based descriptions. Although terminology varies, countries converged around a set of recurring ways of describing degraded forest ecosystems. Countries defined areas in need of restoration based on the general forest condition, using terms such as degraded forest or degraded lands.

Countries that identified restoration needs based on disturbance events referred to causes such as fire, pest outbreaks and weather-related events. Terms such as fire-affected areas, burnt forests and forest areas affected by wildfires appeared repeatedly across regions. Furthermore, countries defined degraded forests in terms of loss of forest cover or structure. These structural changes were often associated with underlying management and land-use practices, including unsustainable harvesting, poor or failed silvicultural practices and land-use conversion, which contribute to reduced forest density, productivity and regeneration capacity. Several countries linked forest degradation to underlying processes, such as soil erosion, overgrazing and broader land degradation. In these cases, forests were described not only as degraded but as part of a wider landscape mosaic (areas affected by erosion, wetlands, mangroves, bare lands or croplands), highlighting the interconnected nature of degradation across ecosystems and land uses.

Adopting a wider landscape perspective is essential for FLR. The analysis of FRA 2025 country reports showed that countries identify a broad range of priority areas across ecosystems and land-uses, including riparian and coastal ecosystems, protected and biodiversity-rich ecosystems, agricultural landscapes, drylands, and urban and industrial environments (Figure 2.5).

Following forests, water-related ecosystems were the second most frequently mentioned areas in need of restoration (Figure 2.5), reflecting both their ecological importance and their cross-cutting role in linking ecosystems. These areas were commonly linked to water security, disaster risk

FIGURE 2.5 DISTRIBUTION OF AREAS IN NEED OF RESTORATION ACROSS NON-FOREST ECOSYSTEM TYPES CATEGORIZED INTO THEMATIC GROUPINGS



NOTES: Bars represent the total number of countries and areas identifying each thematic grouping. Values at the end of each bar indicate global totals. Countries and areas may be represented in multiple thematic groupings, and, therefore, totals are not mutually exclusive.

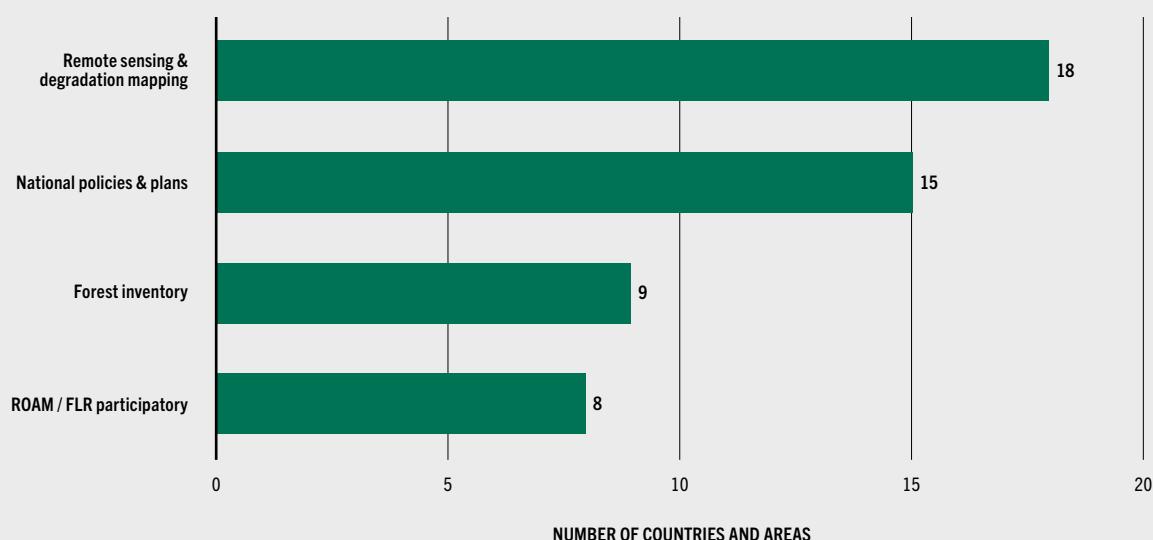
SOURCE: Based on an additional analysis of restoration data and metadata reported in the country reports in FAO. 2025. Global Forest Resources Assessment. In: FAO. Rome. [Cited 10 January 2026] <https://fra-data.fao.org/assessments/fra/2025/>

reduction and climate resilience. The restoration of protected and biodiversity-rich ecosystems was primarily framed within a conservation lens, focusing on ecological integrity, native species recovery and ecosystem functioning. Agricultural landscapes were presented in terms of restoration needs within production systems, particularly in regions where land degradation and livelihood pressures are closely linked and are often approached as integrated systems balancing ecosystem recovery and food production.

Drylands were discussed in the context of the restoration of arid and semi-arid systems affected by desertification, soil degradation and water scarcity, with strong linkages to water-related ecosystems and broader landscape processes. Urban and industrial landscapes were highlighted as areas in need of restoration in human-modified environments (e.g. urban green spaces or mining sites) where restoration was tied to environmental

quality and human well-being. Across all these groupings, the forest and landscape restoration priorities were interconnected and reflected the need for integrated, landscape-level approaches.

The FRA country reports are completed by national correspondents, who are predominantly situated within their government’s forest sector. As a result, the priorities reflected in them tend to mirror the mandates, perspectives and institutional responsibilities of forestry agencies. Other sectors and stakeholder groups, such as agriculture, water management, biodiversity conservation, urban planning, communities, researchers and Indigenous Peoples, may identify different or broader landscape priorities that are not systematically captured through the FRA reporting process. While FLR is well positioned to address forest-sector degradation, its landscape-based approach extends beyond forestry and is equally relevant to the wider thematic groupings identified in this analysis.

FIGURE 2.6 METHODS USED TO IDENTIFY AREAS IN NEED OF RESTORATION

NOTES: Bars represent the total number of countries and areas reporting each method. Values at the end of each bar indicate global totals. Countries may report multiple methods, therefore, totals are not mutually exclusive. FLR = forest and landscape restoration; ROAM = restoration opportunities assessment methodology.

SOURCE: Based on an additional analysis of the national reports in FAO. 2025. Global Forest Resources Assessment. In: FAO. Rome. [Cited 10 January 2026]. <https://fra-data.fao.org/assessments/fra/2025/>

2.2.2 Country-reported methods to identify areas in need of restoration

Analysis conducted by FAO based on restoration data and metadata from FRA 2025 country reports revealed that 43 countries and areas reported on the methods used to identify areas in need of restoration. These approaches are not mutually exclusive as countries often combine spatial analysis, field-based inventories, participatory assessments and planning instruments.

For analytical clarity, the reported approaches are grouped here into four broad categories: (1) remote sensing and degradation mapping; (2) forest inventory-based assessment; (3) the restoration opportunities assessment methodology (ROAM)ⁿ or other FLR-based

participatory assessments;^o and (4) the embedding of restoration priorities in national policies, strategies and plans (Figure 2.6). The fourth category differs from the first three in that it is not a stand-alone technical identification method, but a mechanism through which the priorities identified through one or more of the other approaches are formalized and implemented.

Remote sensing and degradation mapping was the most commonly reported approach. Some countries used remote sensing, Geospatial Information System (GIS) analysis and land-cover change mapping to locate degraded and deforested areas, including zones with low canopy cover, evidence of erosion or desertification, and climate-vulnerable landscapes. For example, in Ecuador and Mexico, these assessments were embedded within formal multicriteria GIS evaluation frameworks, linked to watershed units or legal zoning instruments.

ⁿ ROAM is a framework developed for countries to conduct forest and landscape restoration opportunity assessments and to identify specific priority areas at a national or subnational level.⁶¹

^o FLR-based participatory assessments are a mapping exercise where local communities, stakeholders and experts work together to evaluate and identify restoration needs, priorities and opportunities.

Forest inventory-based approaches were also widely used to identify areas in need of restoration through a systematic, field-based assessment of forest condition, structure and regeneration status. In the Russian Federation, restoration needs were determined through forest inventory classification of non-stocked or degraded forest lands. In Finland, habitat inventories within protected areas combine detailed field surveys with GIS databases to assess habitat representativeness and management needs. In the United States of America, national forest inventory data were used to estimate reforestation needs and identify potential restoration opportunities across federal, state, tribal and private lands. Saint Lucia identified restoration areas using a hybrid approach that combined remote sensing analysis, field-based assessments and local knowledge.

The ROAM or closely related FLR opportunity assessments were widely used in Africa and other regions to identify priority restoration areas. These processes combine biophysical spatial analysis, socioeconomic and governance considerations and structured stakeholder participation. This approach generates transparent and multidimensional prioritization, where restoration needs are evaluated not only by ecological degradation, but also by feasibility, local demand and potential benefits. Belize and Guatemala similarly applied ROAM frameworks to identify restoration areas within broader landscape planning initiatives.

Several countries went a step further by embedding restoration priorities identified through technical or participatory methods into national policies, strategies and plans, which are further described in section 2.5. Policy and planning frameworks can help translate technical or participatory identification processes into zoning, prioritization and implementation pathways. For example, China's national land-use planning operationalizes FLR at scale under the National Overall Planning for Protection and Restoration of Important Ecosystems (2021–2035) and subsequent regional plans. By delineating seven major ecological zones, each with tailored restoration objectives (from arid northern plains to humid southern hills), China matches restoration interventions to local environmental conditions and needs.

This strategic zoning – linked to the country's ecological “red lines” and conservation targets – helps plan the right restoration action in the right place.

Not all countries and areas that identified areas in need of restoration formally reported on restoration commitments. In the FRA 2025 report, 91 out of 236 countries and areas reported quantitative restoration pledges,¹⁹ but these did not fully align with countries and areas that reported areas in need of restoration. Some countries reported restoration commitments without having identified or assessed priority areas for restoration. Among the 91 countries and areas reporting commitments, 64 had identified areas in need of restoration. This provides an important context for interpreting the commitments discussed in the next section, including those reported through FRA and commitments under other global frameworks. ■

2.3 RESTORATION COMMITMENTS

Forest and landscape restoration commitments are reported through multiple global and regional frameworks, each capturing different dimensions of countries' ambitions and policy priorities. As described in **Chapter 1** (Figure 1.8), these global and regional frameworks form a coherent architecture that positions FLR as a unifying strategy for advancing sustainable forest management, enhancing biodiversity, strengthening landscape resilience and promoting inclusive rural development. Together, these frameworks capture FLR commitments across multiple levels, from global targets and regional initiatives to national planning and reporting instruments.

The frameworks provide complementary insights into the scale, geographic distribution and characteristics of restoration ambitions. Since these frameworks differ in ecosystem scope, definitions, reporting organizations and their respective mandates, their reported areas are not conceptually equivalent and cannot be directly compared or aggregated. This section provides an overview of restoration commitments reported

TABLE 2.2 OVERVIEW OF THE TOTAL RESTORATION COMMITMENTS UNDER DIFFERENT SOURCES, AGGREGATED ACROSS THE SIX GLOBAL FOREST RESOURCES ASSESSMENT REGIONS, AND NUMBER OF COUNTRIES THAT PROVIDED RESTORATION COMMITMENTS FOR EACH FRAMEWORK

Regions	Bonn Challenge and associated regional initiatives (only country pledges included)	Global Forest Resources Assessment 2025	National targets/ national biodiversity strategies and action plans (NBSAPs)	Land degradation neutrality (LDN)	Nationally determined contributions (NDCs)
Number of countries globally per reporting framework	75	91	30*	103	61
Restoration commitments (1 000 ha)					
Africa	129 989	92 497	3 930	296 758	63 065
Asia	33 568	73 476	1 440	240 454	71 710
Europe	3 855	3 536	17 648	25 176	445
North and Central America	51 184	6 835	21 471	5 606	30 398
Oceania	0	18	0	4 900	0
South America	32 200	14 114	17 200	41 223	125 819
Global	250 796	190 476	61 689	614 117	291 437

NOTE: * Although additional countries provided restoration commitments, only 30 provided an absolute number in their national targets and national biodiversity strategies and action plans: Armenia, Austria, Brazil, Burkina Faso, Canada, Colombia, Costa Rica, Denmark, Eswatini, France, Germany, Guyana, Hungary, Ireland, Jordan, Kyrgyzstan, Luxembourg, Malaysia, Mauritania, the Netherlands (Kingdom of), Panama, the Republic of Korea, the Republic of Moldova, Saint Vincent and the Grenadines, Singapore, South Africa, Spain, Tunisia, Uganda and the United Kingdom of Great Britain and Northern Ireland.

SOURCES: NBSAP values come from an analysis of data from CBD. 2026. Online Reporting Tool. [Accessed in February 2026]. <https://ort.cbd.int/>; and LDN and NDC values come from UNCCD. 2026. UNCCD Global Restoration Commitments Database. Bonn, Germany. [Accessed in February 2026]. <https://data.unccd.int/>

through the major global frameworks (Table 2.2) and highlights patterns that shape the global restoration agenda.

The comparative overview of restoration commitments across reporting frameworks and regions (Table 2.2) enables a structured assessment of how restoration ambition is articulated globally, while simultaneously revealing the constraints that limit the interpretation of progress.

FRA 2025 provides, for the first time, a global dataset on country-reported forest restoration commitments, enabling a better understanding of restoration ambition in the forestry sector. Similarly, restoration commitments are reported by countries in NBSAPs, national targets, NDCs, LDN targets and the Bonn Challenge; however, they broadly include forest and other landscape ecosystems, rather than forest ecosystems alone. Reported restoration commitments vary

substantially across frameworks, with the largest totals reported under LDN (614.1 million ha), followed by NDCs (291.4 million ha), Bonn Challenge-associated initiatives (250.8 million ha), FRA 2025 (190.5 million ha) and NBSAPs and national targets (62 million ha).^p These differences reflect systematic variations in ecosystem scope, data availability and reporting mandates, rather than simple differences in national ambition.

One hundred and fifty-three countries and areas responded in the FRA 2025 as having forest restoration commitments, although not all provided information on the quantitative estimates. Of these, 91 countries and areas, representing 69 percent of the global forest area, reported quantitative estimates of restoration

^p The restoration commitments reported in NBSAPs and national targets that were reported to the CBD were combined. In cases where countries reported commitments in both NBSAPs and national targets, the highest value was used.

TABLE 2.3 RESTORATION PLEDGES UNDER THE BONN CHALLENGE AND ASSOCIATED INITIATIVES (AFRICAN FOREST LANDSCAPE RESTORATION INITIATIVE AND INITIATIVE 20X20), AGGREGATED ACROSS THE SIX GLOBAL FOREST RESOURCES ASSESSMENT REGIONS

Region	Number of country pledges	Restoration pledges under the Bonn Challenge and regional initiatives (1 000 ha)	Share of total restoration commitments under the Bonn Challenge and regional initiatives (%)
Africa	35	129 989	52
Asia	13	33 568	13
Europe	7	3 855	2
North and Central America	12	51 184	20
Oceania	0	0	0
South America	8	32 200	13
Total Bonn Challenge and regional initiatives	75	250 796	100%

NOTES: Only countries that submitted pledges are included. To avoid double counting, each country's restoration pledge is attributed once. Table figures include only country submitted pledges (75 countries), excluding initiative level and subnational pledges. Of these, 60 country pledges were sourced directly from the Bonn Challenge website. Regional initiative data were also analysed, with African Forest Landscape Restoration Initiative (AFR100) and Initiative 20x20 being the only regional platforms providing country level figures on their websites. Where discrepancies were identified between Bonn Challenge and regional platform data for the same country (15 of the 75 countries: 9 under Initiative 20x20 and 6 under AFR100), figures from the regional platforms were used, as they provided more detailed information. The Gambia reported a pledge under the Bonn Challenge but not under AFR100.

SOURCES: AFR100. 2026. Countries. In: *AFR100*. [Cited 29 March 2026]. <https://afr100.org/countries>; Bonn Challenge. 2026. Current pledges. In: *Bonn Challenge*. [Cited 29 March 2026]. <https://www.bonnchallenge.org/pledges>; and Initiative 20x20. 2026. Countries. In: *Initiative 20x20*. [Cited 29 March 2026]. <https://initiative20x20.org>

commitments totalling over 190 million ha. The top five countries with the largest forest restoration commitments include China (42.6 million ha), India (26 million ha), Ethiopia (22 million ha), Cameroon (12 million ha) and Brazil (12 million ha).¹⁹ In general, Africa has the highest commitment to forest restoration (92 million ha), followed by Asia (73 million ha) and South America (14 million ha). Europe, which accounts for the world's largest forest area, has the lowest commitment (3 million ha) after Oceania. Forty-nine countries and areas reported forest restoration targets for 2030, in alignment with targets of the KMGBF and the UN Decade.

The Bonn Challenge sets a global goal of restoring 350 million ha of degraded and deforested landscapes by 2030, and has catalysed the emergence of regional initiatives that bring countries together to collaborate on FLR. The Bonn Challenge relies on landscape-scale approaches, which encompass mosaics of land uses and may involve other forest-related ecosystems, agricultural, pasture or other lands as part of landscape-scale restoration

commitments and efforts. Africa accounts for a substantial share of these pledges, largely through the African Forest Landscape Restoration Initiative (AFR100), which accounts for approximately 52 percent of current global country pledges, representing about 130 million ha pledged as of February 2026 (Table 2.3). Other Bonn Challenge-aligned regional initiatives include Initiative 20x20, aiming to protect and restore 50 million ha of degraded land in Latin America; ECCA30, which seeks to bring 30 million ha into restoration by 2030 across Europe, the Caucasus and Central Asia; the RESULT Asia-Pacific supporting the restoration and sustainable management of 100 million ha; and the Agadir Commitment in the Mediterranean with 8 million ha.

Together, these commitments contribute to the overarching ambition of the UN Decade, which seeks to accelerate global efforts to prevent, halt and reverse ecosystem degradation. However, while political momentum is strong, translating pledges into effective, large-scale restoration remains a major challenge, particularly in

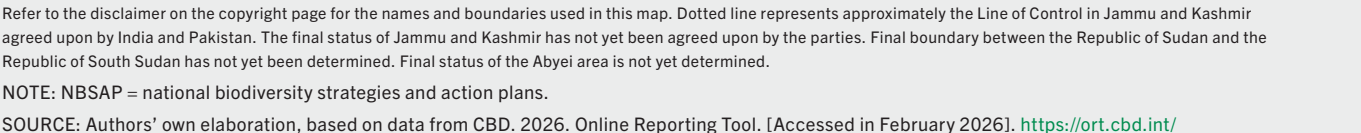
terms of implementation capacity, financing, governance coordination and monitoring of outcomes. In this context, the KMGBF provides a global policy framework to guide, align and monitor restoration efforts and sets a strong vision for ecosystem restoration through its Target 2: “Ensure that by 2030 at least 30 per cent of areas of degraded terrestrial, inland water, and coastal and marine ecosystems are under effective restoration, in order to enhance biodiversity and ecosystem functions and services, ecological integrity and connectivity.”^q

Key to moving beyond restoration commitments, the KMGBF includes indicators for monitoring Target 2, including its headline indicator 2.1, “area under restoration” which is further explored in section 2.4. This target addresses the pressing challenge of ecosystem degradation, which currently impacts between 20 percent and up to 40 percent of the world’s terrestrial surface⁶² and affects the livelihoods and well-being of over 3 billion people.¹⁷ To achieve LDN and move onto a nature-positive trajectory, taking into account trends in land degradation between 2015 and 2019 as reported by governments (Table 2.1), an estimated 1.5 billion ha would need to be restored by 2030. In support of this ambition, and considering global estimates of land degradation (more than 1.5 billion ha in 2019, Table 2.1), the KMGBF Target 2 requires the restoration of an estimated 469 million ha globally by the end of the decade. At the national level, the NBSAPs and national targets are key mechanisms for planning, monitoring, reporting and reviewing restoration in the context of global biodiversity policy and the KMGBF. As of 9 February 2026, 78 countries had submitted NBSAPs to the CBD Secretariat, and 147 countries had submitted national targets (Figure 2.7). Only 66 countries had submitted both NBSAPs and national targets, and several countries (81 in total) submitted only national targets without submitting NBSAPs. Eight countries submitted NBSAPs without national targets. The African region, followed by Europe, submitted the greatest number of national targets and NBSAPs.

A review of the 66 NBSAPs reports and the Target 2-related national targets for countries that submitted both shows a complex picture in ambition, baselines, units and timelines of restoration commitments. Approximately 101 quantitative commitments or targets (expressed in absolute values or percentages) from 50 NBSAPs were identified (see Appendix 1 for example). On the 421 Target 2-related national targets submitted by the 147 countries, only 21 national targets from 17 countries also provide quantitative commitments. Multiple commitments per NBSAP are common, and these have been classified to determine the type of ecosystem of interest. The timelines for the implementation of actions and measures are frequently missing. Thirty-two commitments or targets from 18 NBSAPs^r were expressed in absolute areas (e.g. hectares), representing 60 million ha to be restored. Of these, at least 41 million ha included FLR commitments, from 10 NBSAPs. The NBSAPs with the largest FLR-related commitment was from Canada, which has pledged to restore at least 19 million ha by 2030, and France, which has pledged to restore 15.7 million ha of permanent grassland by 2030. Few NBSAPs mention alignment with regional FLR initiatives, such as the AFR100 in Africa and Initiative 20x20 in Latin America. Brazil’s NBSAP highlighted synergies with other restoration commitments and agreements, such as the UNCCD, SDGs 6.6, 14.2, 15.1 and 15.3, Ramsar Resolution VII.17, the UN Decade, and the Bonn Challenge. Some NBSAPs also referred to ongoing and past initiatives to restore forest areas as part of FLR initiatives and their countries’ climate resilience strategies. Several NBSAPs provide global restoration targets linked to various ecosystems (i.e. “restoration of at least 30 percent of terrestrial, freshwater and marine ecosystems”), making it difficult to isolate forest-specific actions. Some NBSAPs include several examples of indicators to monitor forest restoration and to track restoration effectiveness, such as “the proportion of surface area covered by natural forest”.

^r NBSAP from Austria, Brazil, Burkina Faso, Canada, Colombia, Denmark, France, Hungary, Ireland, Jordan, Luxembourg, Malaysia, Mauritania, Republic of Korea, Republic of Moldova, Tunisia, Uganda and the United Kingdom of Great Britain and Northern Ireland.

^q See <https://www.cbd.int/gbf/targets/2>



These findings highlight the need for alignment and synergy between forest restoration commitments across global policy frameworks, including the harmonization of definitions,

| 32 |

capture FLR, whereas land degradation neutrality, nationally determined contributions and NBSAPs, generally aggregate restoration across forests, agricultural lands, grasslands and other ecosystems beyond forest landscapes. As a result, reported areas are not directly comparable across reporting frameworks, even when expressed in the same units. Therefore, it is not surprising that frameworks encompassing multiple land-use and ecosystem types report higher totals than forest-specific reporting mechanisms, a pattern also observed in global assessments of restoration commitments.⁶³ It is also worth noting that the aggregated value of the restoration commitments can vary depending on the number of countries that submitted pledges to the different frameworks.

Regional distributions further illustrate this dynamic. Africa and Asia account for the largest reported commitments across all frameworks, although there is variation in the number of countries reporting for each framework as well as the size of the commitments. South America's commitments on the other hand are substantially higher under NDCs than under forest-focused pledges.

These patterns indicate that restoration ambition is frequently expressed through landscape-scale or climate policy instruments, particularly in regions where restoration is closely linked to land degradation and climate change mitigation objectives. ■

2.4 RESTORATION PROGRESS

Assessing progress towards achieving restoration commitments remains a challenge due to data availability and differences in how restoration is defined, measured and reported across global reporting systems. While many frameworks capture ambitious restoration targets, commitments and pledged areas, fewer provide consistent and comparable data on actual implementation and progress on the ground. To provide an overview of restoration progress based on the best available evidence, this section synthesizes data from global systems that report on restoration progress.

Specifically, progress is assessed using: (i) data from FAO's FRA 2025 on forest restoration; (ii) restoration initiative-level data from the FERM; and (iii) information reported by countries to the CBD in their seventh national reports, particularly in relation to progress towards ecosystem restoration under the KMGBF Target 2 headline indicator 2.1 (area under restoration).

Drawing on multiple data sources provides a comparative perspective on global restoration progress while also revealing important limitations and inconsistencies in current reporting systems. Therefore, this synthesis offers both an assessment of reported restoration progress and evidence-based insights to inform future reporting, support improved coordination across frameworks, and guide the refinement of monitoring.

2.4.1 Achievements to date as reported in the Global Forest Resources Assessment 2025

Across 91 countries and areas, covering 69 percent of the global forest area (2.87 billion ha), governments have pledged over 190 million ha for forest restoration (Table 2.4).¹⁹ Of these, 55 countries and areas reported quantified forest restoration achievements linked to their pledges, while 36 countries and areas that cumulatively pledged over 69 million ha for forest restoration did not report progress that could be quantified.

In addition to countries reporting progress against pledges, 15 countries and areas reported quantified forest restoration progress without having reported restoration pledges. When these are included, a total of 70 countries and areas, which account for 42 percent of the global forest extent (about 1.75 billion ha), reported a total of almost 44 million ha under restoration, comparable to the area of Uzbekistan and equivalent to 23 percent of the 190 million ha pledged by the countries and areas reporting to the FRA 2025 (Table 2.4).

Implementation rates vary considerably by region, reflecting differences in forest restoration targets, timelines, the pace of implementation and data availability (Table 2.4). The areas reported are not directly comparable across countries, as national reporting may have

TABLE 2.4 OVERVIEW OF THE TOTAL RESTORATION COMMITMENTS AND TOTAL FOREST AREAS RESTORED (1 000 HA) AGGREGATED ACROSS THE SIX GLOBAL FOREST RESOURCES ASSESSMENT REGIONS

Region	Total area commitment (1 000 ha)	Total area under restoration (1 000 ha)	Restoration rate in relation to commitments (%)
Africa	92 497	7 910	9
Asia	73 476	31 015	42
Europe*	3 536	2 093	59
North and Central America	6 835	1 861	27
Oceania**	18	18	99
South America	14 114	1 086	8
Global***	190 476	43 983	23

NOTES: * The Russian Federation reported 1.7 million ha of implemented forest restoration between 2018 and 2021, which exceeded the original restoration target of 1.55 million ha by 2024. The Russian Federation also reported implementing forest restoration of more than 18 million ha between 1990 and 2020. The figures reported here include only forest restoration that took place after 2018. ** The results for Oceania reflect only figures reported by Fiji, New Caledonia and Samoa. *** Numbers shown in the table may not sum to the totals indicated due to rounding. Reported restoration progress and implementation rates are based only on countries and areas that submitted quantitative data to the Global Forest Resources Assessment 2025. These figures do not include several major forest countries that did not report progress data in the Global Forest Resources Assessment 2025 and, therefore, should not be interpreted as fully representative of global restoration implementation.

SOURCE: FAO. 2025. Global Forest Resources Assessment. In: FAO. Rome. [Cited 5 January 2026]. <https://fra-data.fao.org/assessments/fra/2025/>

<https://doi.org/10.4060/ce0633en-tab2.4> 

differences in definition, time frame, scope and other elements. The regional aggregated results should be interpreted with caution due to this heterogeneity. Forest restoration efforts and forest loss can occur within the same country. [Figure 2.3](#) reflects the net outcome of all forest losses and gains, whereas the FRA restoration data presented in [Table 2.4](#) captures only one dimension of this dynamic, areas within countries where restoration activities are implemented, without accounting for concurrent deforestation or degradation.

The figures illustrate different dimensions of forest dynamics: [Table 2.4](#) highlights the scale of restoration efforts underway, while [Figure 2.3](#) shows that these efforts are, in many countries, occurring alongside continued forest loss. Despite these caveats, examining the reported areas under restoration at the regional level helps to assess how forest restoration progress reported to FRA 2025 is distributed geographically ([Table 2.4](#)). Asia reports the largest area under restoration, with approximately 31 million ha, followed by Africa (7.9 million ha). Europe reports just over 2 million ha under restoration, followed by North and Central America (1.8 million ha), while South America reports approximately 1.1 million ha. Oceania

reports a comparatively small area in absolute terms (18 000 ha). These regional figures reflect the aggregated areas reported by countries to FRA 2025 and provide an overview of where forest restoration activities are currently being implemented.

Five countries – India, China, Ethiopia, Indonesia and Türkiye – together account for approximately 70 percent of the total area reported as under restoration in FRA 2025. India reports the largest area, with 9.8 million ha under restoration, followed by China (7.9 million ha), Ethiopia (5 million ha), Indonesia (4.7 million ha) and Türkiye (3.4 million ha).

At the same time, several countries with large forest areas did not report quantified forest restoration progress to FRA 2025. These include Australia, Brazil, Canada, the Democratic Republic of the Congo and the United States of America, which together account for around 35 percent of global forest area, including some of the world's most extensive and biodiverse forest ecosystems. This underscores remaining gaps in reported restoration progress among highly forested countries.

TABLE 2.5 TOP FIVE COUNTRIES REPORTING THE HIGHEST FOREST RESTORATION PROGRESS RELATIVE TO NATIONAL FOREST AREA

Country	Forest area (1 000 ha)	Under restoration (1 000 ha)	% relative to forest area
Syrian Arab Republic	528	227	43
Pakistan	3 192	716	22
Ethiopia	26 747	5 000	19
Azerbaijan	1 214	217	18
Madagascar	9 922	1 510	15

SOURCE: FAO. 2025. Global Forest Resources Assessment. In: FAO. Rome. [Cited 5 January 2026]. <https://fra-data.fao.org/assessments/fra/2025/>

<https://doi.org/10.4060/ce0633en-tab2.5> 

These reporting gaps introduce a source of uncertainty in the interpretation of global restoration progress. In particular, the estimate of approximately 44 million ha under restoration against 190 million ha pledged reflects only reported data and does not cover some countries accounting for a substantial share of global forest area.

As a result, the apparent gap between commitments and implementation may be partly explained by incomplete reporting, in addition to actual differences in the pace of restoration. This highlights the need to interpret global implementation rates with caution, especially considering the limited data coverage from some of the world's largest forest nations.

While reported restoration areas are concentrated in a small number of countries, examining restoration progress relative to national forest area provides additional insight into the scale of restoration efforts. FRA 2025 data show that the leading countries in terms of relative forest restoration progress are not necessarily those with the largest forest areas.

The Syrian Arab Republic reports the highest proportion, with 43 percent of its forest area under restoration, followed by Pakistan (22 percent), Ethiopia (19 percent), Azerbaijan (18 percent) and Madagascar (15 percent) (Table 2.5). These results highlight that strong restoration engagement is not limited to countries with large forest areas, but also includes countries where restoration represents a significant share of the national forest estate.

The FRA 2025 was the first time countries reported on forest restoration commitments and progress. Gaps and challenges persist in data collection and reporting and are expected to improve as the restoration movement gains momentum and monitoring and reporting systems are harmonized.

2.4.2 Achievements to date under the Framework for Ecosystem Restoration Monitoring of the United Nations Decade on Ecosystem Restoration 2021–2030

The UN Decade, proclaimed by the UN General Assembly and led by FAO and the United Nations Environment Programme (UNEP), provides a global framework for preventing, halting and reversing ecosystem degradation. It supports progress towards major international commitments, including the Sustainable Development Goals, the KMGBF, the Paris Agreement, LDN targets and the Bonn Challenge.

Implementation of the UN Decade is supported by five taskforces, with FAO leading the UN Decade Task Force on Best Practices and the Task Force on Monitoring. The Task Force on Monitoring, established in 2020, brings together over 600 experts from 150 organizations (as of March 2026) to collaboratively develop a framework for operational monitoring and reporting on the progress and achievements of restoration initiatives. This framework covers both biophysical and socioeconomic dimensions, including indicators, tools, reporting lines and databases, throughout the UN Decade.⁶⁴ This

BOX 2.1 THE FRAMEWORK FOR ECOSYSTEM RESTORATION MONITORING

Launched in 2022, the Framework for Ecosystem Restoration Monitoring (FERM)^s is a free, voluntary global monitoring and reporting platform developed by the United Nations Decade on Ecosystem Restoration (2021–2030) (the UN Decade) Task Force on Monitoring. It supports stakeholders in tracking, documenting and reporting on restoration efforts under the UN Decade and assists countries in reporting progress on ecosystem restoration under Target 2 of the Kunming–Montreal Global Biodiversity Framework

(KMGBF). The FERM is directly linked to the Convention on Biological Diversity's (CBD) Online Reporting Tool, allowing reviewed data to be transferred and prepopulated in the tool to facilitate country reporting. Aligned with the elements of Target 2, FERM ensures consistent and comparable monitoring worldwide and provides scalable, transparent and harmonized tools for monitoring, reporting, data sharing and showcasing restoration initiatives and good practices across all ecosystems through a user-friendly interface.

NOTE: ^sSee <https://openknowledge.fao.org/server/api/core/bitstreams/77ff5ed3-f111-4c23-8da9-cca7c964db0f/content>

work is operationalized through the FERM (Box 2.1), which, among other functions, compiles restoration data, disseminates good practices and supports countries in reporting areas under restoration.

The FERM compiles initiative-level restoration data, along with associated good practices, documented through its registry. This includes initiatives recognized under the World Restoration Flagships of the UN Decade, regional initiatives (e.g. RESULT Asia-Pacific), project and programme data from the Global Environment Facility (GEF), and other restoration projects. Before publication, data undergo quality checks that focus on completeness and correct formatting, to ensure that the information provided is coherent and does not contain contradictory or illogical values.

Reported outcomes remain self-declared, and each submission is reviewed by the administrator of the institution responsible for the initiative who checks that the information meets the FERM's data entry requirements before approving publication. Once approved, the data are published and made publicly accessible via the FERM search engine, enabling transparent exploration of restoration efforts across ecosystems and regions.

In addition to its registry-based submissions, the FERM integrates data through interoperability^s with external restoration platforms and databases. For initiatives, this includes Nature Commitments, the Restoration Resource Center of the Society for Ecological Restoration (SER), the Brazilian Restoration Observatory, the Kelp Forest Alliance, Acción Andina and the Convention on Wetlands (Ramsar). Implementation of the interoperability framework with FERM is in progress with multiple other platforms, including Restoration Barometer, AFR100, the Great Green Wall Initiative, Restor, trends.earth and others. For good practices, the FERM collaborates with the World Overview of Conservation Approaches and Technologies (WOCAT), Panorama Solutions, GoProFor and the Forest Knowledge Gateway.

The database covers restoration efforts across all ecosystems and, as of April 2026, provides access to 1 016 initiatives and 2 279 good restoration practices (1 868 in English, 319 in French, and 92 in Spanish) contributed by multiple collaborating platforms and accessible through the FERM search tool for initiatives^t and good practices^u (Figure 2.8).

^s FERM's interoperability is based on harmonized metadata fields and structured data-exchange formats, agreed with each partner platform to enable the import of selected information. See <https://www.fao.org/ecosystem-restoration-monitoring/about/gbf-target-2/default-data-for-restoration/en>

^t See <https://ferm.fao.org/search/initiatives>

^u See <https://ferm.fao.org/search/good-practices>

FIGURE 2.8 MAIN PAGE OF THE FRAMEWORK FOR ECOSYSTEM RESTORATION MONITORING SEARCH TOOL FOR INITIATIVES, SHOWING THE INTERACTIVE GLOBAL MAP AND FILTERING OPTIONS USED TO EXPLORE ECOSYSTEM RESTORATION INITIATIVES BY ECOSYSTEM, REGION, SOURCE, COLLECTION, RESTORATION TYPE AND STATUS, AND COUNTRIES

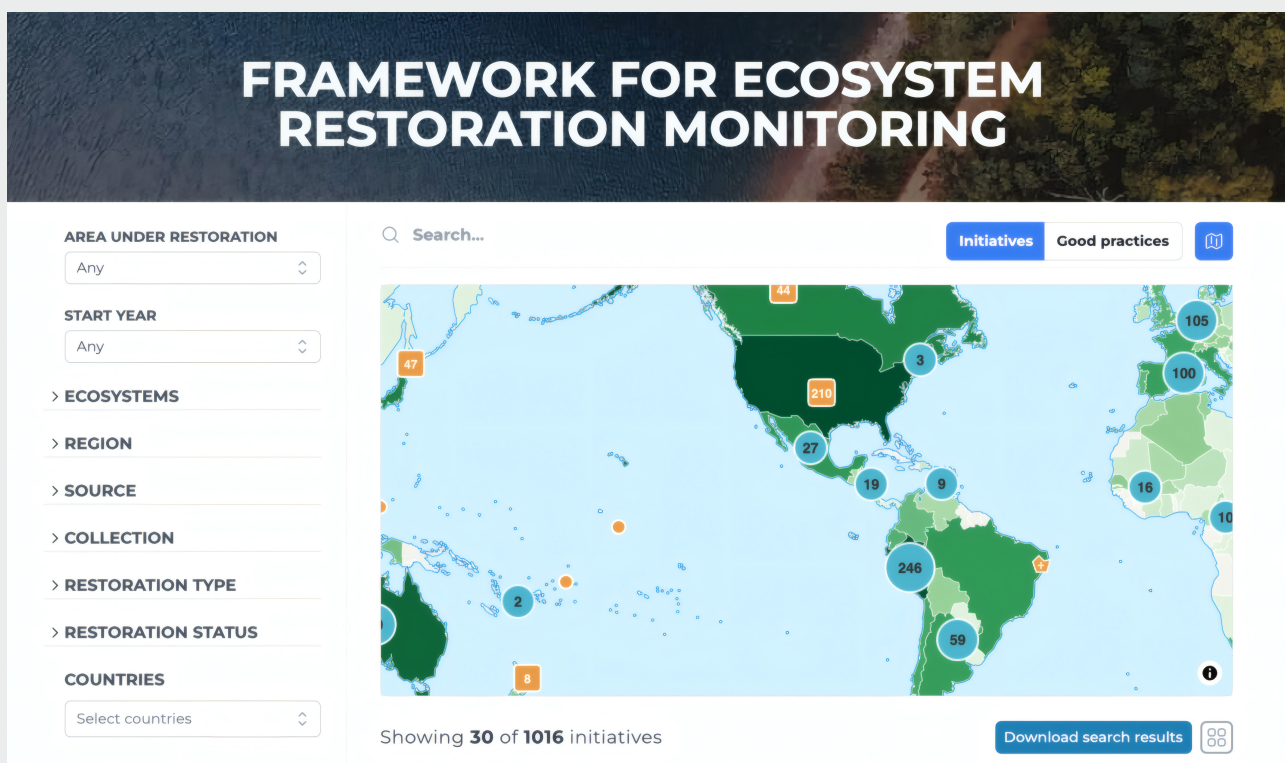


Photo: © FERM FAO

Refer to the disclaimer on the copyright page for the names and boundaries used in this map.

SOURCE: FERM. 2026. FAO FERM Search Tool for initiatives. In: FAO. Rome. [Cited 3 September 2026]. <https://ferm.fao.org/search/initiatives>

Forest ecosystems represent a significant share of restoration initiatives in the FERM public database. As of April 2026, 266 forest-related initiatives are recorded across all sources, meaning that these initiatives identified forests as one of the ecosystems being restored. This accounts for approximately 35 percent of all documented initiatives. In addition, 875 forest good practices (744 in English, 109 in French and 22 in Spanish) are available, representing 38 percent of all good practices in the database. These figures highlight the central role of forest restoration within the UN Decade and the strong representation of forest-related efforts in monitoring and reporting.

Sharing transparent information about where restoration efforts take place is essential for strengthening credibility, improving consistency and supporting coherent progress reporting. Sharing geospatial information allows for potential overlapping restoration efforts to be identified, for aggregating data, conducting spatial analyses and validating the reported progress. The FERM Registry aims to improve the consistency and transparency of restoration data by enabling contributors to share clear, well documented geospatial information that delineates where restoration takes place and what actions are implemented on the ground. In this context, the restoration initiatives shared through the FERM Registry, as of April 2026,

TABLE 2.6 OVERVIEW OF THE FOREST AND LANDSCAPE AREAS UNDER RESTORATION REPORTED IN THE FRAMEWORK FOR ECOSYSTEM RESTORATION MONITORING AND AGGREGATED ACROSS THE SIX GLOBAL FOREST RESOURCES ASSESSMENT REGIONS

Regions	Total forest and landscape area under restoration reported in Framework for Ecosystem Restoration Monitoring (FERM) (1 000 ha)
Africa	5 721
Asia	14 581
Europe	251
North and Central America	432
Oceania	13
South America	2 885
Global	23 883

SOURCE: FERM. 2026. FERM Registry. In: FAO. Rome. [Cited 29 April 2026]. <https://ferm.fao.org/>

were analysed to identify FLR initiatives. The analysis included all initiatives that identified forest ecosystems within their scope, as well as those explicitly described as related to FLR, while excluding initiatives focused exclusively on oceans and coasts and freshwater ecosystems. In total, FLR initiatives shared through the FERM cover about 24 million ha across 111 initiatives. Approximately 72 percent of this area is supported by spatially explicit information, which allows for the assessment of potential duplication, thereby strengthening the robustness of aggregated restoration estimates and enabling transparent reporting and effective monitoring of restoration areas. The reported FLR area is distributed across regions, with 14.6 million ha in Asia, followed by 5.7 million ha in Africa and 2.9 million ha in South America. Smaller reported areas are observed in North and Central America (0.4 million ha), Europe (0.3 million ha), and Oceania (less than 0.1 million ha) (Table 2.6).

Beyond reported areas under restoration, FERM also provides insights into additional characteristics of restoration initiatives aligned with Target 2 metadata.^v An analysis of the 111 FLR initiatives documented within the FERM provides disaggregated information on implementation status, restoration approaches and tenure arrangements. Most FLR initiatives documented in FERM are in progress (82 entries),

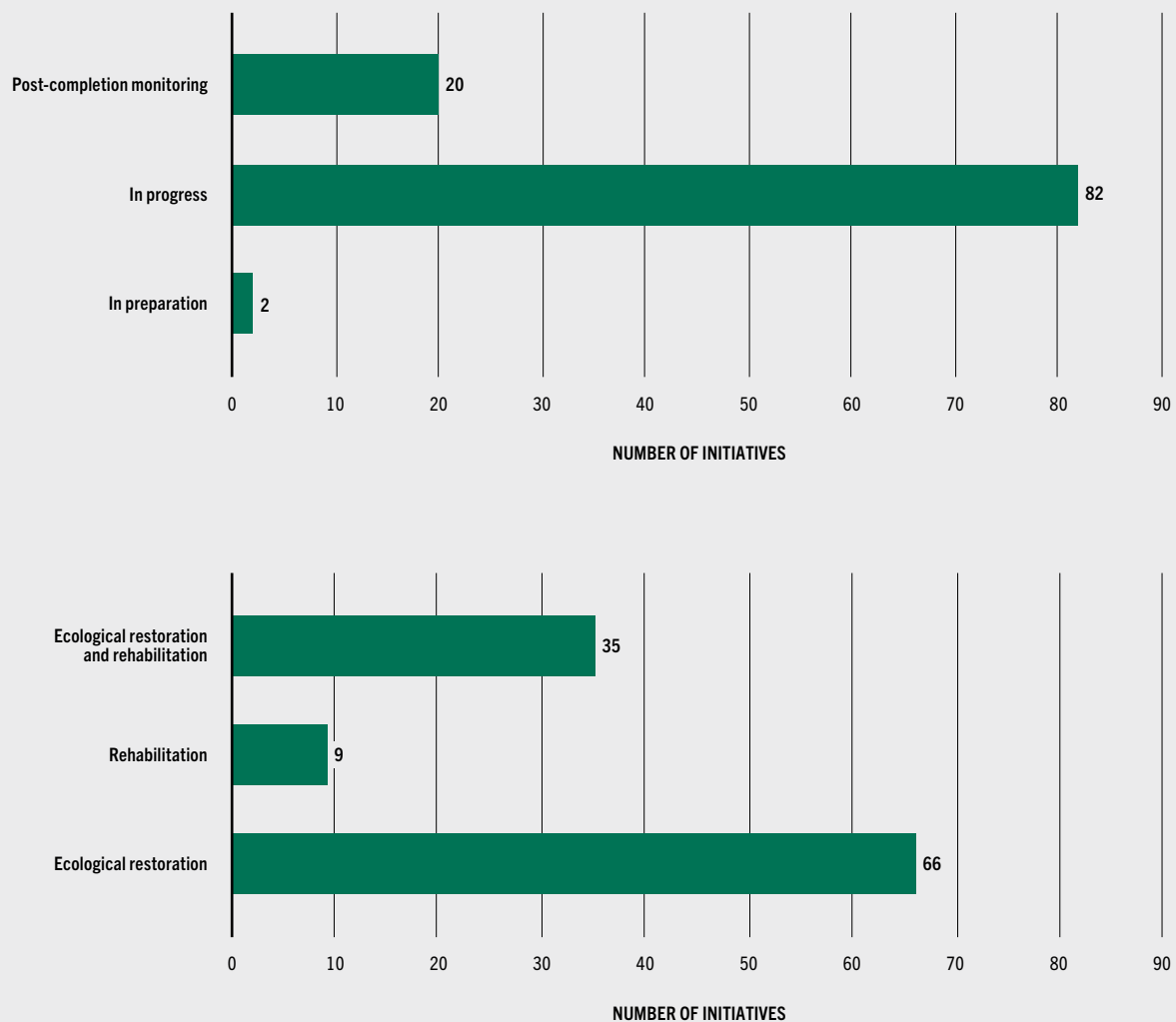
indicating that restoration activities have started at project sites and, depending on the duration of implementation and ecosystem considerations, impacts may begin to be measurable (Figure 2.9). While initiatives cover a wide range of sizes, the majority are large-area efforts with 39 percent of the 82 initiatives exceeding 10 000 ha (32/82) and 18 percent exceeding 100 000 ha (15/82), and around 10 percent already operating at the 1 million ha scale (8/82).^w Duration data further support this interpretation; among the in-progress initiatives with reported start years (79/82), approximately 27 percent have been under implementation for at least 10 years, and around 10 percent have been ongoing for more than two decades. This reinforces that large-scale restoration is an ongoing, long-term process. In addition, a considerable proportion of initiatives began during the period aligned with the UN Decade: 57 percent began in 2020 or later and 53 percent in 2021 or thereafter, indicating a notable expansion of restoration efforts concurrent with the launch of the UN Decade.

The presence of initiatives under post-completion monitoring highlights an emerging, though still limited, emphasis on tracking long-term outcomes following the implementation of restoration interventions. The distribution of restoration types reported to the FERM reveals a strong and consistent emphasis on ecological

^v See <https://www.gbif-indicators.org/metadata/headline/2-2>

^w Larger size categories include all initiatives in the smaller categories; as a result, the percentages overlap and do not sum to 100 percent.

FIGURE 2.9 DISTRIBUTION OF FOREST AND LANDSCAPE RESTORATION INITIATIVES DOCUMENTED IN THE FRAMEWORK FOR ECOSYSTEM RESTORATION MONITORING BY RESTORATION STATUS AND RESTORATION TYPE



SOURCE: FERM. 2026. FERM Registry. In: FAO. Rome. [Cited 29 April 2026]. <https://ferm.fao.org/>

restoration (Figure 2.9). Of the 110 initiatives that provided information on restoration type, 66 are classified as ecological restoration and an additional 35 combine ecological restoration with rehabilitation, meaning that over 92 percent of all initiatives include an ecological restoration component. Only nine initiatives are reported as rehabilitation alone. This indicates that most FLR initiatives documented in the FERM prioritize restoring ecological integrity and biodiversity,

while many also integrate rehabilitation objectives to enhance ecosystem functions and services, largely in productive ecosystems. Additionally, FLR initiatives captured in the FERM predominantly involve government land (57 percent of the total 111 documented FLR initiatives), frequently in combination with private, communal or jointly owned land. While initiatives including Indigenous Peoples

and traditional territories^x are present, they remain less represented (around 14 percent of all initiatives), highlighting an area for further engagement and documentation.

Overall, FERM data indicate that most documented FLR initiatives are ongoing and are primarily a combination of ecological restoration and rehabilitation and are implemented across mixed tenure systems, which highlights the importance of sustained monitoring frameworks to track long-term restoration outcomes across diverse governance contexts.

The FERM supports monitoring beyond area-based indicators, enabling users to report on customizable socioeconomic and environmental outcomes, including the number of beneficiaries, carbon sequestration, and biodiversity-related indicators.⁶⁵ While some socioeconomic data, particularly from UN Decade World Restoration Flagships, are available (see [Box 2.2](#)), reporting to date remains predominantly focused on area-based indicators. Strengthening the systematic reporting of socioeconomic and ecological outcomes remains a key opportunity for improving the evidence base on restoration impacts.

2.4.3 Achievements to date as reported in Kunming–Montreal Global Biodiversity Framework Target 2

Target 2 of the KMGBF calls on countries to ensure that at least 30 percent of degraded ecosystems are under restoration by 2030, with the aim of improving biodiversity, ecosystem functions and services, and ecological integrity and connectivity. Progress across the KMGBF targets is reported by countries to the CBD through their seventh national reports.

Under decision 15/6 of the Conference of the Parties,^y the deadline for submission of the seventh national reports was 28 February 2026. To support countries in finalizing and submitting their reports, a short extension was provided, allowing additional submissions to be integrated into the reporting system. By 18 March 2026,

a total of 125 countries had submitted their seventh national reports,^z forming the basis for this analysis of national reporting on Target 2 headline indicator “areas under restoration”.

While Target 2 includes all ecosystems, this analysis focused on forests and landscapes, which was interpreted broadly as terrestrial ecosystems, in line with the scope of this edition of *The State of the World's Forests*. Data on marine and coastal ecosystems are, therefore, excluded where countries provided ecosystem-level disaggregation. However, there is a high probability that restoration of coastal ecosystems covers the mangrove forest, and, potentially, the area of forests under the restoration is higher. Reporting comments were also reviewed for ecosystem disaggregation or additional information on the reported area, and country reporting focal points were contacted if clarification was needed on the Target 2 reported estimates.

Of the 125 countries that had submitted their seventh national reports, 62 countries (i.e. 49.6 percent) reported data for Target 2 headline indicator “areas under restoration”, totaling 206.5 million ha under restoration. In contrast, 63 countries (i.e. 50 percent) did not report data for Target 2, highlighting a substantial reporting gap. However, several of these countries mentioned that the data compilation process at the national level is ongoing.

Data reported on areas under restoration had varying levels of clarity, from clear explanations on how to aggregate information for the report to others that required additional clarification to correctly interpret the national figures. For example, some countries provided yearly estimates of the area under restoration at the national level without specifying the total restoration area, or whether the yearly values are cumulative. Following email-based exchanges with national reporting focal points for clarification as needed, 189.1 million ha under restoration were clearly reported by 48 countries. For 15 countries, however, the clarification process did not resolve outstanding inconsistencies. For these cases, either the most

^x See <https://iifb-indigenous.org/iifb-guidelines-on-indigenous-and-traditional-territories-itts/>

^y See <https://www.cbd.int/doc/decisions/cop-15/cop-15-dec-06-en.pdf>

^z See <https://www.cbd.int/article/2026-NationalReports>

BOX 2.2 DATA ON FOREST AND LANDSCAPE RESTORATION FROM THE WORLD RESTORATION FLAGSHIPS OF THE UNITED NATIONS DECADE ON ECOSYSTEM RESTORATION 2021–2030

To help translate commitments into action, the United Nations Decade on Ecosystem Restoration 2021–2030 (UN Decade) launched a call for countries to nominate World Restoration Flagships, which are outstanding examples of large-scale and long-term ecosystem restoration efforts that embody the UN Decade's principles and can inspire broader action. These flagship initiatives demonstrate effective restoration in practice and serve as models for addressing the challenges of climate change, biodiversity loss and ecosystem degradation. Since 2022, three calls have resulted in the recognition

of 27 flagships worldwide,* 25 of which fall within the scope of forest and other terrestrial ecosystem restoration. Together, these initiatives have committed to restoring 68.9 million ha and are currently restoring 17.6 million ha (see the Table). In addition, these FLR related restoration initiatives have generated approximately 642 000 jobs. These data illustrate how ecosystem restoration, when implemented at scale, can deliver integrated environmental and social benefits while contributing to global targets on biodiversity, climate change mitigation and adaptation, and sustainable development.

NOTE: *See <https://storymaps.arcgis.com/stories/eb16ef69a97443598be32016c432262d>

TABLE SUMMARY OF REPORTED OUTCOMES ACROSS 25 FOREST AND LANDSCAPE RESTORATION FLAGSHIPS, 2025

Indicators	Value
Area committed to restoration (million ha)	68.9
Total area under restoration (million ha)	17.6
Species population**	843 844
Species richness	6 875
Number of jobs created	641 534
Number of jobs expected by 2030	4 889 281
Number of people trained	1 229 554
Carbon sequestration (Mt CO ₂ eq)	1 355
Carbon sequestration target 2030 (Mt CO ₂ eq)	1 004

NOTES: MtCO₂eq = million tonnes carbon dioxide-equivalent. Not all flagships have reported outcomes across all indicators. As a result, some targets may appear to have been achieved apparent inconsistencies between spatial extent and reported progress, for example, may arise. These differences may reflect gaps in reporting rather than actual performance. **Number of individual organisms monitored or supported by the flagship initiatives.

SOURCE: FERM. 2026. FERM Registry. In: FAO. [Cited 30 March 2026]. <https://ferm.fao.org/>

recent reported figure or aggregated values across reporting years, activities or projects were used as estimates of national areas under restoration. This approach was applied to data from 14 countries, representing 16.2 million ha under restoration. Data from one country was excluded from the analysis due to inconsistent units reported (i.e. “number” without additional information).

In general, 44 of the 62 countries provided some form of disaggregation, either by ecosystem types (44 countries), type of restoration activity (11), protected areas (7), other effective area-based conservation measures (1), or Indigenous and traditional territories (2). Differences in reporting reflect variations in national data availability, monitoring capacity and reporting approaches. Countries that provided clear disaggregation by ecosystem estimates of areas under restoration

TABLE 2.7 AN OVERVIEW OF THE FOREST AND LANDSCAPE AREAS UNDER RESTORATION REPORTED IN THE SEVENTH NATIONAL REPORT TO THE CONVENTION ON BIOLOGICAL DIVERSITY AND AGGREGATED ACROSS SIX GLOBAL FOREST RESOURCES ASSESSMENT REGIONS

Region	Total forest and landscape area under restoration reported in the seventh national report (1 000 ha)
Africa	23 404
Asia	170 161
Europe	1 104
North and Central America	3 685
Oceania	2 948
South America	5 221
Global	206 523

SOURCE: CBD. 2026. Online Reporting Tool. [Accessed on 18 March 2026]. <https://ort.cbd.int/>

in marine and coastal ecosystems were excluded from the analysis. In cases where ecosystem type information was not explicitly provided or mentioned by countries in reporting comments or footnotes, other disaggregation categories were used to categorize the reported areas into broad ecosystems.

For example, disaggregation by activity included restoration of vegetation cover, forestry, agroforestry, natural regeneration, mangrove restoration, planted forests and woodlots, silviculture, land area under sustainable management, reforestation, plantation and sustainable land management, afforestation, area of restored pastures, and planted forest crops, among others.

This supported the inclusion of these data as related to FLR for the purpose of the analysis. At least 206.5 million ha of forest and landscape areas from 62 countries have been reported to CBD as of 18 March 2026 as under restoration (Table 2.7).

Asia, with approximately 170.2 million ha, accounts for the largest reported area, followed by Africa (23.4 million ha) and South America (5.2 million ha). North and Central America accounts for 3.7 million ha, Oceania for 2.9 million ha and Europe for 1.1 million ha.

While around 77 percent of the countries (n=48) reported a total area under restoration of less

than 1 million ha, the top five countries, such as China, India, the Sudan, Mongolia and Indonesia (mainly from Asia), reported the higher forest and landscape areas under restoration, i.e. respectively 127.4 million ha, 18.9 million, 12.6 million ha, 12.3 million and 7.5 million ha.

Figure 2.10 frames the reported restoration progress for terrestrial ecosystems within the broader global context of land degradation and the ambition of KMGBF Target 2 to restore 30 percent of degraded lands by 2030, along with 30 percent of degraded inland water and 30 percent of degraded coastal and marine ecosystems. This highlights both reporting progress and the remaining scale of restoration needed to achieve the global target. At the global level, achieving Target 2 would require bringing approximately an additional 65.6 million ha of terrestrial ecosystems to be under restoration each year from 2027 onwards, totaling 262.5 million ha of terrestrial ecosystems that need to be under restoration by the end of the decade.

The distribution of forest area, degraded land, and areas under restoration from the countries who submitted their Target 2 data to the CBD as part of the seventh national report (Table 2.8) highlights substantial differences between the level of land degradation and reported restoration efforts. In Asia, degraded land estimates of approximately 386 million ha are closely similar to the forest area (around 385 million ha), reflecting the extensive scale of land degradation

FIGURE 2.10 REPORTED RESTORATION PROGRESS RELATIVE TO GLOBAL LAND DEGRADATION AND KUNMING–MONTREAL GLOBAL BIODIVERSITY FRAMEWORK TARGET 2



NOTES: Estimated global degraded land (United Nations Convention to Combat Desertification [UNCCD]), the 30 percent restoration target under the Kunming–Montreal Global Biodiversity Framework Target 2, and reported forest and landscape areas under restoration in March 2026 from the Convention on Biological Diversity (CBD) seventh national reports. The stacked bar represents three values. The largest bar represents the estimated global extent of degraded land (1.56 billion ha), based on UNCCD data. The middle marker indicates the area corresponding to the Target 2 ambition – approximately 469 million ha – representing 30 percent of degraded ecosystems. The smallest bar shows the aggregated area under restoration reported for forests and landscape (terrestrial) ecosystems in the CBD seventh national reports as of 2026 (206.5 million ha).

SOURCES: CBD. 2026. Online Reporting Tool. [Accessed on 18 March 2026]. <https://ort.cbd.int>; and based on data from UNCCD. 2019. *UNCCD Data Dashboard: Sustainable Development Goal (SDG) Indicator 15.3.1*. [Accessed on 27 March 2026]. <https://data.unccd.int/land-degradation>. CC-BY-NC-2.0.

relative to existing forest resources in the region. At the same time, the 170.2 million ha of forest and landscape area under restoration reported in this region indicates substantial progress in restoration efforts relative to the estimated extent of degraded land. In contrast, in Oceania, the reported progress on area under restoration (approximately 3 million ha) exceeds estimated degraded land area (0.8 million ha), which may reflect a strong capacity in restoration implementation, monitoring and reporting in those countries.

2.4.4 Comparative synthesis across reporting frameworks

Global restoration efforts are moving from commitment to implementation, but progress remains fragmented across regions, ecosystems and reporting frameworks. Assessing restoration progress across FRA, the FERM and the seventh national reports to the CBD reveals progress in reporting (Table 2.9). National reporting through FRA indicates that nearly 44 million ha of forest

are under restoration representing approximately 23 percent of pledged forest commitments. Initiative-level reporting through the FERM documents over 23.9 million ha under restoration across forest and landscape ecosystems. Reporting under the CBD's seventh national reports for KMGBF Target 2 indicates approximately 206.5 million ha of forest and landscape areas under restoration across 62 countries. Despite these complementary insights, these figures cannot be aggregated or directly compared due to differences in data collection processes, ecosystem scope, reporting architecture, and country and area coverage across the three reporting frameworks.

The discrepancies between reporting frameworks can be substantial at the country level, reflecting fundamental differences in how restoration is defined, scoped and accounted for. FRA focuses exclusively on forest ecosystems, much larger areas under the KMGBF, where restoration encompasses all ecosystems. In this analysis, FLR is interpreted to include both terrestrial

TABLE 2.8 DISTRIBUTION OF FOREST AREA, DEGRADED LAND AREA AND FOREST AND LANDSCAPE AREAS UNDER RESTORATION

Region	Number of countries that submitted seventh national reports	Global Forest Resources Assessment forest area in 2025 (1 000 ha)	United Nations Convention to Combat Desertification degraded land area in 2019 (1 000 ha)	Total forest and landscape area under restoration reported in the seventh national report (1 000 ha)
Africa	15	119 155	114 687	23 404
Asia	19	384 660	385 993	170 161
Europe	9	72 427	18 960	1 104
North and Central America	8	81 077	142 984	3 685
Oceania	2	11 210	824	2 948
South America	9	706 585	212 718	5 221
Global	62	1 375 114	876 166	206 523

NOTE: The data is based only on the countries who submitted their seventh national report to the Convention on Biological Diversity before the deadline.

SOURCES: Authors' own elaboration, based on data from FAO. 2025. Global Forest Resources Assessment. In: FAO. Rome. [Cited 5 January 2026].

<https://fra-data.fao.org/assessments/fra/2025/>; UNCCD. 2019. *UNCCD Data Dashboard: Sustainable Development Goal (SDG) Indicator 15.3.1*.

[Accessed on 27 March 2026]. <https://data.unccd.int/land-degradation?grouping=SDG>. CC BY-NC 2.0; and CBD. 2026. Online Reporting Tool.

[Accessed in February 2026]. <https://ort.cbd.int/>

<https://doi.org/10.4060/ce0633en-tab2.8> 

TABLE 2.9 REPORTED RESTORATION PROGRESS BY REGION ACROSS DIFFERENT REPORTING FRAMEWORKS

Region	Total forest area under restoration reported in the Global Forest Resources Assessment 2025 (1 000 ha)	Total forest and landscape area under restoration reported in the seventh national report (1 000 ha)	Total forest and landscape restoration area under restoration reported in the Framework for Ecosystem Restoration Monitoring (1 000 ha)
Africa	7 910	23 404	5 721
Asia	31 015	170 161	14 581
Europe	2 093	1 104	251
North and Central America	1 861	3 685	432
Oceania	18	2 948	13
South America	1 086	5 221	2 885
Global	43 983	206 523	23 883

NOTES: Reported values are based on different sets of reporting countries and initiatives and are subject to framework specific definitions and reporting approaches. Therefore, figures should be interpreted as indicative rather than directly comparable. Reported areas under restoration by region from the Global Forest Resources Assessment 2025, Convention on Biological Diversity seventh national reports and the Framework for Ecosystem Restoration Monitoring.

SOURCES: Authors' own elaboration, based on data from FAO. 2025. Global Forest Resources Assessment. In: FAO. Rome. [Cited 5 January 2026].

<https://fra-data.fao.org/assessments/fra/2025/>; CBD. 2026. Online Reporting Tool. [Accessed in February 2026]. <https://ort.cbd.int/>; and FERM. 2026.

FERM Registry. In: FAO. Rome. [Cited 29 April 2026]. <https://ferm.fao.org/>

<https://doi.org/10.4060/ce0633en-tab2.9> 

and inland water ecosystems, excluding only marine and coastal specific ecosystems data reported under KMGBF. The broader scope of KMGBF reporting is reflected in a wide range of restoration interventions across landscapes, such as agroforestry, natural regeneration, sustainable land management, reforestation and afforestation, silviculture, restoration of pastures, and ecosystem-specific interventions such as mangrove restoration, which are included in the analysis as a transitional ecosystem across land and coastal environments.

Even where ecosystem types were not explicitly specified, reported activities frequently indicate that restoration is taking place across diverse land-based systems beyond forests. As a result, a single country may report figures that differ across frameworks, reflecting differences in reporting scope, rather than inconsistencies in underlying efforts.

For instance, large-scale national programmes that combine afforestation, agroforestry, land rehabilitation and ecosystem restoration across

multiple land uses may be fully reflected in KMGBF reporting, but only partially captured in forest-specific reporting systems such as FRA. Understanding these differences is essential for interpreting global restoration figures, as they represent complementary perspectives on restoration progress rather than directly comparable measures of the same phenomenon.

The FRA is an official country-driven reporting mechanism focused primarily on forests and compiles nationally reported statistics rather than geospatially explicit data, limiting the spatial verification or detailed attribution of restoration activities. Although FRA also collects information on “other wooded land”, corresponding areas are not consistently disaggregated within restoration commitments and reported progress, constraining landscape-level comparison.

The FERM, by contrast, is a voluntary database aimed at supporting reporting on restoration at the initiative level, with spatial delineation of restoration areas, which enables disaggregation across ecosystem realms and biomes using the IUCN Global Ecosystem Typology, as recommended for the area-based indicators of the KMGBF, such as T1 Tropical–subtropical forests, T2 Temperate–boreal forests, T3 Shrublands and woodlands, T4 Savannas and grasslands.⁶⁶ In practice, however, many initiatives report aggregate hectares under restoration without consistently breaking down areas by biome or ecosystem type, particularly in landscapes with multiple ecosystems, which makes it difficult to assess ecological distribution, track biome-specific recovery and align reporting with biodiversity and integrity objectives.

The seventh national reports to the CBD provide a country-driven reporting mechanism for tracking progress towards KMGBF Target 2, covering restoration across all ecosystem types. Reporting under the seventh national reporting cycle is conducted through the CBD’s Online Reporting Tool and relies on nationally aggregated estimates rather than spatially explicit data, which limits the ability to verify, map or consistently disaggregate reported restoration areas by ecosystem type or biome. While some countries provide ecosystem level disaggregation or additional contextual information through reporting comments, this

information is not applied systematically across reports, constraining comparability across countries and ecosystems.

To address these limitations, FAO is working with the CBD Secretariat to strengthen linkages between FERM and the CBD Online Reporting Tool, enabling reviewed, spatially explicit data to be prepopulated into national reporting workflows where appropriate. This is being operationalized through the FERM data review functionality, which allows national focal points to visualize and review default data on areas under restoration. The functionality, available exclusively to CBD national focal points within FERM, provides a map view of restoration project areas (as polygons or points) together with key attributes, helping to reduce duplication where possible. Through this process, national focal points are encouraged to conduct quality assurance and quality control reviews and determine how different data sources should be aggregated before potentially integrating the reviewed data into national reporting.

While progress in restoration reporting is evident, achieving the global restoration target by 2030 will require a substantial acceleration of restoration implementation on the ground. This will require stronger enabling conditions (coherent policies, adequate financing, institutional capacity and long-term monitoring), alongside better alignment across reporting systems. Harmonizing core definitions, ecosystem classification, and transparency around country and area coverage, supported by clearer reporting reference years and cumulative versus point in time estimates, would improve comparability. Complementing aggregated national reporting with spatially explicit data and strengthening interoperability between national reporting systems and initiative-level platforms would reduce duplication and enable more coherent tracking of restoration progress.

Strengthening legal mandates, policy coherence and coordination across forestry, environment, agriculture, climate, and other relevant institutions and stakeholders can improve implementation consistency, accountability and data harmonization across government.

This sets the stage for section 2.5, which examines the legal, policy and institutional foundations that enable restoration at scale. Forest and landscape restoration, as a nationally led process, is rooted in country priorities, land-use decisions and long-term development goals, rather than being driven by external agendas. National policies and frameworks should support, consider and acknowledge restoration actions on the ground, and should be led by communities, Indigenous Peoples and local organizations to help bolster national restoration efforts. Achieving these national restoration targets depends on robust national policies, legal frameworks, institutional coordination mechanisms and community action that align commitments with implementation on the ground. ■

2.5 LEGAL AND POLICY FRAMEWORKS

Alongside restoration commitments (see **Chapter 1** and section 2.4), an increasing number of legal and policy frameworks^{aa} are being developed and implemented to support FLR. These frameworks shape the enabling environment for restoration by establishing mandates, institutional responsibilities, incentives and monitoring mechanisms that allow restoration efforts to be implemented at scale. Many originate from, or are linked to, international instruments and are subsequently translated into national laws, regulations, policies and strategies. International frameworks typically establish restoration objectives and guiding principles, while national legal and policy frameworks operationalize these commitments through legislation, policies and implementation mechanisms. As noted in **Chapter 1**, FLR does not have a universally

agreed legal definition.^{ab} Rather than being addressed in isolation, FLR provisions are usually embedded within broader instruments, such as those governing forest management, land use, environmental protection and climate policy. In practice, FLR is rarely governed by a single dedicated instrument. Instead, restoration provisions are typically integrated across broader governance frameworks that involve multiple sectors and stakeholders. Principle 10 of the *Principles for ecosystem restoration to guide the United Nations Decade 2021–2030* emphasizes that ecosystem restoration is enabled by coherent legal, policy and governance frameworks that support long-term implementation, replication and scaling-up of restoration efforts.⁸

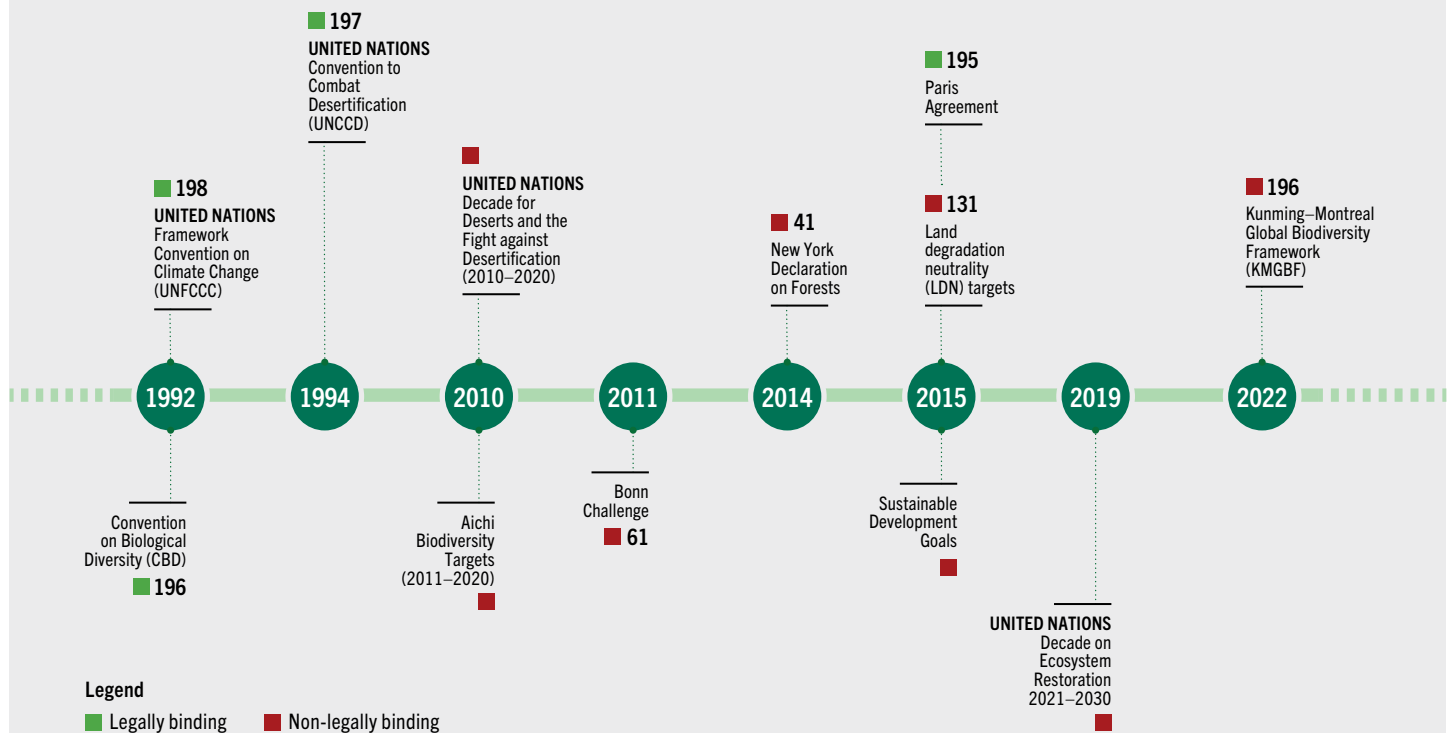
2.5.1 International and regional frameworks guiding restoration commitments

As described in **Chapter 1**, ecosystem restoration has gained global momentum through a range of international initiatives and commitments contributing directly to the implementation of major global policy agendas. In particular, the Rio Conventions – the UNFCCC and the related Paris Agreement, the CBD and the UNCCD – have been influential in promoting restoration-related actions (**Figure 2.11**).

In addition to these legally binding agreements, several global policy initiatives have mobilized political support and voluntary restoration commitments. These include the 2030 Agenda for Sustainable Development (2015), the United Nations Forum on Forests (2000), the Bonn Challenge (2011), the New York Declaration on Forests (2014) and the UN Decade on Ecosystem Restoration (2021–2030). Although non-binding,

^{aa} For the purposes of this section, legal frameworks refer to binding instruments such as laws, regulations and international agreements that establish rights, obligations and institutional responsibilities, and are enforceable through judicial or administrative mechanisms. They are enacted by legislative or governmental bodies. Policy frameworks refer to non-binding instruments such as policies, strategies, plans and programmes that guide implementation to achieve goals and are not generally directly enforceable through judicial means unless incorporated into law.

^{ab} Major organizations each emphasize different aspects of forest and landscape restoration. FAO describes it as a planned process to regain ecological integrity and enhance human well-being in degraded landscapes, focusing on self-sustaining ecosystems and balanced priorities at the landscape scale. The Global Partnership on Forest and Landscape Restoration and IUCN both highlight the restoration of ecological functionality and human well-being, while FAO and the World Resources Institute note that landscapes may be forested or non-forested. The International Tropical Timber Organization further expands the scope, framing FLR as an ongoing process that goes beyond tree planting to restore entire landscapes, addressing complex legal, social and cultural dimensions. These varied definitions reflect the multifaceted nature of FLR, which seeks to reconcile ecological, economic and social objectives in diverse contexts.

FIGURE 2.11 GLOBAL INITIATIVES THAT INCLUDE ECOSYSTEM RESTORATION: SCOPE, LEGAL STATUS AND ALIGNMENT WITH NATIONAL FRAMEWORKS

NOTE: Numbers refer to Parties and signatories. More detailed information can be found in **Appendix 2**.

SOURCE: Authors' own elaboration.

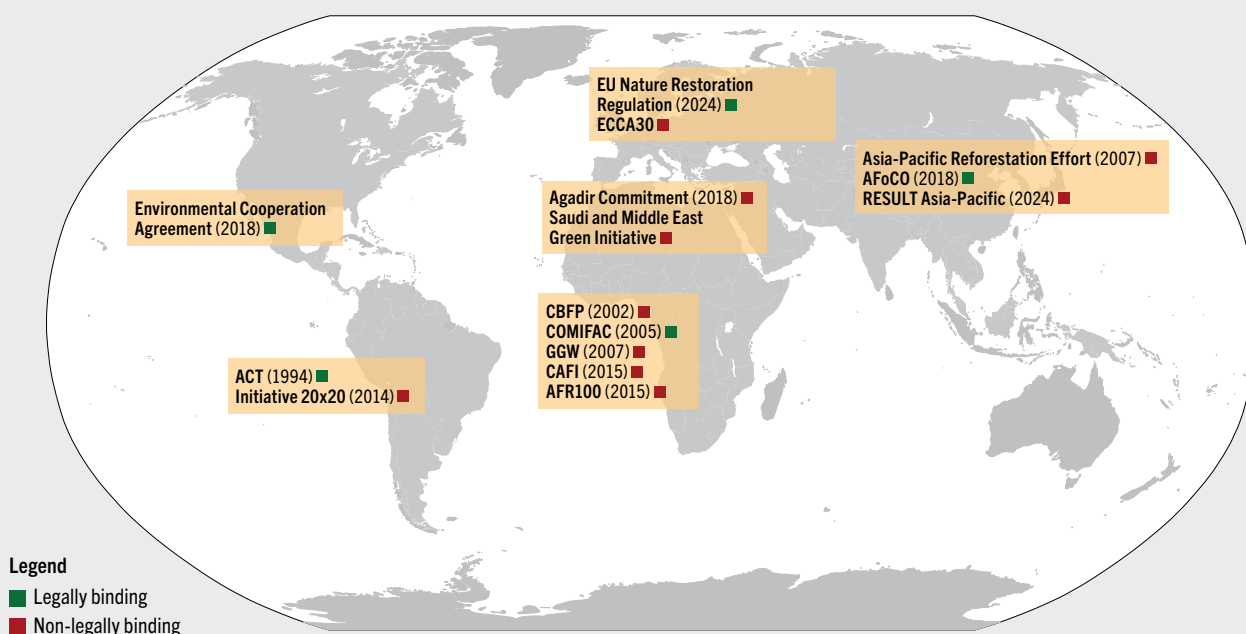
these initiatives articulate targets and timelines that have helped create a shared vision for FLR and stimulate action at global, national and subnational levels (Figure 2.11).

Considerable effort has been devoted to promoting FLR and its benefits for biodiversity, climate change mitigation and adaptation, and human well-being. At the same time, there is a growing demand for evidence demonstrating the tangible application of national and local policy frameworks and plans, particularly at the level of specific landscapes. In this context, numerous global (Figure 2.11) and regional (Figure 2.12) frameworks, both legally binding and non-binding, increasingly embed FLR targets, monitoring and reporting requirements and implementation guidance into national legal and policy frameworks. These frameworks are helping

to shape national legal and policy frameworks and to support countries in translating restoration pledges into measurable action.

A number of these initiatives establish global targets and implementation mechanisms, which are subsequently reflected in national policy instruments. Under the CBD, the KMGBF sets global targets for ecosystem restoration. In particular, Target 2 calls on Parties to ensure that at least 30 percent of degraded terrestrial, inland water and coastal and marine ecosystems are under effective restoration by 2030. Its implementation has already triggered the review and update of the NBSAPs, the main national instruments for implementing KMGBF goals and targets and subsequently shaping related policies and legal frameworks.

FIGURE 2.12 REGIONAL INITIATIVES THAT INCLUDE ECOSYSTEM RESTORATION: SCOPE, LEGAL STATUS AND ALIGNMENT WITH NATIONAL FRAMEWORKS



Refer to the disclaimer on the copyright page for the names and boundaries used in this map.

NOTES: More detailed information can be found in **Appendix 2**. ACT = Amazon Cooperation Treaty, AFoCO = Asian Forest Cooperation Organization, CBFP = Congo Basin Forest Partnership, COMIFAC = Central African Forest Commission; GGW = Great Green Wall, CAFI = Central African Forest Initiative, AFR100 = African Forest Landscape Restoration Initiative.

SOURCE: Authors' own elaboration.

Similarly, the Paris Agreement encourages countries, through its Article 5, to “take action to conserve and enhance, as appropriate, sinks and reservoirs of greenhouse gases”.^{ac} In this context, FLR has increasingly been promoted as climate change mitigation and adaptation measures. NDCs, established under Article 4 of the Paris Agreement, detail countries’ mitigation and adaptation plans endorsed at the highest policy level and play a pivotal role in translating global restoration goals into nationally defined actions. By providing a framework for coordinating climate action across sectors, including FLR, NDCs create opportunities to strengthen and better align national legal and policy frameworks. Their regular review cycles also provide countries with an opportunity to enhance and expand their restoration ambitions.

^{ac} See <https://sdgs.un.org/frameworks/parisagreement>

Data from FAO’s NDC database⁶⁷ – a greenhouse gas (GHG) accounting tool to monitor past and ongoing climate actions and estimate the mitigation potential of planned actions – show that countries rarely articulate FLR as a distinct concept. Instead, they typically refer to related measures within key areas of forests and land-use governance – including forest management, deforestation and degradation control, agroforestry, wetlands and peatlands, wildfire prevention and conservation,^{ad}

^{ad} Measures include: afforestation, reforestation and forest ecosystem restoration; sustainable forest management; reducing deforestation and degradation; agroforestry; wild-fire prevention and integrated fire management; community-based forest management; forest conservation; urban and peri-urban forestry; climate-tolerant forest species and genetic diversification; non-timber forests products; and forest pest and disease management.

BOX 2.3 A PIONEERING REGIONAL FRAMEWORK FOR FOREST AND LANDSCAPE RESTORATION IN CENTRAL AFRICA

Established in 2005 under the Treaty of Brazzaville^{*} on the conservation and sustainable management of forest ecosystems, the Central African Forest Commission (COMIFAC)^{**} is the principal regional body legally responsible for coordinating forest and environmental policies across 11 Congo Basin countries (Angola, Burundi, Cameroon, Chad, the Congo, Gabon, Equatorial Guinea, the Central African Republic, the Democratic Republic of the Congo, Rwanda, and Sao Tome and Principe). While COMIFAC does not directly regulate forest management, it provides a shared legal and institutional framework for policy harmonization, regional cooperation and coordinated national implementation. Within this framework, sustainable forest management functions as an umbrella concept encompassing forest and landscape restoration (FLR). COMIFAC's Convergence Plan serves as the strategic platform guiding priority interventions across the subregion.

It aligns national policies and legislation with multilateral environmental agreements and global initiatives, including the Bonn Challenge through

the African Forest Landscape Restoration Initiative (AFR100), and embeds FLR within broader objectives related to biodiversity conservation, climate change mitigation and land degradation neutrality (LDN). The plan promotes participatory governance, integrates traditional knowledge with scientific approaches and supports coordinated action on shared forest and land-use challenges. Through the Central Africa Forest Observatory (OFAC), COMIFAC supports evidence-based monitoring and periodic reporting on forest and landscape dynamics. Its policy initiatives link restoration with poverty reduction, gender equity and climate resilience, while addressing the key drivers of degradation, such as unsustainable agriculture and resource extraction. Despite persistent funding and capacity constraints, COMIFAC is supported by voluntary partnerships, such as the Congo Basin Forest Partnership,^{***} and has strengthened regional cooperation and helped position the Congo Basin as a global priority for sustainable forest management.

NOTES: * See https://comifac.org/wp-content/uploads/2016/08/Traité_COMIFAC_2005.pdf; **See <https://comifac.org/>; ***See <https://pfbc-cbfp.org/en/>

operationalized through national legal,^{ae} policy and institutional regimes.

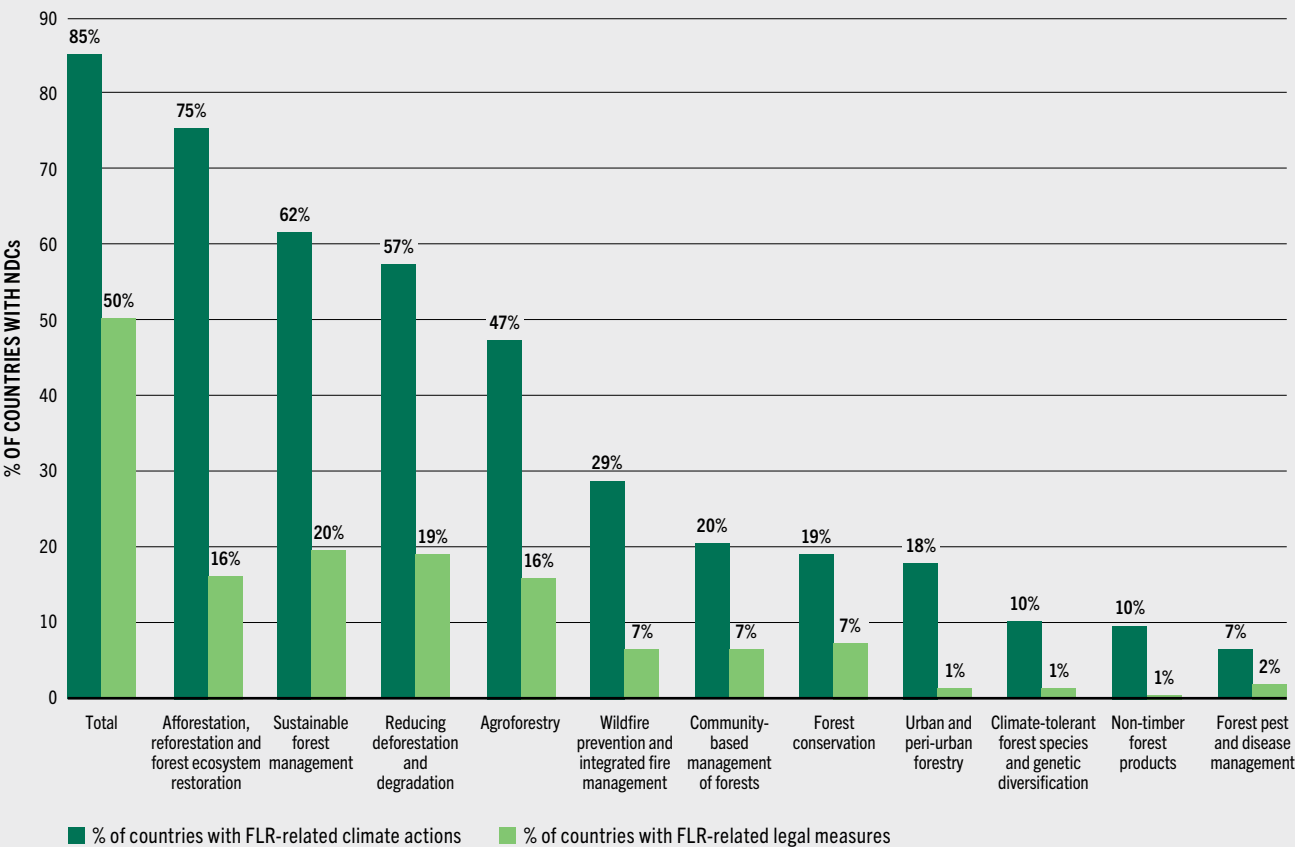
This situates FLR-related commitments within areas that are governed – or that should be

^{ae} Legal approaches: laws and regulations aiming at reducing environmental degradation (e.g. protected areas) and addressing social and economic drivers of climate vulnerability (e.g. land tenure, access rights, economic opportunity, poverty, disputes). Legal systems play an important governance role in facilitating responses to climate change across all levels of society, and legal instruments can facilitate climate action in multiple ways, including through: (i) mandating and guiding the behaviour of governance structures and actors; (ii) fostering coordination between different levels of government; (iii) enforcing climate responses; (iv) its symbolic value; and (iv) aligning scientific evidence and societal norms.⁶⁸ Keywords include law, legal, legislation, regulation, act, statute, code, decree, ordinance, by-law, rule, judicial, court, directive, amendment, compliance, norm, moratorium, ban, prohibit(ion), obligat(ion), authority, treaty(ies), tenure, reform, rights, zoning, protected areas, flexible permits, adjust multilateral treaties, legal instruments used for managing shared transboundary ecosystems, co-management schemes, customary tenure and law enforcement.

governed – by national legal frameworks. One hundred and forty-two countries (85 percent with NDC) report having FLR-related policy measures, and 78 (50 percent) explicitly tie their commitments to a legal measure (Figure 2.13). Such measures are embedded in instruments related to protected or conservation areas, zoning, tenure, LDN and forest management plans, among other areas. This suggests that FLR-related actions are frequently framed in connection with broader legal instruments, rather than through specific stand-alone FLR legal instruments.

Forest-related NDC measures are recorded across all regions, with notable uptakes in Africa and South America (Figure 2.14).

FIGURE 2.13 PROPORTION OF COUNTRIES GLOBALLY WITH NATIONALLY DETERMINED CONTRIBUTIONS THAT INCLUDE POLICY AND LEGAL MEASURES RELATED TO FOREST AND LANDSCAPE RESTORATION, BY CLIMATE ACTION CATEGORY



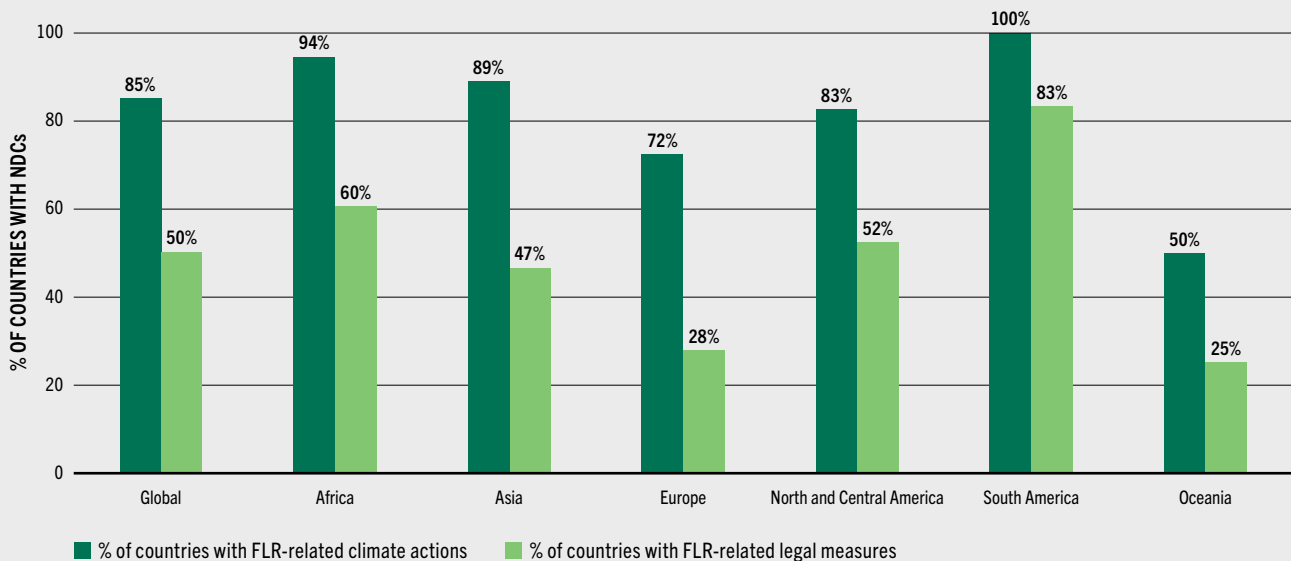
NOTES: NDCs = nationally determined contributions; FLR = forest and landscape restoration.

SOURCE: Crumpler, K., Wybieralska, A., Roffredi, L., Tanganelli, E., Angioni, C., Prosperi, P., Umulisa, V. et al. 2025. *Agrifood systems in nationally determined contributions*. Rome, FAO. <https://doi.org/10.4060/cd6284en>

Among countries explicitly referencing FLR, the Democratic Republic of the Congo includes a broad commitment to “support initiatives enabling the restoration of forests and landscapes”. It also refers to the creation of a platform through legal reform to support the operation of FLR projects.⁶⁹ This illustrates how FLR can be explicitly recognized in NDCs, including through references to legal and institutional measures, with further specification typically developed through national legal and policy frameworks to support implementation.

Forest ecosystem restoration, reforestation and afforestation targets vary widely in their level of ambition and specificity across countries and regions, as reflected in FLR-related climate actions in FAO’s NDC database (see Figures 2.13 and 2.14). In some cases, commitments are defined in terms of area of forest to be restored, while others refer to the number of trees to be planted or the expected contribution to GHG storage. A smaller number combines several types of metrics. For example, Angola, Belize, Brazil, Colombia, Nepal, Pakistan and Rwanda

FIGURE 2.14 PROPORTION OF COUNTRIES GLOBALLY WITH NATIONALLY DETERMINED CONTRIBUTIONS THAT INCLUDE POLICY AND LEGAL CLIMATE MEASURES RELATED TO FOREST AND LANDSCAPE RESTORATION, BY GLOBAL FOREST RESOURCES ASSESSMENT REGION



NOTES: NDCs = nationally determined contributions; FLR = forest and landscape restoration.

SOURCE: Crumpler, K., Wybieralska, A., Roffredi, L., Tanganelli, E., Angioni, C., Prosperi, P., Umulisa, V. et al. 2025. *Agrifood systems in nationally determined contributions*. Rome, FAO. <https://doi.org/10.4060/cd6284en>

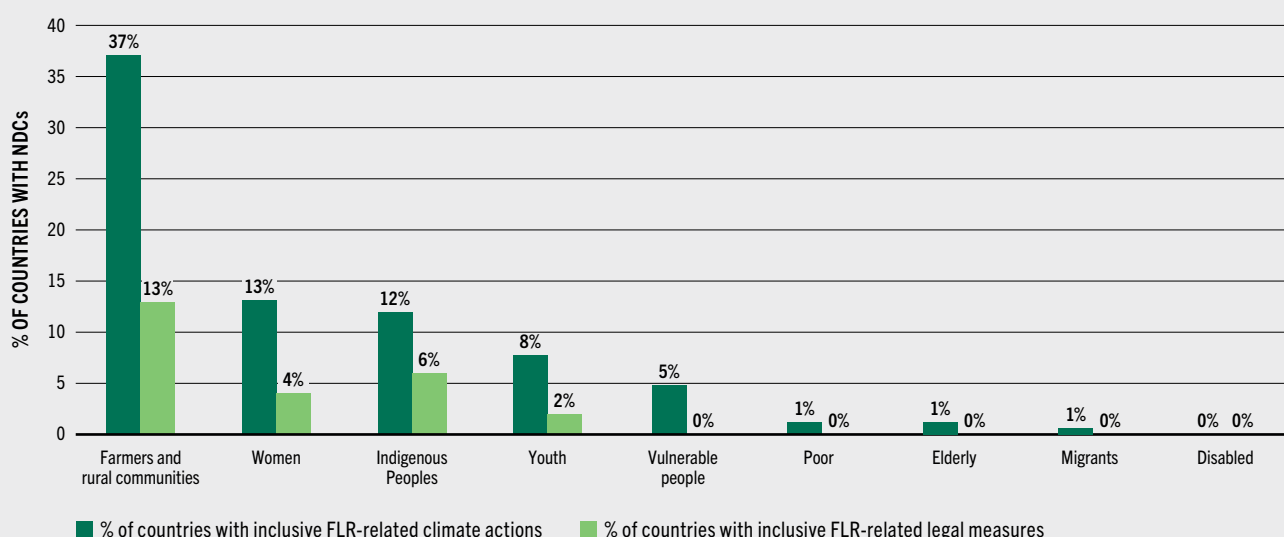
mention hectares of restored forests. Others, such as the Bolivarian Republic of Venezuela, Canada, Jordan and Nigeria set forth numbers of trees they aim to plant. Bosnia and Herzegovina, and Eritrea include quantified targets regarding GHG storage. Chad and Uganda blend several types of metrics. Countries specifying quantifiable GHG emission reduction or carbon sequestration pledges are a minority, although many are among the most forested ones.^{19, 70} In most cases, at least part of these commitments are conditional on external funding.⁷⁰

In many cases, NDC commitments aim to restore a wide range of environmental, social and economic functions, rather than solely contribute to mitigation efforts. Environmental co-benefits include preserving watersheds in Ethiopia and Rwanda, tackling desertification in Nicaragua, Saudi Arabia and Uzbekistan, and conserving mangroves in the Bahamas, Guyana, Haiti, Saint

Vincent and the Grenadines, Samoa, Sao Tome and Principe, and Senegal. Complementary objectives highlighted in NDCs include supporting rural livelihoods. Thirty-seven percent of countries with NDCs target their FLR-related policies towards farmers and rural communities, while 13 percent target women, and 12 percent Indigenous Peoples (Figure 2.15).

Nationally determined contributions also point to barriers to FLR, including financial gaps. Only 13 countries make unconditional commitments for their afforestation, reforestation and forest ecosystem restoration as part of their mitigation measures. Additional constraints include limited data about forest conditions in the absence of any forest survey or robust monitoring framework. These constraints are generally the result of weak forest governance processes.⁷¹

FIGURE 2.15 INCLUSIVITY OF POLICY AND LEGAL MEASURES RELATING TO FOREST AND LANDSCAPE RESTORATION IN NATIONALLY DETERMINED CONTRIBUTIONS



NOTE: FLR = forest and landscape restoration.

SOURCE: Crumpler, K., Wybieralska, A., Roffredi, L., Tanganelli, E., Angioni, C., Prosperi, P., Umulisa, V. et al. 2025. *Agrifood systems in nationally determined contributions*. Rome, FAO. <https://doi.org/10.4060/cd6284en>

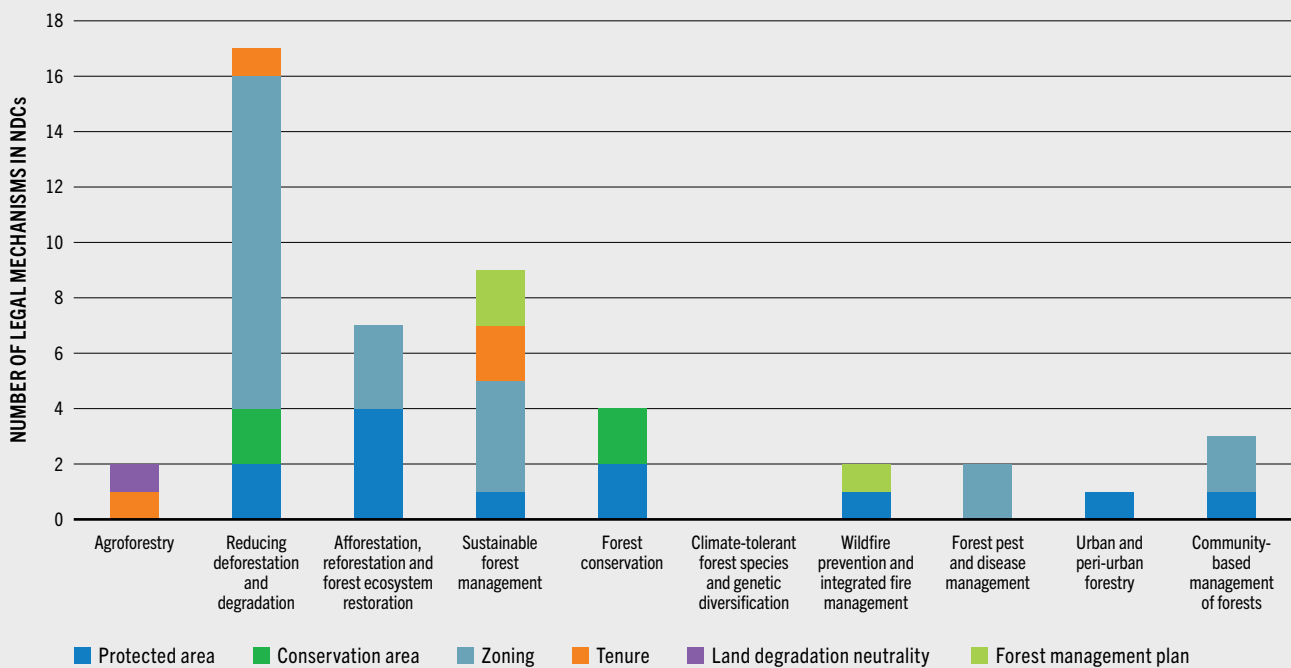
In some cases, FLR is articulated as part of broader national strategies. Both Costa Rica and Madagascar, for example, incorporate restoration as a core component of their national climate neutrality plans. Countries such as Bhutan, Indonesia, Mexico and Viet Nam link restoration efforts to frameworks for reducing emissions from deforestation and forest degradation in developing countries, and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks (REDD+), leveraging international climate finance and technical support. Several countries also reference global and regional restoration pledges. Twenty-five out of the 75 countries participating in the Bonn Challenge and related regional initiatives such as AFR100 and Initiative 20x20, explicitly reference these initiatives in their NDCs. These alignments demonstrate an emerging coherence between national commitments and international FLR initiatives.

Where NDCs measure explicitly referenced legal approaches,^{af} this may indicate an intent to rely on national legal instruments that can mandate, implement or enforce forest-related actions. Among the 78 countries reporting at least one type of FLR-related legal measure, the measures address a diverse range of issues, such as reducing deforestation and forest degradation, sustainable forest management, afforestation, reforestation and forest ecosystem restoration (Figure 2.16).

The analysis highlights how FLR-related action is frequently framed in connection with broader legal instruments, rather than pursued solely as a stand-alone, project-based or voluntary intervention.

^{af} Keyword searches included: law, legal, legislation, regulation, act, statute, code, decree, ordinance, by-law, rule, judicial, court, directive, amendment, compliance, norm, moratorium, ban, prohibit(ion), obligat(ion), authority, treaty(ies), tenure, reform, rights, zoning, protected areas, flexible permits, adjust multilateral treaties, legal instruments used for managing shared transboundary ecosystems, co-management schemes, customary tenure and law enforcement.

FIGURE 2.16 NUMBER AND TYPES OF LEGAL MEASURES RELATED TO FOREST AND LANDSCAPE RESTORATION, BY CLIMATE ACTION CATEGORY



NOTE: NDCs = nationally determined contributions

SOURCE: Crumpler, K., Wybieralska, A., Roffredi, L., Tanganelli, E., Angioni, C., Prosperi, P., Umulisa, V. *et al.* 2025. *Agrifood systems in nationally determined contributions*. Rome, FAO. <https://doi.org/10.4060/cd6284en>

Taken together, these patterns underscore the importance of legal frameworks in enabling FLR-related activities. As instruments under the Paris Agreement, NDCs rely on national legal and policy frameworks for implementation. Effective implementation depends not only on the existence of legal frameworks, but also on their coherence, adequacy and enforcement, including across forest, land-use and environmental laws. In this context, embedding FLR-related climate actions within legal frameworks can strengthen coherence between climate commitments and national frameworks and support more durable implementation.

Analysis of FAO's NDCs database suggests that FLR is most often addressed through sectoral measures embedded in forest, land-use, agriculture and environmental governance, rather than articulated as a distinct legal or

policy category.⁶⁷ Anchoring FLR-related climate actions within legal frameworks provides an entry point for strengthening coherence between climate commitments and national legal frameworks for the long-term impact of FLR.

In addition, many current approaches link restoration to current deforestation or degradation, while areas affected by past degradation remain to be restored. Legal and policy approaches may help tackle persistent drivers of deforestation and degradation.

To strengthen the role of FLR in future NDC cycles, and given that the law provides mandate, durability and accountability, countries may consider articulating FLR more explicitly and anchoring restoration objectives in legal and regulatory frameworks. Effective implementation also depends on practical conditions,

coordination among actors and governance capacity. Greater alignment between FLR-related climate actions in NDCs, national and regional legal frameworks, related policy instruments such as NBSAPs under the Convention on Biological Diversity, could support improved coherence and more effective implementation.

2.5.2 National legal and policy frameworks enabling implementation

Progress in legal and policy integration is evident in a growing number of countries. This is important because policy and legal frameworks are foundational for effective FLR, as they establish the legal basis for planning, implementation, compliance and enforcement.⁷² Evidence from FRA 2025 indicates that many restoration commitments are supported by national legal frameworks. Out of the 153 countries and areas reporting restoration commitments, 128 (representing 90 percent of global forest area) indicated having legislative frameworks supporting restoration.¹⁹ While these figures provide a useful overview of global trends, they offer only a partial picture of the role of law in enabling FLR. The existence, or even proliferation, of legal frameworks does not in itself guarantee their effectiveness or their capacity to support restoration outcomes in practice. This suggests that the key issue may lie less in the multiplication of legal instruments than in the ways existing rules are understood, interpreted and mobilized. In this respect, strengthening FLR may also depend on the ability to engage with and make effective use of existing legal frameworks, including developing approaches that make law more accessible, usable and responsive to local contexts. This also suggests that the presence or absence of formal legal frameworks, while important, may not in themselves be sufficient to assess the effectiveness of restoration efforts. By contrast, 28 countries and areas reported that restoration commitments lacked a formal legal basis and often relied on donor-funded projects or community-led initiatives. This suggests that while many commitments are anchored in legislation, others rely primarily on policy instruments or projects that do not create legally binding obligations. Where the latter are not anchored in legislation, they typically function as policy guidance. The presence of legislative

frameworks, however, does not necessarily imply that they are sufficiently comprehensive, coherent or effectively implemented to fully enable FLR over the long term.

Fifty-five countries reported to FRA having a legal definition of forest restoration, which can help clarify the scope and interpretation of restoration-related obligations and the roles of implementing stakeholders.¹⁹ In Brazil, for example, Law No. 12651 on the protection of native forests⁷³ establishes legally binding obligations to restore native vegetation in areas of permanent preservation and legal reserves. These obligations are further operationalized through Decree No. 8972 of 23 January 2017, which establishes the National Policy for the Recovery of Native Vegetation, provides instruments for implementation and recognizes different approaches to vegetation recovery.

Within this framework, the National Commission for the Recovery of Native Vegetation (CONAVEG) is mandated to periodically revise the national restoration plan; the 2025–2028 plan expands the scope to protected areas, Indigenous People's lands and other collective territories.⁷⁴ While not framed explicitly as FLR, these legal and policy instruments contribute to restoration outcomes at landscape scale. At the regional level, the European Union⁷⁵ requires the restoration of terrestrial, coastal and freshwater habitats, setting targets for 30 percent of habitats in good condition by 2030, 60 percent by 2040 and 90 percent by 2050 (Case study 13).^{ag}

Policy instruments can complement legally binding frameworks by supporting their implementation. In Brazil, the Plan for the Recovery of Native Vegetation establishes a national policy to restore 12 million ha of forests by 2030.⁷⁴ This plan complements the Forest Code by supporting the implementation and enforcement of its restoration obligations through coordinated policy measures. It notably seeks to support the compliance of rural properties with Law No. 12651 on the protection of native forests by restoring 9 million ha of native vegetation in areas of permanent preservation, legal reserves

ag Art. 4 para. 1, Regulation (European Union) 2024/1991 of the European Parliament and of the Council of 24 June 2024 on nature restoration and amending Regulation (European Union) 2022/869.

BOX 2.4 FAOLEX: A GLOBAL DIGITAL PUBLIC GOOD FOR FOREST AND LANDSCAPE RESTORATION

Recognized as a digital public good, FAOLEX* is a global database, accessible in the Food and Agriculture Organization of the United Nations (FAO) official languages, providing open access to more than 200 000 laws and policies across sectors within FAO's mandate, including forestry, land, soil, water, climate and biodiversity. By centralizing this information, FAOLEX enables users to review legal and policy frameworks, compare approaches and identify gaps, fragmented data and regulatory approaches for the sustainable transformation of agrifood systems, while supporting alignment with international and regional commitments and more informed legal and policy development. FAOLEX also provides insight into how countries regulate forest and landscape restoration (FLR). In most jurisdictions, although FLR is not defined as a distinct legal concept, restoration-related objectives are addressed through multiple sectoral legal and policy instruments. Searches using proxy terms

derived from restoration frameworks (e.g. "afforestation and reforestation", "soil rehabilitation", "ecosystem conservation" and "forest management"), combined with filters across relevant domains (e.g. "forestry", and "land and soil"), can be used to identify and analyse relevant legal and policy instruments. For example, applying a set of keywords aligned with restoration frameworks such as the Bonn Challenge and filtering across these domains can yield in the order of 15 000 documents, providing an indicative starting point for further analysis, and illustrating both the breadth of existing frameworks and the intersectoral nature of FLR. At the same time, practical limitations should be noted. Searches rely on proxy terminology, which may vary across jurisdictions, and results depend on the choice of keywords and filters applied. Coverage also varies across countries, and some instruments – particularly recent or subnational measures – may not be captured in the database.

NOTE: *See <https://www.fao.org/faolex/en/>

and restricted land-use areas by 2030 through coordinated, multilevel capacity-building efforts. In the Philippines, ongoing legislative reforms seek to give binding legal status to the National Greening Programme launched in 2011, which aims to restore all degraded forestlands by 2028.^{ah}

Forest and landscape restoration legislation and policies often operate within broader governance frameworks that also address forest deforestation and forest degradation, including restrictions on the conversion of remaining natural forests. When restoration obligations

^{ah} See Senate Bill No. 629, 19th Congress, An Act providing for the urban and countryside greening in the Philippines; House Bill No. 8632, 19th Congress An Act to promote greening and forestland rehabilitation and protection at the barangay level, stimulating local climate change action, appropriating funds therefor and for other purposes; House Bill No. 3453 and 19th Congress, An Act strengthening Executive Order No. 193 or the National Greening Program and the Forest Protection Program by mandating every local government unit in the country to set aside one percent of its total registered land area of jurisdiction to establish forest parks and provide for the conservation, maintenance and protection thereof.

are defined primarily in relation to degraded or converted ecosystems, restoration obligations are typically triggered only in response to new ecological damage. This makes it challenging to achieve net gain for people and nature.

Binding legislation such as Planaveg or the European Union's Nature Restoration Regulation obligate the restoration of past degradation, decoupled from new damage. This is an important advancement in restoration and reforestation legislation.⁶ In Cambodia, the Long-Term Strategy for Carbon Neutrality (LTS4CN) commits to reducing deforestation by half by 2030 and achieving zero emissions in its forestry sector by 2040.⁷⁶ In Indonesia, a legally binding moratorium prohibits the clearing of primary natural forests and peatlands.^{ai} Whether legally binding or policy-based, such measures

^{ai} See Presidential Instruction No. 5 of 2019 Concerning the Termination of the Granting of New Permits and Improvement of Primary Natural Forest Governance and Peatlands.

BOX 2.5 COMMUNITY-BASED FOREST MANAGEMENT IN NEPAL: A TOOL SUPPORTING FOREST AND LANDSCAPE RESTORATION

Between 1990 and 2025, Nepal's forest area increased by 9 percent, accounting for 44 percent of the country's land area.¹⁹ This growth is mainly attributed to community-based forest management.⁷⁹ Community forestry was designed to restore degraded mountain forests while meeting local subsistence needs. Nepal's 1976 National Forest Plan, the country's first forest policy, aimed to enable people to meet their needs for forest products while restoring degraded forests. Since the Forest Act of 1993 and its 1995 by-laws, Nepal's legal framework has progressively

devolved tenure and decision-making rights to communities. Although forests remain state-owned, community forestry user groups are granted rights to manage, protect and use forests without time limits. Together with flexible rules on allowable activities,^{*} this has provided strong incentives for communities to restore degraded areas. At least half of the communities' forest revenues must be directed towards ecological or social objectives,^{**} and community forest user groups, as inclusive bodies representing community members, report annually to the forest administration.^{***}

NOTES: ^{*} Section 10 of Forest Rules, 2051 (1995) lists the activities that are prohibited within community forests but does not otherwise limit activities that can be conducted, beyond compliance with the provisions of the management plans. This provides community forest user groups with flexibility. ^{**} Section 22, Forests Act, 2019 (2076). ^{***} Section 31, Forests Act, 2019 (2076).

are essential to ensuring that restoration efforts lead to net gains and do not undermine climate and biodiversity goals.

Secure tenure is a key condition for successful FLR. In many contexts, secure and clearly defined land and resource rights function not only as an enabling factor, but as a precondition for sustained restoration investment, as they underpin incentives for long-term stewardship, access to finance and equitable benefit-sharing. An increasing number of countries have adopted legal frameworks securing the land, forest and tree tenure rights of forest-dependent communities. In 35 countries analysed, 104 community-based tenure regimes are recognized in national legislation.⁷⁷ Community-based forestry frameworks in particular empower communities to restore and sustainably manage forests, illustrating how secure tenure contributes to successful restoration outcomes. Nepal provides a notable example⁷⁸ (see [Box 2.5](#)).

Financial incentive mechanisms embedded in legal and policy frameworks can support FLR by enabling smallholder producer organizations, Indigenous Peoples' organizations and sustainable supply chains for goods produced in restored landscapes. Costa Rica provides an

example. Under Forest Law No. 7575 (1996), the National Forest Financing Fund administers a payment for an environmental-services scheme that compensates landowners for undertaking restoration activities. The scheme has enabled smallholders to participate in restoration and sustainable forest management.

Institutional coordination and stakeholder participation mechanisms anchored in legal frameworks establish mandates, responsibilities and procedures among the range of actors involved in FLR. These mechanisms facilitate dialogue, negotiation, cooperation and partnership among public authorities at national and subnational levels.

Because FLR operates at the landscape scale, these frameworks often require coordination across sectors and land uses. They also provide mechanisms for implementation, including tenure arrangements, financial incentives and institutional coordination. By strengthening coordination across sectors, they enable effective FLR.⁸⁰

Innovative legal approaches increasingly focus on how legal frameworks are used and how they operate in practice, rather than focusing only

on their formal design. This involves selecting legal instruments that are appropriate to a specific context, while ensuring that lawmaking processes integrate evidence-based (scientific and social) knowledge.

From this perspective, the law is understood not only as a set of rules, but also as a part of a broader process that governs interactions among actors, decision-making practices and implementation pathways.

Engaging a range of stakeholders in the development and application of legal frameworks can help align legal provisions with local practices, improve coordination across sectors and levels of governance, and support their effective use. Bridging legal processes with other forms of knowledge, including scientific research, behavioural insights and customary systems, further contributes to shaping legal frameworks that are responses to contexts. Embedding provisions related to implementation, compliance and enforcement help translate commitments into practical outcomes.⁸¹ Therefore, particular attention to how rules are interpreted, mobilized and enforced is essential, reflecting a broader shift towards understanding law not only as a set of formal rules producing effects, but as processes embedded in practice, involving interaction and dynamic governance contexts.

In line with the *Principles for ecosystem restoration to guide the United Nations Decade 2021–2030*, particularly Principle 10, translating restoration commitments into effective implementation requires coherent legal and policy frameworks, including measures such as:

- ▶ clarifying how FLR is defined and addressed in legal and policy frameworks, and how it is reflected across related instruments;
- ▶ reviewing sectoral legislation to identify gaps and inconsistencies, including laws and policies that may incentivize deforestation and degradation;
- ▶ clarifying the legal basis of FLR instruments, including provisions governing afforestation and reforestation, land-use controls and protected areas, promoting ecologically appropriate FLR approaches, such as using native species, preventing conversion of non-forest ecosystems and providing for FLR in areas affected by past degradation;
- ▶ aligning FLR measures with legal frameworks, institutional mandates and associated monitoring mechanisms (e.g. reporting and data sharing) in sectors through which restoration is implemented, such as forestry, land use and the environment;
- ▶ strengthening legal and policy frameworks to recognize tenure rights, where necessary, through legal reform, and to support the meaningful participation of stakeholders as well as rights and knowledge holders, in particular Indigenous Peoples, women, youth and local communities, in FLR planning and implementation;
- ▶ examining how laws and policies governing sectors such as agriculture, land, forestry, pastoralism, social protection, inclusivity and rural development support incentives, value chains and market access for goods and services generated in restored landscapes; and
- ▶ articulating FLR objectives more explicitly in NDC and NBSAP cycles and anchoring them in legal frameworks to strengthen accountability and long-term sustainability. ■

2.6 PROGRESS, GAPS AND THE WAY FORWARD

This chapter looks at recent commitments, progress and relevant legal and policy frameworks on FLR globally across different data sources. In doing so, several challenges and opportunities have been identified. One limitation concerns the consolidation of data among reporting platforms. In several frameworks, not all countries indicating commitments provide quantitative estimates, and not all countries reporting quantitative commitments provided corresponding data on implementation. This constrains the ability to assess progress comprehensively and to determine the proportion of pledged areas that have moved into active restoration. In reports where implementation data are available such as in FRA 2025, reporting practices are not fully standardized, and some countries report areas under restoration in terms of the number of trees planted rather

than the extent in hectares. Tree-based metrics, however, do not necessarily correspond to areas under restoration and cannot be interpreted as restoration extent without additional information on restoration objectives, outcomes and spatial coverage. The absence of consistent reporting units reduces the reliability of aggregated global progress estimates and constrains comparability across countries. In addition, the number of countries and consistency of data submitted differs by reporting framework and platform, as some countries report commitments or progress under one framework but not under others. As a result, cross-platform comparisons reflect not only differences in restoration ambition but also differences in reporting coverage. Additionally, the lack of spatial data and ecosystem-level breakdowns limits the ability to assess overlap, track ecosystem-specific recovery or reconcile forest restoration figures with landscape-scale initiatives. Strengthening spatial reporting and interoperability with geospatial platforms would improve transparency, analytic and monitoring capacity.

The observed disparities also reflect a lack of institutional coordination at the national level. Countries often report restoration data through multiple reporting channels, each aligned with different policy objectives and led by different institutions. Climate authorities, forest agencies, land management institutions and biodiversity focal points may report overlapping or divergent figures under nationally determined contributions, Global Forest Resources Assessment, land degradation neutrality targets, national biodiversity strategies and action plans, and Convention on Biological Diversity seventh national reports. Consequently, the same country may report different restoration areas under different frameworks, not because restoration activities differ, but because of differences in definitions, scopes, baselines and reporting mandates. These structural disparities indicate that current reporting systems for restoration targets capture overlapping but non-equivalent dimensions of restoration ambition. While they provide valuable insight into political commitment and regional prioritization, they do not yet support a harmonized assessment of implementation status or ecological and socioeconomic outcomes.

Another key limitation is the lack of standardized definitions among countries and reporting frameworks, for example on “degraded lands” and “forest and landscape restoration” itself and what is a “restored ecosystem”. To ensure credible and comparable assessments, countries and framework custodians should: (i) harmonize concept definitions and ecosystem classifications; (ii) standardize area-reporting units, baselines and metadata; and (iii) establish mechanisms to reconcile country-reported data across international frameworks, with the aim of aligning and validating data across reporting streams. Without such alignment, global restoration assessments will continue to reflect differences in reporting architecture as much as differences in restoration effort. FAO is currently leading efforts through the Target 2 Road Map^{aj} to work with partners to articulate synergies across international frameworks and conventions, namely the FRA, CBD, UNCCD, UNFCCC and Ramsar Convention on Wetlands and harmonize reporting on ecosystem restoration.

While current platforms report restoration progress mainly in terms of areas under restoration (hectares), there is little information available on impacts, and ecological and socioeconomic indicators are not being tracked. An illustrative example of monitoring and reporting beyond hectares is the FERM, where initiatives can select indicators beyond the biophysical realm, such as “jobs created” or “people trained” based on their objectives.

The inclusion of restoration variables in FRA 2025 represents a significant advancement in global forest restoration reporting. For the first time, countries were requested to provide information not only on restoration commitments, but also on legal frameworks, national definitions, areas in need of restoration and areas currently under restoration. FRA 2025 was the first global official data-collection effort on forest restoration and similarly, the CBD seventh national reports represent the first time countries have reported progress on the global restoration target for all ecosystems. As monitoring capacities improve and countries refine their restoration tracking systems, more comprehensive reporting

^{aj} See more information about the Target 2 Road Map here <https://www.fao.org/ecosystem-restoration-monitoring/about/gbf-target-2/roadmap/en> and in **Chapter 5**.

from additional countries and progressively more complete datasets are possible in future cycles. Strengthening project-level monitoring – particularly monitoring that captures location-specific and relevant biophysical, ecological and socioeconomic indicators – is essential for adaptive management and effective ecosystem restoration. While not all fine-scale project-level information needs to be aggregated at a broader scale, ensuring that a core set of harmonized indicators – such as area under restoration – can be consistently aggregated across initiatives is critical for building coherent and integrated national reporting systems.

Section 2.5 shows a gradual shift towards greater legal formalization, which can contribute to strengthening the accountability and enforceability of restoration commitments. This is important because legal and policy frameworks play a structural role in shaping how restoration efforts are organized, implemented and coordinated. Yet, implementation gaps persist partly due to limited resources, fragmented and overlapping institutional mandates, weak governance systems and insufficient enforcement. These gaps may also reflect challenges related to

the design, coherence and practical applicability of legal frameworks themselves, including the extent to which they are adapted to specific contexts and can be effectively interpreted and mobilized in practice. Stronger documentation of legal bases and clearer linkages between mandates and implementation outcomes would enhance transparency, accountability and long-term policy coherence to create the enabling environment for effective and sustained ecosystem restoration.

Overall, this chapter highlights the need for improved methodological guidance, clearer definitions, standardized reporting units, enhanced spatial integration, increased legal and policy coherence, and collaboration across society and government. Addressing these challenges in future reporting cycles for frameworks such as FRA and KMGBF will be essential to strengthening the robustness, comparability and policy relevance of global forest restoration data. Better data on FLR will strengthen our understanding of restoration needs and help catalyse the policy action, financing, long-term partnerships and on-the-ground action required to scale up effective restoration worldwide. ■



CAMBODIA

Community members
plant native tree
seedlings for forest
restoration.

© FAO/Christophe Besacier

CHAPTER 3

COST-EFFECTIVE WAYS TO DELIVER THE MULTIPLE BENEFITS OF FOREST AND LANDSCAPE RESTORATION INVESTMENTS FOR PEOPLE AND NATURE

3.1 INTRODUCTION

Ecosystem restoration provides major economic, social and environmental benefits and is a vital nature-based solution to global challenges. Healthy ecosystems support more than half the world's gross domestic product (GDP). Under favourable conditions and over long time horizons, returns of up to USD 30 for every USD 1 invested have been estimated, and restoring over 1 billion ha of degraded land could provide USD 1.8 trillion per year in benefits.⁸² Investing USD 2.6 trillion over 15 years in land degradation and drought mitigation could yield an eight-to-one social return.⁸²

Most benefits stem from improved ecosystem services – worth USD 992 billion per year, representing 53 percent of all the benefits combined – including enhanced biodiversity, water regulation and improved soil fertility.⁸² Global commitment is strong: nearly 400 national targets under the Kunming–Montreal Global Biodiversity Framework (KMGBF) relate to Target 2; as highlighted in **Chapter 2**, if they were met, about half these targets would achieve nearly 30 percent of global ambition – with two-thirds of countries setting terrestrial restoration goals and many focusing on forests. This underscores

the central role of forest and landscape restoration (FLR) in achieving biodiversity, climate and development outcomes. When combined with nationally determined contributions (NDCs) and land degradation neutrality (LDN) targets, these pledges enable aligned, synergistic restoration programmes that benefit nature, people and the planet.⁸³

Together, these policy frameworks can improve targeting priority areas of restoration. Global analyses show that restoring areas where biodiversity, carbon and water values overlap delivers multiple benefits and higher overall returns.^{27, 84} These insights also clarify that effective entry points differ across scales, with landscape-level vision, coordination and public policy frameworks guiding priorities, while implementation and stewardship are driven by local and individual actions, including by communities and private actors.

More than 1.3 billion people currently live on increasingly degraded agricultural land. Restoration efforts can help address land degradation in these areas, playing a critical role in ensuring food security.⁸² Restoration and avoiding degradation together could deliver a substantial share of climate change mitigation by 2030: natural climate solutions – including ecosystem restoration and avoiding land

degradation – have been estimated to provide around one-third of the mitigation needed. Additionally, broader mitigation potentials in the agriculture, forestry and other land use sector also include agricultural and livestock emissions⁴⁷ (Chapter 5).

Investments in dryland agriculture, mangroves and water management further strengthen resilience and economic value.⁸² Yet cost and cost-benefit data remain limited and inconsistent across biomes, interventions and methods, fostering the misconception that restoration is inherently costly.^{85–87}

Costs vary widely; natural regeneration is often inexpensive, whereas active restoration can be up to ten times more costly where ecosystems have low regenerative capacity.⁸⁸ Without standardized data, or indicative cost ranges by ecosystem and territory, combined with practical tools to assess costs and benefits under local conditions, decision makers struggle to gauge long-term value.⁸⁵

A more coherent and standardized understanding of the costs and benefits of FLR is essential for guiding the transitions towards regenerative economies.⁸⁹ This chapter examines both the benefits and costs associated with FLR, focusing primarily on the use of this approach for ensuring comparability of global evidence and alignment with the mandate of *The State of the World's Forests*. It begins by reviewing restoration benefits and then analyses costs – recognizing that these dimensions must be assessed together – and provides the analytical foundation for the four restoration pathways discussed in Chapter 4. ■

3.2 FOREST AND LANDSCAPE RESTORATION GENERATES MULTIPLE BENEFITS ACROSS SCALES FOR PEOPLE AND NATURE

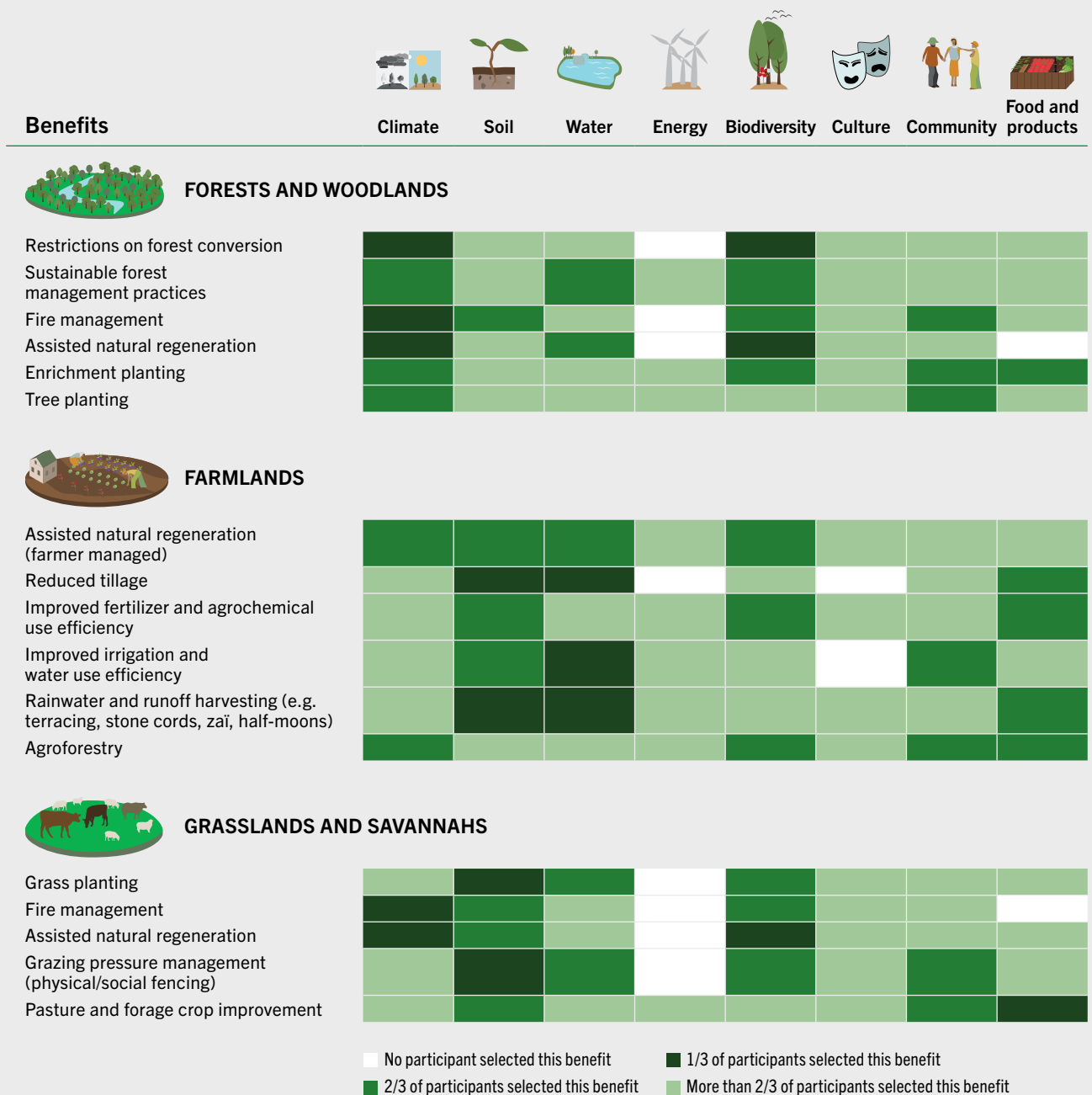
3.2.1 Combining restoration interventions to attain different objectives and benefits

Forest and landscape restoration is a process aimed at regaining ecological functionality and structure, which generates multiple benefits across provisioning, regulating, cultural and supporting ecosystem services (Figure 3.1). Restoration benefits encompass both an increased supply of essential ecosystem services, such as provisioning services (e.g. food, timber, medicines and water), regulating services (e.g. water purification and climate regulation), cultural services (e.g. spiritual benefits, tourism, recreational and aesthetic values) and supporting services (e.g. nutrients and soil), all of which are fundamental for human well-being.^{82, 90, 91} These benefits foster the ability of both ecosystems and people to cope with environmental variability.

Forest and landscape restoration generates multiple ecosystem service benefits, but these benefits are not automatic; they depend on the type of intervention, ecological context, governance conditions, time horizon and distribution of costs and benefits.

Restoration interventions vary widely – from tree planting approaches as part of monocultures, agroforestry and mixed species forest restoration, to assisted natural regeneration (ANR) and ecological restoration – each leading to distinct outcomes for nature and people (Figure 1.5).

Because these methods differ in their techniques, management and ecological conditions, they inherently support different objectives and generate different benefits. The adequate selection and combination of restoration interventions will depend on the context, communities' needs and the benefits expected to be generated by different restoration processes in a given area.

FIGURE 3.1 BENEFITS GENERATED BY FOREST AND LANDSCAPE RESTORATION INTERVENTIONS IN VARIOUS LANDSCAPES

NOTES: Forest and landscape restoration is implemented along a continuum of interventions selected for the benefits they provide, depending on the context and conditions of each landscape. This figure presents the results of a survey where restoration experts were asked to select the benefits associated with different interventions in various landscapes. The benefits described assume that the restoration design and outcomes are ideal; they are considered to occur if the interventions are carried out correctly and under the right conditions. Since interventions across different landscapes provide distinct benefits to the groups living in them, these benefits may be perceived differently by beneficiaries depending on their proximity to the interventions, as discussed later in this chapter.

SOURCE: Authors' own elaboration in consultation with experts.

Reforestation approaches can target highly diverse goals, including timber production, biodiversity recovery, livelihood support, climate change mitigation and watershed protection.⁹² Depending on the approach chosen, such as intensive monoculture, enrichment planting or natural regeneration, trade-offs inevitably arise,⁹³ shaped not only by ecological outcomes but also by time horizons and by how costs and benefits are shared among different actors.

Creating multifunctional landscapes, therefore, requires combining different reforestation types across space and time to balance these trade-offs and align with local socioecological realities.²⁹

Similarly, ANR leads to another set of benefits and constraints. It is cost-effective, enhances native biodiversity and restores ecosystem functions, such as water regulation, soil formation, erosion control and carbon storage.^{94, 95} However, its success depends heavily on local biophysical and landscape conditions, meaning that it is best suited to areas with high natural regeneration potential and low opportunity costs.⁹³ In contrast, areas with low regeneration capacity may require more intensive tree planting approaches to meet restoration goals.

No single intervention is “best”. Instead, each restoration strategy is suited to particular objectives and site conditions and thus produces different ecological, economic and social benefits (Figure 3.2).

Therefore, effective FLR depends on selecting and combining interventions that match desired outcomes while minimizing trade-offs and maximizing benefits for both people and nature.

Forest restoration improves hydrological processes, microclimates, soils and biodiversity, generating multiple co-benefits across ecological and socioeconomic systems.^{48, 91, 96, 97} Increased ground cover reduces erosion, slows runoff and boosts infiltration, thereby strengthening agricultural stability in regions such as the Loess Plateau in China and the drylands of Eastern Africa.^{91, 98, 99}

On the Loess Plateau, vegetation recovery has improved soil retention and reduced sediment yields.^{100, 101} It has improved soil structure and shades farms located near vegetated buffer zones from extreme heat, reducing stress on crops and livestock,^{102, 103} while restoration also moderates temperatures and alleviates environmental pressures affecting human health and well-being.¹⁰⁴

At the same time, restoration enhances biodiversity at ecosystem, species and genetic levels – even where full reference conditions are not reached – thereby increasing ecosystem resilience, strengthening freshwater systems and restoring connectivity for wildlife and seed dispersal.^{90, 91} Genetic diversity further supports disease resistance, pollination, soil health, diverse food sources and cultural values. Overall, restoring degraded lands increases resilience to droughts and floods⁸ (Box 3.1). Early interventions often prioritize rapid vegetation establishment to stabilize soils; for example, phytoremediation efforts in Lake Michigan and Lake Superior watersheds in the United States of America used 20 000 hybrid poplars and willows to reduce runoff and improve stormwater control (Case study 15). Natural capital assessments and participatory valuation highlight broader gains – from biodiversity and improved soils to microclimate regulation and climate change mitigation.^{61, 105} Global analyses indicate restoration can be cost-effective,^{ak} particularly where natural regeneration reduces establishment costs and reinforces ecosystem functions.¹⁰⁶

ak In this publication, cost-effectiveness refers to the extent to which an intervention achieves desired outcomes at the lowest possible cost, by maximizing benefits relative to the resources invested. In the context of restoration, it implies delivering the greatest ecological, social and economic gains, such as improved biodiversity, soil health and climate regulation, for each unit of expenditure.

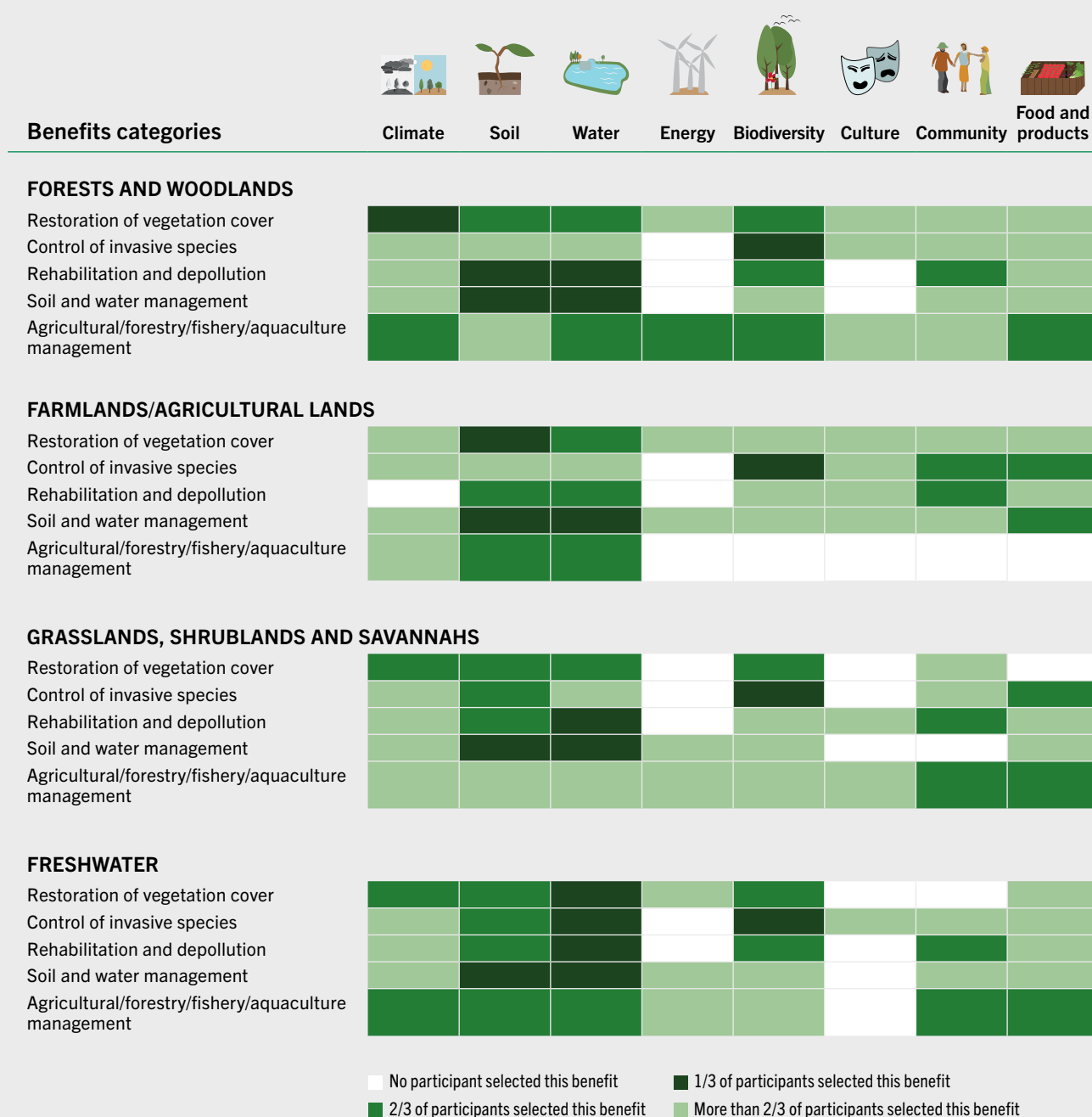
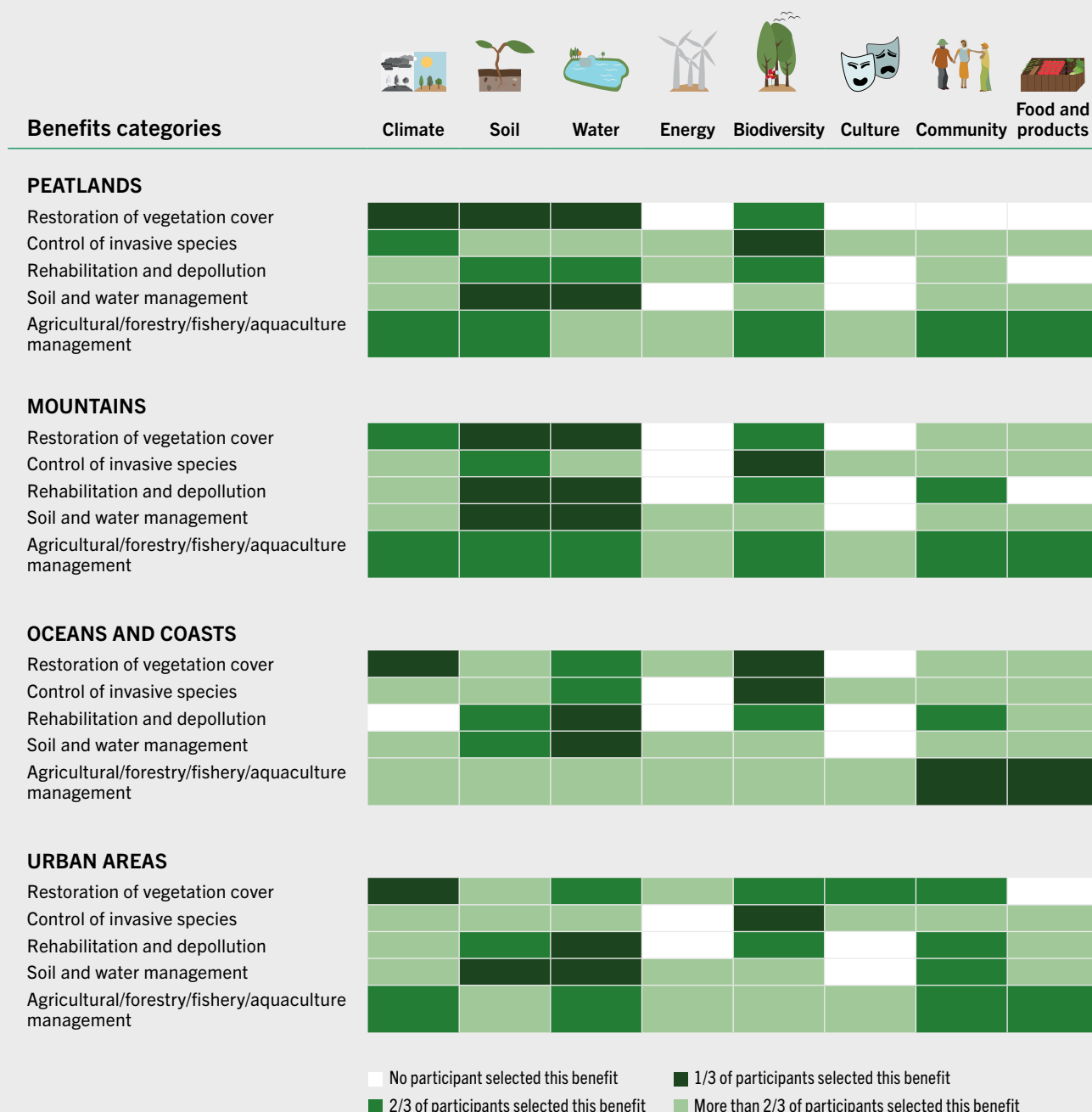
FIGURE 3.2 BENEFITS TO EXPECT FROM SPECIFIC RESTORATION INTERVENTIONS IN VARIOUS ECOSYSTEMS

FIGURE 3.2 (Continued)



NOTES: The ecosystem types are based on the classification of the United Nations Decade on Ecosystem Restoration 2021–2030; the restoration interventions are based on activity categories in the Framework for Ecosystem Restoration Monitoring (FERM) platform, based on The Economics of Ecosystem Restoration's (TEER) glossary of interventions; and the benefit categories are based on the Restoration Monitoring Wheel (FAO & WRI. 2019. *The Road to Restoration: A Guide to Identifying Priorities and Indicators for Monitoring Forest and Landscape Restoration*. Rome, FAO and Washington, DC, WRI). The Restoration Monitoring Wheel is a participatory, multidimensional assessment framework used to track and evaluate the progress and quality of ecosystem restoration over time. It provides a structured yet flexible way of monitoring restoration outcomes across key domains – typically including ecological integrity, socioeconomic benefits, governance and implementation processes.

SOURCE: Authors' own elaboration in consultation with experts.

BOX 3.1 QUANTIFYING CLIMATE CHANGE MITIGATION AS A CO-BENEFIT OF RESTORATION INTERVENTIONS

Restoration efforts lead to sustainably managed and resilient landscapes that deliver environmental and socioeconomic benefits, with carbon sequestration increasingly recognized as a major co-benefit.⁶¹ Central to restoration efforts is the recovery of healthy soils and vegetation cover. These provide essential ecosystem services, such as water regulation, erosion control and long-term productivity, but also act as dynamic carbon sinks by sequestering carbon in biomass and the soil.^{107–109} Land-based restoration interventions thus have strong potential to mitigate climate change. In this context, robust carbon accounting is essential, for two main reasons:

- ▶ An accurate assessment of carbon sequestration in forests, soils and agroecological systems provides science-based evidence of how much carbon is being absorbed and stored, ensuring that land-based climate solutions are both credible and actionable.
- ▶ Reliably measuring and monitoring carbon dynamics enables stakeholders to track progress towards national and global climate commitments, design mitigation strategies aligned with land-use priorities and prioritize cost-effective practices that deliver high mitigation outcomes.⁴⁷

The Food and Agriculture Organization of the United Nations (FAO) conducted a study to quantify climate change mitigation potentials associated with key restoration activities in forests, soils and mangrove ecosystems using FAO's Environmental eXternalities ACcounting Tool (EX-ACT). This tool uses a standardized, science-based method for

estimating greenhouse gas (GHG) emissions and emissions mitigation across the agrifood sector.¹¹⁰ The methodology used in the study and the study results are reported in **Appendix 4**. The mitigation potentials estimated are provided as ranges in **Table A4.2**.

The key takeaways from the study are as follows:

- ▶ Mangrove restoration showcases the highest carbon mitigation potential, due to rich-soils and high root productivity.^{111, 112}
- ▶ Terrestrial forest restoration typically achieves high per-hectare mitigation due to greater biomass density.^{52, 113}
- ▶ Agroforestry and mosaic restoration often yield moderate per-hectare gains; however, in absolute term these systems can result in large cumulative mitigation because they can be applied across more extensive areas.^{47, 65, 114}
- ▶ Sustainable agricultural practices, such as cover crops, reduced tillage and improved fallows generally produce incremental but sustained increases in soil organic carbon.^{112, 115}

Since emission ranges and sequestration depend on climatic zones, moisture regimes, soil types, land-cover transition and management intensity, context-specific measurements remain essential; localized data, long-term monitoring and transparent reporting are crucial to ensuring that climate change mitigation as a co-benefit is effectively and credibly included in any assessment of the cost-effectiveness and benefits of restoration interventions.

NOTE: The methodological approach used in this study is available in **Appendix 4**.

3.2.2 Forest and landscape restoration is economically and socially transformative for communities

Economic transformation and livelihood diversification

Forest and landscape restoration enhances and creates new livelihood opportunities through restoration activities and the improved economic

prospects that emerge as landscapes recover. In many regions, during restoration implementation, communities earn income from seed collection, nursery production, site preparation, planting, regeneration management and basic monitoring, offering more stable earnings where agricultural labour is uncertain.^{116, 117} Local enterprises supplying seedlings, transport, mapping, fencing, monitoring and certification often

BOX 3.2 SMALLHOLDER LAND RESTORATION

Smallholder agriculture – defined as farms under 2 ha – remains central to global agrifood systems, with 570 million households producing 35 percent of the world's food on only 12 percent of agricultural land.¹²⁵ Restoration on smallholder land generally follows two approaches. The first focuses on improving soil health through physical and biological practices.¹²⁶ Healthy soils are increasingly recognized as essential for productivity gains and food availability, which underpin income and employment improvements.¹²⁷ However, productivity increases can sometimes induce agricultural expansion and forest clearing,¹²⁸ which need safeguards, land-use planning and incentives to avoid leakage or rebound effects. The second approach involves afforestation or tree planting on smallholder farms.¹²⁹ Diverse smallholder systems, from

woodlots to home gardens, contribute to timber supply, livelihoods and environmental sustainability.¹³⁰ On-farm timber production can be an important subsistence and economic activity for smallholder farmers around the world. For instance, the bolaina (*Guazuma crinite* Mart.) value chain in Peru provides a valuable example of both the potential of smallholder timber production and the coordinated package of actions that is required to develop such value chains. This fast-growing species grows naturally on fallow land, thus providing a simple and cost-effective way of producing timber that can be integrated into agricultural activities.¹³¹ In contrast, well-designed agroforestry systems, which integrate productive and environmental benefits, tend to be economically viable and more attractive for smallholders.

emerge around restoration, especially where procurement is transparent and community roles are recognized.⁴³

As vegetation recovers, households gain access to a wider range of forest and farm products, such as fruits, nuts, herbs, timber and fuelwood, which support self-sufficiency, food security, dietary diversity and income diversification.^{118, 119} In Côte d'Ivoire, the PROMIRE project (**Case study 2**) restored more than 4 600 ha using agroforestry systems that combine forest fruits, agricultural fruit tree species and shade and timber tree species, thereby improving soil conditions and diversifying household income sources.^{102, 103} Strengthening climate resilience is achieved through income diversification, social inclusion, gender-responsive local governance and land tenure security. In the Sahel, farmer-managed natural regeneration has been associated with 10–30 percent income gains, higher crop yields and greater availability of tree products thanks to strong local participation.¹²⁰ These outcomes enhance livelihood stability and reduce reliance on external support, particularly in climate-stressed regions. Some restored areas and improved ecosystems attract tourism, creating income for families engaged in guiding, hospitality and crafts.¹²¹ These benefits tend

to be strongest where restoration is integrated into long-term land-use plans and supported by active local institutions^{122, 123} and where protected areas or scenic attractions are present in the landscape. Taken together, restoration can generate a cycle in which communities gain access to training, finance and markets, turning restoration into a driver of local economic transformation. Many ecological and management gains remain undervalued in conventional cost-benefit analyses,⁸⁶ yet evidence from Nepal, the Plurinational State of Bolivia and the United Republic of Tanzania shows that restoration contributes substantially to long-term livelihood stability and overall landscape performance¹²⁴ (**Box 3.2**).

Social empowerment

Restoration strengthens local capacities along the production chain, from seed selection and processing to plant health management, propagation and field maintenance. Drawing on local knowledge of soils, microclimates and seedling care further reinforces these skills.^{132, 133} Women and youth often lead nurseries, producer groups and monitoring initiatives, and their participation contributes improved site management and stronger community engagement.^{134, 135} The return of

particular species or landscape features can reinforce identity, heritage and spiritual values that influence long-term protection.¹³⁶ Traditional ecological knowledge contributes to species selection and site management, and projects that incorporate it tend to align more closely with local conditions.^{137, 138} Research from Latin America and other regions shows that these cultural and relational dimensions are strongly linked with well-being, local governance and long-term commitment to restored landscapes.^{139, 140} For example, in Brazil, Xukuru Indigenous Peoples have led a biocentric restoration project over 91.5 ha in a rocky ecosystem of a sacred territory, with a strong grounding in respect for nature that transcends its utility to humans (**Case study 18**).

Traditional and community-based systems, including shaded coffee in the Bolivarian Republic of Venezuela and Colombia, cacao cabruca, a traditional cocoa agroforestry system, in Brazil and Western Africa, and *erva-mate* agroforests in southern Brazil and Paraguay, reflect generations of ecological knowledge, stewardship values and social organization.^{136, 138, 141} These systems also illustrate how agroforestry knowledge is generated, validated and transmitted through long-term practice and social relations, rather than through standardized technical prescriptions alone.¹⁴² Comparable arrangements documented across Africa and Asia^{143, 144} integrate multiple species, maintain biodiversity and conserve culturally important plants while supporting intergenerational learning and collective organization. More recent research from Latin America and other regions shows that, in contexts where restoration is embedded in long-standing local institutions and culturally rooted land-use systems, these cultural and relational dimensions are closely linked to local governance, well-being and sustained commitment to restored landscapes.^{139, 140} Their continuity illustrates how cultural values and ecological outcomes reinforce one another and how restored landscapes contribute to stable local governance over time.

Improved socioecological resilience

More stable yields and a wider range of forest and farm products strengthen household food security, diets and well-being.^{118, 145} Vegetation recovery also reduces hazards such as landslides,

sedimentation and flooding, thereby protecting homes and cropland.^{146, 147} Reviews show these ecological gains enhance carbon storage and ecosystem integrity, which improves resilience at the household and landscape scale.⁸ Areas under restoration also ease pressure on water and grazing resources, thereby reducing conflict and stabilizing local management.^{148, 149} Research on rural–urban linkages highlights improved water supply, reduced environmental hazards and more diversified livelihoods, which strengthens territorial resilience.¹⁵⁰ In peri-urban areas, trees and green spaces improve thermal comfort and quality of life,^{90, 151} thereby creating stronger foundations for communities facing climate uncertainty.^{22, 152} Global assessments confirm that restoration reduces exposure to extreme rainfall, heat and erosion.¹⁵³ In territories governed by Indigenous Peoples, stewardship practices sustain locally important food and knowledge systems, supporting dietary diversity and cultural continuity.¹⁵⁴

Agroforestry as a restoration option directly contributes to ecological resilience by integrating trees, crops and livestock across production systems. Multiple vegetation layers regulate temperature and humidity, retain soil moisture and limit erosion, thereby stabilizing production under variable rainfall. Tree–crop and tree–pasture systems improve soil fertility and maintain biological processes that lower input needs while supporting ecological integrity.^{145, 151} Agroforestry in degraded or marginal areas expands productive options and reduces climate vulnerability.¹⁵² These systems rely on locally grounded knowledge and management practices that are essential for long-term resilience.¹⁴² Restoration can also generate new products and income streams, making livelihood gains more durable by linking production to markets, enterprises and enabling policies. Diversified income from agroforestry and non-timber forest products, such as fuelwood, fodder, honey and mushrooms, strengthens food security and economic resilience, helping households to buffer climatic and economic shocks.¹⁵⁵ These benefits are often especially important for women and marginalized groups, for whom diversified income contributes to improved financial security and livelihood stability.

MOROCCO

Regenerating
Atlas cedar trees.
© FAO/Valentina Garavaglia

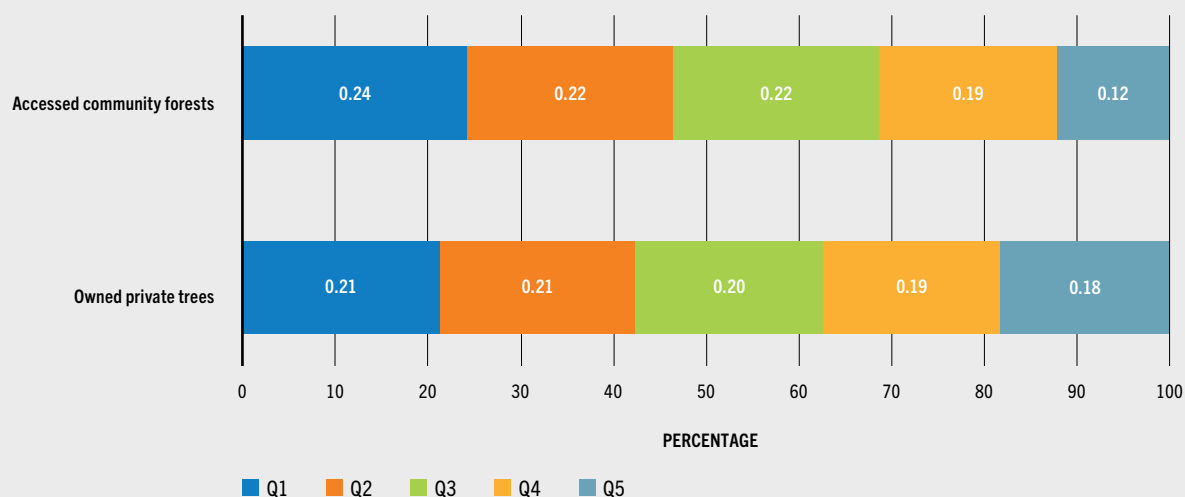
BOX 3.3 TREES UNDER PRIVATE TENURE IN NEPAL REDUCE DEPENDENCY ON COMMUNITY FORESTS

In the 1990s, Nepal's community forestry programme devolved the restoration of degraded government forests to community forest user groups.¹⁵⁶ These community forest user groups used temporary exclosures to regenerate biomass and later allowed regulated access for member households. Creating exclosures in contexts where households depend on forests encourages planting trees under private tenure. Over the past two decades, extensive out-migration has reduced the availability of household labour, while remittances have enabled smallholders to reduce crop cultivation and expand the cover of trees under private tenure.^{156, 157} National data confirm declining crop areas (Agricultural Census 2021/22) and rising forest cover.¹⁵⁸

A nationally representative survey carried out in 2023 found that 48 percent of households owned trees under private tenure and 39 percent accessed community forests for non-timber forest products.¹⁵⁹ Poorer households accounted for a larger share of community forests, while richer and poorer households alike reported trees under private tenure ownership, as shown in the Figure.

The ownership of trees under private tenure reduced reliance on community forests – especially for firewood and fodder – saving women significant time and labour. Supporting small-scale agroforestry can improve livelihoods and reduce pressure on community forests by expanding access to quality saplings, inputs and training on ecologically suitable agroforestry practices.

FIGURE RELIANCE ON COMMUNITY FORESTS AND TREES UNDER PRIVATE TENURE BY POVERTY STATUS IN NEPAL



NOTES: Poorer households rely more heavily on community forests, while ownership of trees under private tenure is widespread across all wealth quintiles. This suggests that private-tenure trees reduce dependency on community forests and associated labour burdens, particularly for lower-income households. Poverty status is measured using quintiles of per capita annual household consumption expenditure (Q1–Q5), where Q1 represents the poorest 20 percent of the population. Data was collected between January and April 2023, with recall periods 12 months prior to the date of the interview

SOURCE: World Bank. 2025. *May the Forest Be With You: Mapping Nepali Landscapes and Livelihoods*. Washington, DC. <https://doi.org/10.1596/43894>

3.2.3 Benefits for the private sector from forest and landscape restoration

Of the 13 billion ha of ice-free land, 6.6 billion ha are working lands – defined here as agricultural, pasture- and forestlands actively managed for production – used to produce goods consumed by people.^{160–162} While companies often support restoration outside their value chains, those with land footprints are increasingly recognizing the benefits of integrating restoration directly into their own value chain management (called “insetting”). Emerging voluntary and regulatory reporting frameworks highlight nature related physical, regulatory and reputational risks, encouraging companies to invest in risk mitigation measures. Through one of these regulatory frameworks, the Science-Based Targets for Nature, firms can now address impacts within their value chains and engage in restoration in the landscapes that are material to their land-related impacts.¹⁶³

Within forested and tree-based landscapes, FLR offers a comprehensive means of strengthening corporate resilience,¹⁶⁴ profitability and leadership, while contributing to climate change mitigation and carbon neutrality goals. The scale of potential impact in value chains far exceeds past private sector restoration finance. Recent examples include approximately USD 40 billion in corporate commitment to support sustainable food and farming over the next five years to support long-term sustainable growth across the sector, including many key FLR actions in working lands. South-eastern Asia’s second largest financial services group by assets, has launched the first financing facility with interest rate incentives tied to Science-Based Targets initiative (SBTi)-validated Forest, Land and Agriculture (FLAG) targets for 1.5 °C climate alignment. The loan is a sustainability-linked revolving credit facility worth USD 600 million incorporating SBTi-validated FLAG emissions reduction and deforestation-free targets. For reference, the entire voluntary carbon market’s estimated value in 2024 is USD 1.4 billion.¹⁶⁵ Forest and landscape restoration can yield short- to long-term corporate benefits by reducing regulatory, supply and demand risks, generating new growth opportunities and reinforcing values-based leadership.¹⁶⁶

Analyses further show that restoration strengthens production landscapes and reduces long-term development risks.¹⁶⁷ With USD 44 trillion of economic value dependent on nature,¹⁶⁴ businesses face mounting risks from degradation and climate change. Investing early in restoration provides a competitive advantage and positions companies as leaders in the shift to a net zero economy.¹⁶⁸

This requires rethinking the traditional mitigation hierarchy towards one that emphasizes avoiding and reducing impacts while regenerating working lands and restoring ecosystems.¹⁶³ Despite challenges, including long time frames, technical complexity, market alignment, limited incentives and tenure issues,¹⁶⁶ companies typically engage through physical and transition risk management, compliance and regulatory considerations, and reputational or financial motivations.

Benefits of addressing physical and transition risks in production landscapes

Many businesses, even those outside the forestry sector, depend on ecosystem services, such as water regulation, soil fertility and pollination, and face rising supply, regulatory and market risks as degradation intensifies.¹⁶⁴ Restoration supports these essential services, including pollination, erosion control and microclimate regulation. Pollination alone contributes hundreds of billions of dollars annually to global agriculture,¹⁶⁹ yet pollinator populations are declining, with more than one-fifth of native species in North America at elevated risk of extinction¹⁷⁰ and broader evidence linking declines to growing risks for agrifood systems.¹⁷¹ By conserving and reconnecting habitats, landscape restoration can stabilize pollination services, reduce supply disruptions and strengthen sourcing resilience across agricultural value chains.

Forest and landscape restoration also enhances supply chain resilience by reinforcing the ecological foundations of production systems, particularly in regions where small and medium enterprises^{al} and smallholders dominate sourcing networks.^{164, 166} Nature-based solutions – including restoration – can significantly

^{al} “Small and medium enterprises” is used here in a generic sense, as definitions vary by country and sector, and includes microenterprises and producer organizations with business purposes, consistent with FAO usage.

reduce climate-related risks, with estimates suggesting up to USD 170 billion per year in avoided losses by 2030.¹⁷² Restoration stabilizes yields and moderates hydrological extremes, lowering exposure to shocks in agriculture and forestry. The World Bank's Country Climate and Development Reports increasingly recognize nature loss and restoration as macrocritical risks and opportunities, with synthesis across 93 economies highlighting the integration of ecosystem services into macroeconomic diagnostics.¹⁵⁹ Multinational companies are also embedding restoration and agroforestry into supply chain risk management strategies. In the cocoa and coffee sectors, firms support restoration among suppliers to improve soil health and climate resilience, thereby reducing long-term sourcing risk.¹⁶⁶ These inseting approaches show how restoration can deliver direct business benefits while contributing to landscape scale ecological recovery.

Benefits of addressing regulatory and compliance risks

Some businesses engage with FLR through offsetting and voluntary environmental commitments linked to carbon, biodiversity and water outcomes, particularly where residual impacts cannot be fully avoided. Interest in these approaches has increased as regulatory requirements, disclosure frameworks and stakeholder scrutiny shape corporate environmental performance. Regulatory and disclosure requirements, including those under the International Sustainability Standards Board, and emerging nature-related disclosure frameworks, such as the Taskforce on Nature-related Financial Disclosures, are further raising expectations for companies to account for climate- and nature-related risks within their value chains.^{173, 174}

Restoration can deliver climate and biodiversity outcomes that are increasingly recognized within voluntary carbon markets and emerging nature-related reporting and disclosure frameworks, often alongside co-benefits for ecosystem services. Compared with many technological mitigation options, nature-based solutions are widely cited as offering cost-effective mitigation potential, which has contributed to growing private sector interest in

restoration linked offsetting and compensation initiatives, particularly in sectors with substantial land use footprints. However, most corporate frameworks that incorporate restoration as a compensatory mechanism explicitly require that such actions complement, rather than substitute for, efforts to reduce emissions and environmental impacts within companies' own operations and supply chains. As a result, restoration cannot be used to offset impacts that companies have chosen not to address at source, especially where land use impacts are material to business activities. Despite decades of use, restoration-based offsets face well-documented limitations or absence of evidence related to permanence, additionality, leakage and social safeguards, and most frameworks emphasize that such approaches should complement rather than replace direct emissions reductions and other mitigation efforts, as structured in the mitigation hierarchy and the science-based target for nature.¹⁷⁵ The long time frames required for ecosystems to recover also mean that many benefits accrue gradually, reinforcing the importance of viewing restoration-linked offsetting as part of broader, long-term sustainability strategies rather than as a stand-alone solution.

Benefits of addressing reputational, market and financial risks

Forest and landscape restoration creates opportunities for businesses to enter premium markets through sustainability labels and certifications, such as the Forest Stewardship Council (FSC), Rainforest Alliance or organic and fairtrade standards, and to access innovative finance streams including carbon markets, green bonds and blended finance (**Chapter 4**). Consumers are increasingly willing to pay more for environmentally responsible products.^{am}

Forest and landscape restoration combined with sustainable forest management could generate USD 165 billion in additional annual revenue by

am In January and February 2024, PricewaterhouseCoopers surveyed 20 662 consumers across 31 countries and territories: Australia; Brazil; Canada; China; Czechia; Egypt; France; Germany; China, Hong Kong SAR; Hungary; India; Indonesia; Ireland; Malaysia; Mexico; Kingdom of the Netherlands; Philippines; Poland; Qatar; Romania; Saudi Arabia; Singapore; Slovakia; South Africa; Republic of Korea; Spain; Thailand; United Arab Emirates; Ukraine; United States of America; and Viet Nam. See <https://www.pwc.com/gx/en/issues/c-suite-insights/voice-of-the-consumer-survey/2024.html>

2030,¹⁶⁴ while FSC certified roundwood yields an extra USD 1.80 per cubic metre through premiums and efficiency gains.¹⁷⁶ Examples include a Brazilian pulp and paper company reducing costs by integrating native species with eucalyptus, thereby enhancing ecosystem services such as soil fertility, water regulation and natural pest control, which improved productivity and reduced input costs, amid rising global demand for sustainable wood expected to double or triple by 2050.¹⁷⁷

In Burkina Faso, a women-led cooperative restoring shea parklands achieved organic and fairtrade certification, allowing it to sell higher quality shea products into premium export markets. This resulted in unit price increases of 20–30 percent, a 40 percent rise in export volumes, and growth in annual revenues from USD 150 000 to USD 210 000.^{178–180}

Restoration linked carbon finance can also generate meaningful income.¹⁸¹ Nicaragua's Community Tree Carbon Program has delivered over USD 40 million to farmers since 2010, including USD 9.7 million in direct payments for ecosystem services through Plan Vivo certified credits.¹⁸² As the largest programme under the Plan Vivo Standard, it demonstrates how high-quality carbon credits can deliver verified emissions reductions alongside poverty alleviation and gender equity.

Private sector engagement takes many forms. Beyond compliance and risk management, more companies are embedding social and ecological goals into their business models. Certified B corporations – companies independently verified to meet high standards of social and environmental performance – demonstrate that profitability and environmental commitment can reinforce each other.

Regenerative business models are also emerging: one Brazilian cosmetics company now uses *ucuuba* seed butter from standing trees, generating approximately three times more cumulative income per tree over time than felling the same tree for timber, while contributing to the recovery of a formerly endangered species.¹⁶⁶ Similarly, a beverage company created a North American market for yerba mate sourced from restored Atlantic Forest landscapes,¹⁶⁶

illustrating how demand for sustainable products can raise the value of standing forests and incentivize restoration.

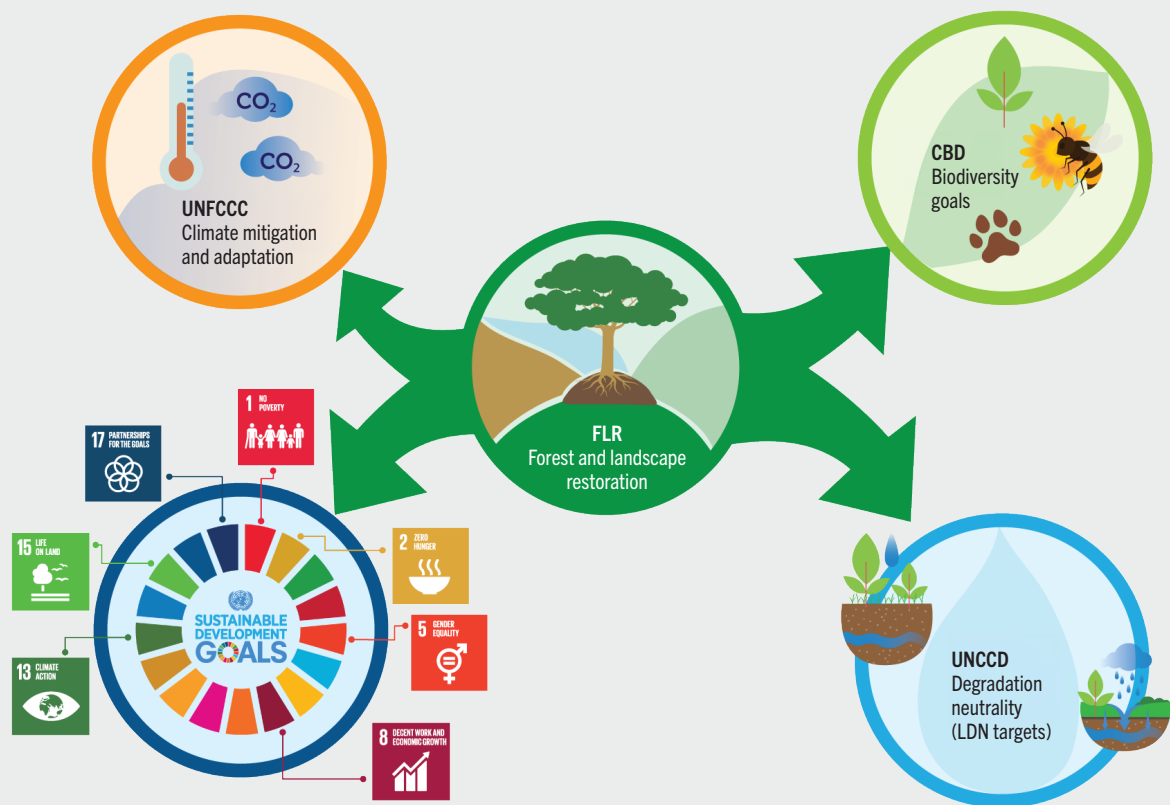
Forest and landscape restoration investments enable businesses to align their values with consumer values, strengthen brand trust and build strategic partnerships, while driving sustainability across supply chains. These mechanisms can also enable better financing terms, including concessional loans, sustainability linked finance and improved insurance conditions. Demand for sustainable products is rising, with 79 percent of consumers in Europe, India and the United States of America willing to change habits based on sustainability concerns.¹⁸³

Companies are responding: for example, a global food company partners with cocoa suppliers and local actors to restore the Cavally Forest in Côte d'Ivoire,¹⁸⁴ which led to a significant reduction in deforestation, the natural regeneration of 7 000 ha, the reforestation of almost 1 500 ha and more than 1 400 people benefiting financially from the project. While a major United States retailer has pledged to help protect, manage and restore 20 million ha of land and 2.6 million km² of ocean by 2030 through its Project Gigaton initiative, which has reached its goal to reduce, avoid, or sequester 1 gigaton of emissions from its supply chain six years earlier than expected. By leveraging their scale, these companies demonstrate how businesses can drive change throughout their supply chains. These efforts work best when supported by policy coherence, safeguards and strong public institutions – topics addressed in **Chapter 4**.

3.2.4 Forest and landscape restoration allows government, policymakers and institutions to effectively promote the transition to a regenerative economy

Forest and landscape restoration delivers interconnected benefits across climate, biodiversity, land and development objectives, operating from local livelihoods and well-being to national resilience and international commitments.

FIGURE 3.3 CONCEPTUAL RELATIONSHIPS AMONG GLOBAL CLIMATE, BIODIVERSITY, LAND AND DISASTER RISK COMMITMENTS WITHIN THE 2030 AGENDA FOR SUSTAINABLE DEVELOPMENT



NOTES: While these international frameworks are distinct, they are strongly synergistic and collectively contribute to the achievement of the Sustainable Development Goals, which provide the overarching and integrative policy framework. CBD = Convention on Biological Diversity, UNCCD = United Nations Convention to Combat Desertification, UNFCCC = United Nations Framework Convention on Climate Change.

SOURCE: Authors' own elaboration.

By restoring ecological functionality at the landscape scale, restoration strengthens climate change mitigation and adaptation, supports biodiversity recovery, stabilizes land and water systems, and underpins social and economic outcomes, including risk reduction, livelihood diversification and long-term sustainability of production systems. Forest and landscape restoration also contributes to food security through multiple ways, including water regulation that sustains rainfed agriculture, effects on agricultural productivity, and the provision of forest foods and inland fisheries, as discussed elsewhere in the chapter. These interlinked benefits are synthesized in [Figure 3.3](#).

Forest and landscape restoration as a strategy for economic stability and risk reduction

Forest and landscape restoration is highly relevant for national economic planning because it reduces exposure to climate and environmental hazards that impose recurring fiscal burdens.

Evidence from many regions shows that nature-based solutions lower disaster losses and reduce long-term public spending on repairs and risk management.¹⁹² Avoiding drought alone brings an estimated USD 106 billion in annual global benefits.⁸² The restoration of upstream catchments and degraded slopes has been linked to reduced flood damage and reconstruction costs,

BOX 3.4 ACHIEVING LAND DEGRADATION NEUTRALITY TARGETS WITH PHYTOMELIORATION OF DEGRADED PASTURES AND AGROFORESTRY: THE CASE OF THE BLACK LANDS AND KIZLYAR PASTURES IN THE NORTHERN CASPIAN REGION, RUSSIAN FEDERATION

In the 1980s, the Northern Caspian region – especially Kalmykia – faced severe desertification due to arid climate conditions and pasture overuse, resulting in high soil salinity, widespread livestock losses and large areas classified as ecologically devastated.^{185–188} The livelihoods of over 135 000 people reliant on livestock grazing were threatened by this degradation.¹⁸⁶ In 1986, in what is now the Russian Federation (then part of the Union of Soviet Socialist Republics), the General Plan to Combat Desertification of the Black Lands and Kizlyar Pastures was launched, becoming one of the most successful large-scale restoration programmes in the region. Between 1990 and 1995, over 250 000 ha of pasture were placed under restoration, and 400 000 ha of sand were stabilized, generating long-term economic benefits for more than 50 000 people reliant on grazing.^{186, 188} Using agroforestry techniques and native halophytic shrubs and grasses (e.g. *Artemisia lerchiana* and *Calligonum aphyllum*), the programme improved forage availability

for livestock and the saiga antelope, a near threatened species with transboundary habitat.¹⁸⁹ Satellite comparisons show that soils prone to wind erosion in the Black Lands decreased by up to 70 percent from 1975 to 2016.¹⁸⁶ These interventions also enhanced pasture productivity, reduced vulnerability to climate extremes and strengthened the resilience of pastoral livelihoods. The campaign generated major ecological and socioeconomic benefits, supporting national land degradation neutrality efforts and contributing to the Russian Federation's National Biodiversity Strategy and Action Plan (NBSAP), including saiga conservation.¹⁹⁰ The sustainable restoration of degraded steppe habitats across the saiga range remains essential and aligns with broader ecosystem restoration initiatives, such as the Altyn Dala Initiative, a large-scale, long-term conservation and restoration programme launched in 2005 in Kazakhstan, which aims to restore and protect the vast steppe and semi-arid ecosystems of Central Asia.¹⁹¹

especially where infrastructure and agriculture are highly exposed. Global assessments confirm that disaster risk reduction investments – including ecosystem-based approaches – often deliver benefits several times their cost.¹⁹²

Forest and landscape restoration can also act as infrastructure itself, forming part of green and blue infrastructure, understood as networks of natural and semi-natural areas that deliver services. This approach is increasingly embedded in policy frameworks such as those of the European Union¹⁹³ and is being integrated into investment strategies of institutions like the World Bank.¹⁹⁴ These benefits are particularly important in economies where agriculture, fisheries, hydropower and tourism depend heavily on landscape condition.^{100, 113}

At the national scale, restoration supports fiscal stability by reducing the frequency and impact of climate-related shocks. Forest

cover has an impact on the stability of local climate, moisture recycling and precipitation patterns.^{195, 196} This is increasingly relevant for ministries of finance and planning, as climate impacts threaten public budgets and development gains. Integrating restoration into disaster risk reduction and development strategies has been shown to improve the cost-effectiveness of public investment by addressing underlying risk drivers rather than repeatedly funding emergency response.^{8, 192}

Taken together, these contributions make landscape restoration a strategic component of national approaches to risk reduction and economic resilience, allowing governments to tackle the root causes of vulnerability, reduce long-term fiscal exposure, and support more stable development aligned with national priorities and climate-resilient growth.

Contributions of restoration to sectoral productivity and national development priorities

Beyond reducing economic risk, FLR directly supports national development priorities by strengthening productivity across key systems. By stabilizing landscapes, restoration sustains food production, natural resource sectors and place-based economies that underpin employment and food security. Comparative analyses show that some modes of FLR, such as natural regeneration, can deliver climate change mitigation benefits at relatively low cost compared with other land-based mitigation options assessed in global models, reinforcing their value for development and investment planning.¹⁹⁷ Restoration enhances agrifood systems by improving the productive capacity of agricultural landscapes and reducing climate-related stresses. Restored soil health is projected to increase global average crop yields by about 2 percent by 2050, with the largest gains – 10 percent in the Near East and North Africa, 5 percent in Central America and South America, and 5 percent in sub-Saharan Africa.⁶³ Investments in combating desertification, land degradation and drought generate USD 31 billion per year in productivity gains.⁸²

Nationally, these improvements lead to more stable food supplies and lower vulnerability to shocks, especially where agriculture is a major source of income. Maintaining traditional and multifunctional systems, including Globally Important Agricultural Heritage Systems, has also been linked to stronger food security and cultural benefits.¹⁹⁸ By improving watershed function and ecosystem integrity, restoration also stabilizes natural resource-based sectors and reduces disruption risks across interconnected value chains.^{8, 100} Restoration also contributes to development through cultural landscapes and nature-based tourism, which provide income and reinforce identity and heritage. In countries where tourism is economically significant, biodiversity-rich restored areas enhance destination attractiveness and resilience. Broader ripple effects arise by stabilizing inputs, reducing disruptions and supporting downstream value chains. Costa Rica illustrates this: long-term public investment in restoration, supported by fossil-fuel tax revenues and payment for ecosystem services, expanded forest cover and fuelled a nature-based tourism sector contributing roughly 5 percent

of GDP and substantial employment, while incentivizing long-term conservation.^{197, 199, 200}

Together, these contributions show that FLR underpins national development not as a single sectoral intervention but as a foundation for multiple systems. By reinforcing productivity across agrifood systems, natural-resource sectors and territorial economies, restoration aligns environmental objectives with broader economic and development goals.

Policy coherence, valuation gaps and alignment with international commitments

Despite strong evidence of the economic and development benefits of FLR, scaling up remains limited because of institutional and policy barriers, with fragmentation weakening effectiveness even where political commitment and technical capacity exist (**Chapter 4**, policy coherence and law pathway). A major constraint is the incomplete valuation of restored landscapes in national planning and accounting systems. Many benefits – risk reduction, ecosystem services, long-term productivity – are not fully reflected in economic assessments or land use classifications. Agroforestry exemplifies this gap, often falling between agricultural and forest categories, leading to under recognition in policy and incentive schemes.⁸ As a result, restoration is frequently undervalued compared with short-term extractive uses, despite its development contributions. Conversely, when governments adopt coherent, integrated policies that recognize restoration's benefits, scaling can generate substantial long-term economic advantages.²⁰¹

Alignment with international commitments further strengthens coherence. Forest and landscape restoration directly contributes to NDCs, national biodiversity strategies and action plans (NBSAPs), land degradation neutrality targets, the Sustainable Development Goals (SDGs) and National Adaptation Plans (NAPs). Investments in addressing desertification, land degradation and drought significantly reduce carbon-related damages, avoiding an estimated USD 720 billion globally.⁸² When these commitments are embedded into national development strategies and budgets, they create a shared framework across ministries and support access to international finance for climate, biodiversity and restoration initiatives.⁸

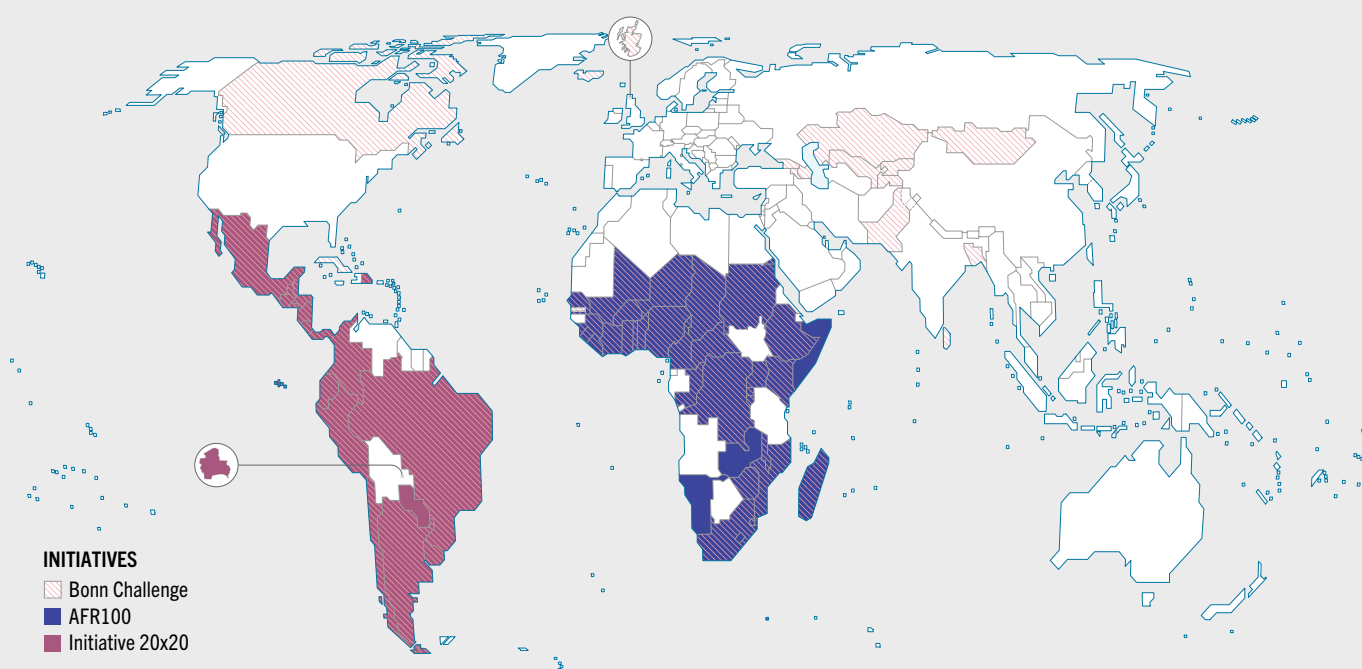
BOX 3.5 ASSESSING THE CLIMATE CHANGE MITIGATION POTENTIAL OF FOREST AND LANDSCAPE RESTORATION MEASURES USING OFFICIAL CLIMATE CONVENTION SUBMISSIONS FROM COUNTRIES, TERRITORIES AND SUBNATIONAL JURISDICTIONS PARTICIPATING IN KEY INTERNATIONAL INITIATIVES

The Bonn Challenge serves as the global umbrella framework for forest and landscape restoration (FLR) pledges. Under this global umbrella, regional platforms such as the African Forest Landscape Restoration Initiative (AFR100) in Africa and Initiative 20x20 in Latin America act as implementing and coordinating mechanisms contributing to and reporting progress towards the Bonn Challenge targets. Using FAO's Nationally Determined Contribution Expert Tool (NEXT), FAO conducted a study to assess the climate change mitigation potential of various FLR measures reported by countries participating in these initiatives in their official submissions to the United Nations Framework Convention on Climate Change (UNFCCC) between

2019 and 2025. The methodology used in the study is described in detail in **Appendix 5**.

FAO's NEXT tool is a greenhouse gas (GHG) emissions accounting tool for agriculture, forestry and other land use and the agrifood sector. It was developed using the methodologies of the Intergovernmental Panel on Climate Change (IPCC) and provides 30-year time series of carbon removals and emission reductions. The study included 67 of the 75 Bonn Challenge, AFR100 and Initiative 20x20 participants (sovereign states and subnational pledging entities and jurisdictions) with FLR initiative pledges, excluding those whose UNFCCC submissions did not include explicit surface-area data for restoration measures (see participating countries in the **Figure**).

FIGURE GLOBAL DISTRIBUTION AND OVERLAP OF 67 COUNTRIES ACROSS THREE FOREST AND LANDSCAPE RESTORATION INITIATIVES: THE BONN CHALLENGE, AFRICAN FOREST LANDSCAPE RESTORATION INITIATIVE AND INITIATIVE 20x20



Refer to the disclaimer on the copyright page for the names and boundaries used in this map. Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties. Final boundary between the Republic of Sudan and the Republic of South Sudan has not yet been determined.

NOTES: AFR100 = African Forest Landscape Restoration Initiative. For consistency, forest and landscape restoration measures without explicit surface-area data or an explicit activity were excluded.

SOURCE: Authors' own elaboration.

BOX 3.5 (Continued)

The assessment covers ten categories of agriculture, forestry and other land use measures relevant to FLR and their associated mitigation outcomes: afforestation/reforestation; agroforestry; assisted natural regeneration (ANR); management of fire, fuelwood and disturbances; forest restoration; reduction of deforestation; sustainable forest management; sustainable or improved management of non-forest lands; urban green; and management of wetlands and mangroves. Together these categories encompass restoration activities, avoided loss and conservation measures, and broader land management practices that contribute to mitigation and restoration outcomes.

Mitigation measures were extracted from official UNFCCC submissions, including nationally determined contributions (NDCs), biennial transparency reports (BTRs) and biennial update reports (BURs). To ensure comparability across countries and initiatives, only measures with reported surface area data were included in the analysis. This approach likely underrepresents non area-based measures, such as governance, tenure reform or policy instruments, which are often reported qualitatively but play an important role in enabling restoration outcomes.

As a result, the analysis may be biased towards area explicit actions, such as planting or land-based interventions, and this limitation should be considered when interpreting results. The cumulative climate

change mitigation potential of reported FLR measures for the period 2021–2030 was calculated using FAO's NEXT tool (see the [Table](#)). Results were generated for each country and measure, and subsequently compiled and aggregated by initiative using the statistical computing software R.

The study results suggest that FLR can make a meaningful contribution to climate change mitigation across participating initiatives, while highlighting that the magnitude of impacts remains highly context-dependent. They also show the importance of strengthening national data systems, improving the completeness of UNFCCC reporting and advancing country-specific analyses to refine future estimates and better capture the full range of restoration benefits and trade-offs.

UNFCCC submissions often lack information on methodological approaches, activity data and baselines, creating uncertainties and making comparisons difficult. The analysis focuses solely on GHG mitigation potential and does not capture co-benefits (e.g. biodiversity, livelihoods and water security) or trade-offs (e.g. land competition leakage effects). Results should, therefore, be interpreted as indicative of broad mitigation trends and orders of magnitude, rather than as precise predictions of national or measure-specific outcomes.

Assumptions for specific measures are detailed in [Appendix 5](#).

NOTE: The methodological approach used in this study is available in [Appendix 5](#).

TABLE CLIMATE CUMULATIVE MITIGATION POTENTIAL BY INITIATIVE, 2021–2030

Initiative	Bonn Challenge	AFR100	20x20
Number of countries analysed versus total with pledges	61/69	33/34	18/18
Cumulative mitigation potential over 2021–2030 (GtCO ₂ eq)	-5.36	-2.92	-1.91
Surface area found in UNFCCC submissions (Mha) (surface area pledged by the countries analysed)	179.7 (179.2)	62.6 (124.3)	111.1 (49.9)

NOTES: GtCO₂eq = gigatonnes of carbon dioxide-equivalent, Mha = million hectares, UNFCCC = United Nations Framework Convention on Climate Change. Negative values represent net carbon removals.

SOURCE: Authors' own elaboration.

<https://doi.org/10.4060/ce0633en-tab3.5> 

BOX 3.6 RESTORATION TRADE-OFFS AND SYNERGIES

Forests and trees regulate the water cycle and provide multiple ecosystem services.² Restoration can generate strong synergies between water-related benefits and climate regulation, soil fertility and biodiversity. Restored forests improve infiltration and soil moisture retention (green water), stabilize streamflow and groundwater recharge (blue water), and enhance water quality by filtering sediments and nutrients. These hydrological functions strengthen ecosystem services like erosion control, nutrient cycling and pollination, which in turn support crop productivity and resilience. Riparian buffers and agroforestry systems exemplify these co-benefits as they reduce

runoff, improve soil structure and provide habitats for wildlife. However, restoration also involves trade-offs. Increased tree cover can raise evapotranspiration and reduce water availability for crops or downstream users in water scarce regions. Shading from dense canopies may limit solar radiation for nearby crops, lowering yields. Large scale afforestation focused mainly on carbon can unintentionally alter hydrology, displace agriculture, affect food security or impact biodiversity far beyond the restoration site. These risks highlight the need for context-specific planning – considering species choice, planting density, spatial layout and time scales – to balance objectives.

3.2.5 Strategic implications of restoration benefits for high-quality, equitable and long-term forest and landscape restoration

Implementing national ambitions for FLR not only depends on the benefits described earlier but also on the enabling conditions that allow those benefits to be realized and sustained. Evidence shows that restoration yields the strongest social, economic and environmental returns when it is carried out in the right places, reflects the interests of different groups, is planned across whole landscapes and is supported by institutions able to coordinate long-term action. Integrated land-use planning and spatial prioritization help direct efforts to areas with the greatest potential for biodiversity, carbon, soil and water gains, thereby improving efficiency and avoiding overly diffuse investments.⁸ These approaches are most effective when combined with local knowledge and governance arrangements that enable meaningful community participation, which strengthens legitimacy and long-term impact.¹⁴⁰

Across regions, restoration endures when Indigenous Peoples, forest communities and dwellers and local organizations are involved from the outset.¹¹⁶ Participation in setting priorities and in monitoring helps align initiatives with everyday land use practices.^{121, 202} Secure

tenure and recognition of customary rules further reinforce stewardship by giving communities confidence to invest in restored areas; they are also a safeguard against exclusion, elite capture and inequitable benefit distribution.¹⁴⁸ Cases from Africa, Asia and Latin America show that clarifying rights and responsibilities is fundamental, as people manage restored land more actively when their rights are recognized.²⁰³

Integrating restoration within national-development, climate and agrifood-system strategies enhances coherence and amplifies benefits.¹⁶⁷ Inclusive governance that engages women and youth also improves management and institutional continuity.^{204, 205}

Improved soil and water condition, combined with diverse land management practices, such as agroforestry and ANR, helps households manage risks and stabilize livelihoods. This improved stability lasts longer when restoration is linked to local development planning and when community institutions remain engaged beyond project cycles. Regional evidence shows that when restoration is integrated into broader territorial planning covering rural–urban connections, water supply, hazard reduction and agrifood systems, landscape resilience improves over time.¹⁵⁰

TABLE 3.1 MAIN BENEFIT CATEGORIES ASSOCIATED WITH FOREST AND LANDSCAPE RESTORATION AT VARIOUS SCALES

	Local or community scale	Private-sector scale	Landscape scale	National or policy scale
Livelihoods and economic opportunities	▶ Increased income opportunities from diversified land-use activities ▶ More stable employment linked to restoration and sustainable production ▶ Greater economic security for households and small enterprises	▶ New markets or increased market share from restoration products or innovation ▶ Development of proprietary and patentable products and processes ▶ Potential revenue and assets from various certification systems for environmental attributes (e.g. carbon and biodiversity credits)	▶ Strengthened local and regional economies through diversified value chains ▶ Improved viability of small and medium enterprises linked to land-based activities ▶ Reduced economic vulnerability in areas dependent on natural resource use	▶ Contribution to inclusive economic growth and rural development ▶ Reduced regional inequalities through revitalization of degraded landscapes ▶ Support for employment and income generation in land-based sectors
Food and production systems	▶ Improved stability of agricultural production and yields ▶ Enhanced access to food and diverse diets through more resilient farming systems ▶ Reduced dependence on external inputs through improved land condition	▶ Improved per-hectare commodity yields ▶ Integration of nature-positive or regenerative practices into commodity production systems ▶ Diversified commodity production systems	▶ Greater reliability of food supply across interconnected production areas ▶ Improved functioning of agroecological systems supporting productivity ▶ Reduced vulnerability of agrifood systems to climate and environmental stresses	▶ Increased stability of national food production and supply ▶ Reduced exposure of agrifood systems to climate-related shocks ▶ Support for long-term food security and agrifood system planning
Resilience and risk reduction	▶ Reduced exposure to climate and environmental shocks ▶ More stable household and producer incomes ▶ Lower recovery and coping costs after extreme events	▶ Reduced commodity value-chain risks from degradation ▶ Improved resilience to environmental and climate risks in landscapes that are material to companies ▶ Competitive advantage from targeted supply chain-risk reductions	▶ Fewer disruptions to production systems and supply networks ▶ More reliable economic activity across interconnected land uses ▶ Reduced losses from floods, droughts and land degradation	▶ Lower disaster-related losses and recovery expenditures ▶ Reduced fiscal exposure to climate and environmental risks ▶ Greater predictability for economic and development planning
Social and cultural outcomes	▶ Strengthened social cohesion and collective action around land management ▶ Stronger local identity, knowledge and cultural practices ▶ Greater participation in decision-making about land use and restoration	▶ Increased social licence to operate due to reduced or eliminated landscape impacts and restoration ▶ Communication opportunity around positive collaboration between companies, communities and nature ▶ Support for worker livelihoods and environmental and human health	▶ Improved landscape governance and coordination among stakeholders across sectors and jurisdictions ▶ Recognition and maintenance of culturally significant landscapes ▶ Enhanced social legitimacy of restoration and land-use decisions	▶ Support for inclusive governance and participatory development approaches ▶ Recognition of traditional and multifunctional land-use systems ▶ Alignment of restoration with social, cultural and development priorities ▶ Support for horizontal and vertical policy coherence
Ecological and environmental outcomes	▶ Improved soil condition, water availability and on-farm ecosystem functions ▶ Recovery of local biodiversity and habitat quality ▶ Enhanced environmental conditions supporting livelihoods and well-being	▶ Improved quantity and quality of water, carbon sequestration, biodiversity, pollination and other contributions of nature to business ▶ Dividends from payments for ecosystem-services programmes	▶ Improved regulation of water flows, erosion and other landscape processes ▶ Increased connectivity and resilience of ecosystems across land uses ▶ Enhanced delivery of ecosystem services at the landscape scale ▶ Improved recovery of threatened species through better connectivity at the landscape scale	▶ Contribution to biodiversity conservation and climate objectives ▶ Improved condition of natural capital supporting long-term development ▶ Support for national and international environmental commitments ▶ Recovery of threatened species at the national and global scales

SOURCE: Authors' own elaboration.

Restoration progresses more consistently when policies in agriculture, forestry, water and climate reinforce rather than compete with one another.²⁰⁶ Clear roles, transparent decision-making and equity safeguards help align responsibilities and ensure fair benefit-sharing. Predictable governance, stable rules and strong collaboration mechanisms reduce uncertainty and encourage private sector engagement, particularly when partnerships with communities are well established.¹⁷² Traditional systems show how secure rights, strong institutions and long-term stewardship create regenerative landscapes that support both livelihoods and national development, but these outcomes typically emerge gradually and may require sustained support during transition periods. Coherence across land use, climate and biodiversity strategies provides the predictability needed to sustain restoration and translate ecological gains into broader economic benefits over time.^{62, 207}

Although land restoration can deliver lasting contributions to human well-being and global sustainability, its success ultimately depends on acknowledging costs, managing short-term distributional impacts and sustaining long-term commitments aimed at strengthening socioecological resilience and reducing inequalities.⁸² ■

3.3 THE MULTIPLE COSTS OF FOREST AND LANDSCAPE RESTORATION ACROSS SCALES AND HOW THEY ARE ASSESSED

3.3.1 Understanding restoration costs from a stakeholder perspective

Information on restoration costs is scattered, inconsistent and generally difficult to compare.⁸⁵ This imprecision arises from the nature of restoration projects, whose planning and reporting are seldom public or discussed in peer-reviewed literature²⁰⁸ but also reflects the broad and context-dependent use of the term “restoration”.

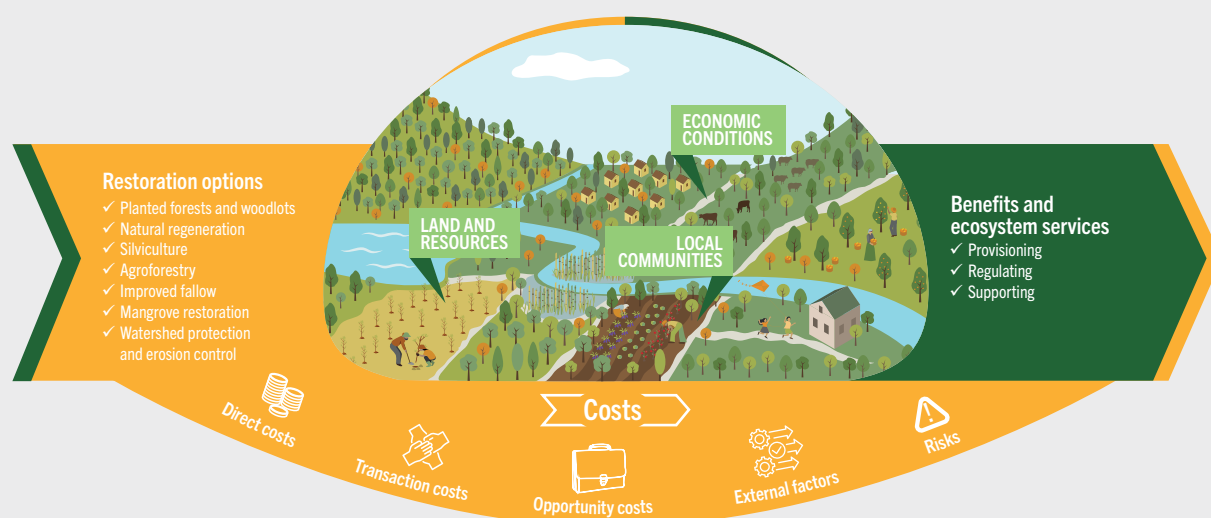
Forest and landscape restoration encompasses actions ranging from forest recovery to soil, water and land management practices, and project-level applications often adopt narrower or differing interpretations. For example, improved management of agricultural land often restores ecological productivity near forests and can mitigate, reduce or eliminate the drivers of degradation,⁶² but such restorative actions are described using various terms without being systematically referred to as “restoration” in most academic contexts. Additionally, many estimates of restoration costs imply that restoration itself is the objective without clearly defining or acknowledging the underlying objectives these interventions aim to achieve and the benefits they are expected to generate.²⁰⁹ These issues, combined with the disconnect between restoration costs and realized benefits in both space and time, have historically made clear attribution, governance and investment in FLR challenging.

Assessing the true costs of landscape restoration requires understanding the intersection between restoration objectives as perceived by different stakeholders, the interventions selected to achieve those objectives and how restoration costs are distributed among different stakeholder groups.

While landscape restoration is undertaken for the public good, different actors with various interests in the landscape pursue more specific and concrete objectives. Since all restoration occurs at the local level, it ultimately relies on the intrinsic motivation of actors who are willing to invest their own time and resources to achieve their restoration goals first and other objectives only if they reasonably align. In this regard, the costs of restoration are always considered from the stakeholder perspective.

While this chapter focuses on forest and tree-based restoration, it is essential to understand and appreciate the many restoration opportunities available within working lands, including those adjacent to forests. These are farms, working forests, fields and other places where people work to generate or harvest the resources that form the foundation of economies and societies.²¹⁰ While the concept of restoration explored in this publication applies

FIGURE 3.4 CONCEPTUAL FRAMEWORK LINKING FOREST RESTORATION OPTIONS, COSTS AND BENEFITS AT THE LANDSCAPE SCALE



SOURCE: Adapted from Pacheco, P., Beatty, C. & Patel, J. 2024. An economic view on the costs and benefits of forest restoration. In: P. Katila, C.J. Pierce Colfer, W. de Jong, G. Galloway, P. Pacheco & G. Winkel, eds. *Restoring Forests and Trees for Sustainable Development: Policies, Practices, Impacts, and Ways Forward*. Oxford University Press. <https://doi.org/10.1093/9780197683958.003.0009>

to all land uses, the vast majority of restoration opportunities arise within working lands.

These cover over 50 percent of ice-free land globally and are home to the local communities on whom restoration ultimately depends. Importantly, restoration interventions that maintain the existing land-use classification of a place rather than changing it (e.g. agriculture to forest) can often be more effective. These approaches seek to integrate trees and other restoration interventions into existing land uses to improve sustainability and ecological productivity. Such approaches not only lower financial costs but also reduce the social transaction costs involved in proposing and implementing restoration initiatives that may compete with other land uses.²¹¹

Frameworks for assessing restoration costs

Since stakeholders value, report and absorb costs differently, transparent frameworks are needed to define cost boundaries and improve comparability across different restoration contexts. Various frameworks are used to

categorize the costs of restoration. Their purpose is not only to classify costs but also to identify types of costs that might be overlooked and to provide methods for recognizing and calculating them. A key development is The Economics of Ecosystem Restoration (TEER) initiative, a multipartner initiative created to address the lack of cost–benefit data for ecosystem restoration, which provides a method for understanding costs at both the intervention and project levels. TEER was designed to be user-friendly for project managers, enabling them to systematically report restoration costs across different cost categories with minimal processing and administrative effort required. Therefore, it has the potential to be widely used (Box 3.7).⁸⁵

While TEER offers an operational standard for systematically collecting and comparing restoration cost data at both the project and intervention levels, project-level information recorded in these databases often does not fully capture opportunity costs, unpaid labour, externalities or the cost of inaction. This limitation reflects TEER's purpose as a practical

BOX 3.7 WHERE DATA MEET DECISION-MAKING: THE ECONOMICS OF ECOSYSTEM RESTORATION INITIATIVE IN NIGERIA

Nigeria is one of the countries applying the Participatory Informed Landscape Approach* (PILA) under the FOLUR Impact Program with the aim of supporting integrated landscape planning and sustainable land use transformation. PILA encourages participatory, evidence-based decision-making, which makes Nigeria an early and relevant case for applying and strengthening the principles of The Economics of Ecosystem Restoration (TEER) initiative using existing national data and field experience. A review of ongoing and past restoration projects, mainly from the Forestry Research Institute of Nigeria (FRIN), showed that, despite limited published literature, national reports and project documents contain substantial information that is useful for building an initial TEER-aligned database. Nigeria already maintains detailed records of afforestation and agroforestry interventions across different states and ecological zones, including spatial locations, hectares planted, species used and years of implementation. This aligns well with TEER's requirements for documenting interventions at specific spatial and temporal units. Cost data are also well structured, with per hectare estimates covering labour,

materials, tools and maintenance activities, such as pruning, weeding and fire tracing. These allow for distinguishing between establishment and maintenance phases and contribute empirical evidence for analysing restoration cost profiles. However, the data were originally designed for forestry project accounting, making them less applicable for economic restoration analysis. Several TEER categories, such as enabling and institutional costs, opportunity costs, paid and unpaid labour, and project level overheads, are missing or inconsistently captured, as shown in the Table. Benefits and baseline conditions are also missing, limiting the assessment of the full economic value of restoration outcomes. Nigeria's example shows why the TEER approach is necessary: strong field data and institutions experienced in the methods already exist, but systematic data organization, standardization and expansion are needed to capture the economic dimensions of restoration. PILA–FOLUR offers a strategic entry point for Nigeria to build on its current strengths while progressively adopting TEER as a unified framework for restoration economics at the landscape scale.

NOTE: *See <https://pilafolur.earthmap.org/login>

TABLE SUMMARY OF AVAILABLE RESTORATION DATA FROM NIGERIA FOR THE INITIAL COMPILATION OF COST–BENEFIT DATA USING THE ECONOMICS OF ECOSYSTEM RESTORATION INITIATIVE PRINCIPLES

What is reported	Key figures	How this fits into The Economics of Ecosystem Restoration initiative
Time period covered	2017–2023	Data span several years, suitable for retrospective (Type 3) TEER entries**
Main data source	Forestry Research Institute of Nigeria	National institutional source with consistent reporting
Area under restoration	Approximately 350 ha	Restoration implemented at a meaningful scale
Number of locations	30+ sites across multiple states	Allows future definition of TEER intervention units
Types of interventions	Tree planting, agroforestry, plantation maintenance	Aligns with TEER biophysical restoration interventions
Establishment cost	NGN 1.3 million per ha (Year 1)	Offers a reliable reference for the costs of planted forest restoration
Annual maintenance cost	NGN 200 000 to 400 000 per ha	Enables long-term cost profiling
Cost time horizon	10 years	Consistent separation of establishment and maintenance phases
Labour input	High (major cost component)	Confirms labour-intensive nature of restoration
Benefits data	Not documented	Key gap for TEER cost–benefit analysis
Social and environmental context	Partially documented	Requires further data collection

NOTES: **Type 3 refers to economic data retrofitted *ex post* from projects that are ending or already closed, using information available after implementation. Since they are not collected through systematic monitoring during project implementation, Type 3 data are typically less accurate and less granular than other data types, and may not allow for detailed temporal analysis, such as cost curves across years of implementation.
TEER = The Economics of Ecosystem Restoration (initiative).

SOURCE: Authors' own elaboration.

tool designed to support project managers and practitioners during implementation, rather than as a comprehensive economic accounting framework.

Therefore, complementary analytical approaches remain useful. A more holistic, though less operational, framework groups costs into four broad categories: (1) direct; (2) transaction; (3) opportunity; and (4) external costs (Figure 3.4).²¹² The cost categories included in TEER are largely compatible with this broader typology, although they serve different purposes. Used together, these approaches provide more consistent and transparent estimates of restoration costs at the project and intervention levels, while highlighting cost components that are often overlooked. It should be noted that these categories may not align perfectly with donor or agency reporting requirements, as accounting practices vary among funders and implementing organizations.

Direct costs

Direct costs refer to the material investments and operational expenditures required to implement ecosystem restoration interventions. These include the procurement of land, labour, physical inputs and capital.²¹² Direct costs are typically reported most often, because they are reflected in budget lines within restoration planning and implementation. They include material costs (e.g. inputs, equipment and land) and operational costs (e.g. labour and implementation activities) and are often reported per unit area or aggregated by intervention type.^{85, 213, 214}

Transaction costs

Transaction costs refer to the expenditures associated with coordinating ecosystem restoration, including planning, agreements, stakeholder engagement, workshops, fundraising, grant writing, policy engagement, governance, and contracting and policy processes. Given the complexity of FLR, these costs are neither insignificant nor unnecessary and often represent essential enabling conditions for effective restoration.²¹⁵ Importantly, transaction costs should not be interpreted as inefficiencies. On the contrary, they often reflect the scale, inclusiveness and ambition of restoration efforts. While site-level interventions may report low transaction costs, large-scale restoration programmes

typically involve higher transaction costs due to the need for coordination across actors, sectors and landscapes.

Understanding transaction costs helps understand restoration investments. Their inclusion indicates efforts to plan more comprehensively and better manage trade-offs and account for externalities, whereas their absence may suggest that certain costs are implicitly shifted or overlooked.

Opportunity costs

Opportunity costs refer to the foregone economic benefits of alternative land uses when restoration interventions are implemented. They represent the financial consequences of choosing restoration over pursuing other land-use options, with implications that may unfold over the short, medium and long term.²¹⁶ In practice, these costs vary depending on prior land use, landscape characteristics and market conditions.²¹⁷

Opportunity costs are perceived differently among stakeholders. For local communities reliant on agricultural income, short-term revenue losses from reduced production may represent a significant barrier to restoration, particularly where benefits take time to materialize.⁹² In contrast, governments or private actors may consider the opportunity costs of *not* restoring degraded land, such as declining productivity, lost ecosystem services or reduced long-term economic returns.^{82, 214}

Considering opportunity costs helps make trade-offs among stakeholder objectives more explicit and informs decision-making processes at multiple scales. Opportunity costs are often expressed in monetary terms, but they can also include non-monetary dimensions, reflecting how restoration is valued and implemented culturally, socially and institutionally.^{218–221} Private sector stakeholders can similarly assess economic trade-offs associated with restoration decisions, including foregone or at risk returns linked to temporary or permanent income reductions and to reputational or transition risks,²²² indirect economic losses related to human health and physical working conditions affecting labour productivity,²²³ and missed or delayed opportunities for market and value chain development.^{224, 225}

BOX 3.8 LAND RETIREMENT PROGRAMMES: BALANCING FOREST RESTORATION WITH RURAL LIVELIHOODS

Land retirement programmes illustrate how restoration can generate substantial long-term environmental benefits while imposing significant short-term opportunity costs on land users, underscoring the importance of compensation and policy design. Such programmes compensate landowners for withdrawing land from production to enable natural regeneration or afforestation. In China, the Grain for Green programme (also known as the Conversion of Cropland to Forest programme) has provided payments to farmers since 1999 to convert erosion-prone cropland to forest or grassland, making it one of the largest land-retirement and ecological restoration programmes in the developing world.^{226, 227}

The programme has delivered substantial gains in tree cover and erosion control at scale. Subsequent assessments indicate that ecological outcomes, particularly for biodiversity, have varied across regions and implementation approaches, and suggest that future iterations could further enhance outcomes through greater emphasis on natural regeneration and more diverse restoration practices.^{226–228} In the United States of America, the Conservation Reserve Program offers time-bound contracts and rental payments to retire environmentally sensitive cropland, primarily to reduce soil erosion while delivering additional benefits for biodiversity and water quality.^{229, 230} Comparable approaches have also been adopted in other regions, including under the Great Green Wall initiative in Africa, where land

retirement is combined with restoration and rural development objectives.²³¹

Land retirement may be implemented over short-, medium- or long-term horizons. Short-term programmes typically aim to reduce immediate environmental risks and are reversible, while medium-term schemes (often 5 to 15 years) allow natural regeneration or afforestation to establish and enable households to reallocate labour. Long-term or permanent retirement requires sustained compensation or alternative livelihood avenues, as income losses may persist once payments end.

A key challenge is that removing land from production reduces incomes and employment – impacts that fall disproportionately on poorer households.²³² Therefore, compensation payments are central to helping households adjust²²⁶ and should at least cover transition and opportunity costs from giving up agricultural activity.²³³ However, determining adequate payments requires detailed socioeconomic data that many low- and middle-income countries lack. Impacts also vary: in China's Grain for Green programme, changes in household well-being differed by ethnicity, gender and education.^{234, 235}

Land retirement commonly triggers labour reallocation, with households shifting to off-farm work, migrating or intensifying production on the remaining land.²³⁶ Benefits are uneven, with younger and better educated individuals often benefiting more from new off farm opportunities.^{235, 237, 238} Where such opportunities are limited, labour is underutilized and incomes may fall.

Opportunity costs for governments differ depending on the primary ministry engaged in restoration work or planning, since environment, natural resource, financial and agricultural ministries may each have different perspectives on opportunity costs associated with restoration.

External costs

External costs are those costs generated by restoration interventions that are not fully borne or accounted for by the actors financing or implementing restoration but instead fall on other stakeholders or on society more broadly. These costs arise when restoration-related activities

generate impacts – positive or negative – that are not reflected in project budgets, financial accounts or cost-per-hectare estimates. In restoration, external costs often represent a major but overlooked component of total costs. They are often distributed inequitably among stakeholders, particularly where direct costs are shouldered by local communities without proper recognition or compensation, this situation also affects many Indigenous Peoples. This is especially evident in restoration initiatives organized and implemented across large or global spatial scales, where financial flows are managed by international institutions but implemented in large part by local actors.

It is rarely possible to fully capture the range of direct and indirect costs that local people incur when implementing restoration programmes, or to ensure that these costs are adequately compensated through the restoration finance flows distributed by global institutions. This typically does not reflect a lack of awareness of these costs; rather, they reflect the difficulty of calculating, standardizing and integrating such costs into conventional accounting frameworks. Unpaid labour, overlooked opportunity costs and the unintended consequences of restoration interventions all represent external costs. In restoration design and planning, where costs per hectare often serve as the dominant metric for guiding decision-making, external costs may increase as estimated direct and transaction costs decline.²³⁹ In practice, restoration costs can always be “reduced” on paper by excluding or externalizing transaction, opportunity or external costs, but these costs are invariably borne by someone.

There is no single global institution that internalizes or compensates for all external costs associated with restoration. Instead, direct, transaction, opportunity and external costs are distributed across different stakeholders, sectors and scales, reflecting the diverse objectives, constraints and capacities of those engaged in landscape restoration.

Costs of forest and landscape restoration interventions

The direct, transaction, opportunity and external cost categories together provide a comprehensive cost lens, but published evidence often reports only partial components – direct implementation costs most commonly – resulting in wide and sometimes non-comparable ranges. Estimating the costs of FLR is challenging. First, restoration occurs through multiple interventions within diverse ecological, social, economic and institutional contexts and across landscapes at different stages of degradation. Second, there are various definitions of restoration and various methods used to determine the costs included in calculations and data sources, which are often fragmented.²¹² Although FLR cost estimates are reported in a similar manner, they often rely on insufficient cost data, particularly regarding transaction costs and externalities, and on

contextual factors that affect those costs. Here we provide examples of cost estimates, intended only as a starting point for fully capturing the costs associated with various interventions across different restoration contexts and objectives. A key challenge in understanding the costs of a restoration intervention is determining whether shared vocabulary translates into shared practice. Given the contextual and geographic individuality of restoration, this is by no means guaranteed (see **Appendix 3** for a representative list of restoration intervention types included in restoration assessments).

The specific costs of restoration interventions are easy to find. However, these are always contextual, and determining the specifics of what is included and excluded from an intervention – whether in practice or in the terminology – remains a challenge. An assessment of restoration interventions included as part of restoration opportunity assessments⁹⁰ identifies more than 190 restoration interventions (**Appendix 3**) spread across general categories such as agroforestry, reforestation, afforestation, silviculture, forest protection, watershed and soil restoration, and working land restoration. Some use narrow definitions of FLR (e.g. reforestation, afforestation and forest restoration) while others rely on a broader definition of land restoration that includes biodiversity, improving the management of working lands, and increasing productivity or rehabilitating degraded lands.^{6, 62, 90}

An emerging approach used for understanding restoration costs is to report the relative costs of restoration interventions so that these are comparable and scalable across countries. Recent global analyses provide median and relative estimates of restoration costs across a wide range of projects and intervention types, including natural regeneration and forest plantations.^{197, 240} These assessments show that variation in restoration costs is often influenced more by geographic and contextual factors than by restoration type alone, reinforcing the inherently local nature of restoration cost assessments. However, an accurate evaluation of restoration costs also depends on how the cost boundaries are defined. Cost assessments that focus narrowly on project-level or implementation costs may exclude or shift certain cost categories

TABLE 3.2 RELATIVE COST OF SELECTED FOREST AND LANDSCAPE RESTORATION INTERVENTIONS PER HECTARE COMPARED TO GRAZING MANAGEMENT

Restoration intervention	Relative cost of restoration intervention per hectare
Grazing management	1
Irrigation	7.5
Silvopastoralism	6.8
Forest plantations	5.9
Agroforestry	4.7
Mixed restoration	4.6
Water management	2.9
Cross-slope barriers	2.7
Agroforestry measures	2.1
Passive restoration	1
Assisted natural regeneration	1
Conservation agriculture	1

NOTES: Relative costs are calculated using project-level implementation cost data and expressed as ratios relative to the least costly intervention. Categories reflect how restoration activities are reported in cost datasets rather than representing a standardized classification of restoration systems. In this context, irrigation refers to restoration projects in which irrigation infrastructure accounts for the largest portion of implementation costs, since irrigation is not considered a restoration intervention in its own right.

SOURCE: Adapted from Verhoeven, D., Berkhout, E., Sewell, A. & van der Esch, S. 2024. The global cost of international commitments on land restoration. *Land Degradation & Development*, 35(16): 4864–4874. <https://doi.org/10.1002/ldr.5263>

<https://doi.org/10.4060/ce0633en-tab3.2> 

– such as opportunity costs, transaction costs or social costs – outside the accounting framework used. As a result, cheaper restoration options within a given project boundary may displace some of the costs on to other stakeholders or sectors, meaning that the total societal costs are not necessarily lower. This can bias comparisons between restoration options and favour interventions that externalize costs over those that more fully account for them.

Forest and landscape restoration intervention costs per hectare

Verhoeven *et al.* (2024)²⁴⁰ report a global median cost for FLR interventions of USD 1 691 per ha (with an average of USD 2 876 per ha). Within this assessment, agroforestry (USD 2 390 per ha), cross-slope barriers (USD 2 562 per ha), irrigation (USD 2 886 per ha) and silvopasture (USD 3 012 per ha) have the highest median costs. The lowest median costs are recorded for forest management (USD 185 per ha), passive regeneration (USD 513 per ha), grazing management (USD 631 per ha) and assisted natural regeneration (USD 804 per ha). Interestingly, despite the place-based nature

of restoration interventions, Verhoeven *et al.* (2024)²⁴⁰ find that cross-country variation in reported restoration costs is primarily associated with differences in national income levels, as measured by GDP, rather than with restoration type. This suggests that adjusting restoration cost estimates across countries using relative GDP or income-based metrics may have analytical value, while still requiring local validation. This approach, based on the understanding that it is an incomplete assessment, provides a method to calculate the relative costs of several common restoration interventions, where the least expensive intervention (grazing management) serves as the reference category and the other interventions assessed in the study are assigned relative costs based on this reference (Table 3.2).

While relative cost ratios provide a convenient way to compare restoration interventions,²⁴⁰ applying this approach to existing cost estimates quickly reveals its limitations. The relative cost ratios reported in global syntheses are not consistently replicated across published project-level estimates, reflecting the wide variability underlying average values derived

TABLE 3.3 REPORTED PER HECTARE TOTAL COST RANGES FOR SELECTED FOREST AND LANDSCAPE RESTORATION INTERVENTION CATEGORIES

Intervention category	Intervention as described in source publication	Lowest reported cost (USD/ha)	Highest reported cost (USD/ha)
Agroforestry	Agroforestry with annual or perennial crops ⁱ	2 754	28 058
	Agroforestry ⁱⁱ	130	1 960
	Agroforestry ⁱⁱⁱ	n/a	2 390
Agrosilvopastoral	Agrosilvopastoral systems ⁱ	3 192	20 234
	Silvopasture ⁱⁱⁱ	n/a	3 012
Assisted natural regeneration	Assisted natural forest regeneration ⁱ	515	5 279
	Assisted natural regeneration ⁱⁱ	14	4 093
	Assisted natural regeneration ^{iv}	188	500
	Assisted natural regeneration ^{v, iii}	n/a	804
Natural regeneration	Natural forest regeneration ⁱ	579	2 384
	Natural regeneration ^{vi}	48	50
	Natural forest regeneration ^v	50	300
	Passive regeneration ⁱⁱⁱ	n/a	513
Tree plantation	Forest plantation ^v	5 000	30 000
	Monoculture tree plantations ⁱ	781	3 829
	Planted forests (commercial/monoculture plantations) ^{vii}	77	7 038
	Tree plantations with annual crops ⁱ	1 621	3 562
Tree planting	Planted forests (for restoration) ^{vii}	272	28 251
	Seedling planting ^{vi}	1 863	2 793
	Enrichment planting ^{vi}	311	1 267

NOTES: ha = hectare; N/A = not available. Values represent the minimum and maximum reported costs for implementation or establishment per hectare, as described in the original sources, and typically reflect short-term project phases rather than full life-cycle costs. Reported costs vary widely due to differences in geographic context, project design, time horizon and the cost categories included. Some estimates reflect direct implementation costs only, while others include labour, inputs or infrastructure. Opportunity, transaction and external costs are often excluded. Figures, therefore, should be interpreted as indicating an order of magnitude rather than precise benchmarks.

SOURCES: ⁱPacheco, P., Beatty, C. & Patel, J. 2024. An economic view on the costs and benefits of forest restoration. In: P. Katila, C.J. Pierce Colfer, W. de Jong, G. Galloway, P. Pacheco & G. Winkel, eds. *Restoring Forests and Trees for Sustainable Development: Policies, Practices, Impacts, and Ways Forward*. Oxford University Press. <https://doi.org/10.1093/9780197683958.003.0009>; ⁱⁱBodin, B., Garavaglia, V., Pingault, N., Ding, H., Wilson, S., Meybeck, A., Gitz, V., d'Andrea, S. & Besacier, C. 2021. A standard framework for assessing the costs and benefits of restoration: introducing The Economics of Ecosystem Restoration. *Restoration Ecology*, 30(3): e13515. <https://doi.org/10.1111/rec.13515>; ⁱⁱⁱVerhoeven, D., Berkhout, E., Sewell, A. & Van Der Esch, S. 2024. The global cost of international commitments on land restoration. *Land Degradation & Development*, 35(16): 4864–4874. <https://doi.org/10.1002/ldr.5263>; ^{iv}Brancaion, P.H.S., Meli, P., Tymus, J.R.C., Lenti, F.E.B., M. Benini, R., Silva, A.P.M., Isernhagen, I. & Holl, K.D. 2019. What makes ecosystem restoration expensive? A systematic cost assessment of projects in Brazil. *Biological Conservation*, 240: 108274. <https://doi.org/10.1016/j.biocon.2019.108274>; ^vBusch, J., Bukoski, J.J., Cook-Patton, S.C., Griscom, B., Kaczan, D., Potts, M.D., Yi, Y. & Vincent, J.R. 2024. Cost-effectiveness of natural forest regeneration and plantations for climate mitigation. *Nature Climate Change*, 14(9): 996–1002. <https://doi.org/10.1038/s41558-024-02068-1>; ^{vi}FAO & UNEP. 2020. *The State of the World's Forests 2020 – Forests, biodiversity and people*. Rome, FAO and UNEP. <https://doi.org/10.4060/ca8642en>; ^{vii}FAO. 2026. Agroforestry. In: FAO. Rome. [Cited 15 February 2026]. <https://www.fao.org/agroforestry/en>

<https://doi.org/10.4060/ce0633en-tab3.3> 

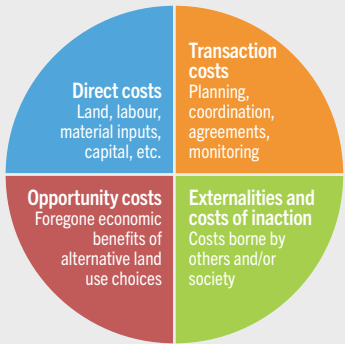
from large datasets. More importantly, this highlights that restoration cost estimates are only meaningful when interpreted in relation to their underlying assumptions, including which direct, transaction, opportunity and external costs are included or excluded. As with estimating the

cost of feeding a family – where results depend on context, preferences and constraints – reliable restoration cost estimates must ultimately be developed at the local level, with explicit attention to scope, inclusions and objectives. **Table 3.3** presents combined per-hectare cost estimates for

FIGURE 3.5 FRAMEWORK FOR ESTIMATING THE COSTS OF RESTORATION

EXAMPLE

Assisted natural regeneration USD 4–989 /ha/yr
Assisted natural regeneration establishment USD 12–388/ha
+ Annual maintenance USD 2–213/ha (5 years)



[Stakeholder type]	Total cost USD	Annual cost USD
[Direct cost]		
[Transaction cost]		
[Opportunity cost]		
[Cost of inaction]		
[Externality]	[Qualitative assessment]	N/A

NOTES: All restoration inherently includes direct, transaction and opportunity costs, externalities and the cost of inaction, which may be borne by different stakeholders. N/A = not available.

SOURCE: Adapted from Pacheco, P., Beatty, C. & Patel, J. 2024. An economic view on the costs and benefits of forest restoration. In: P. Katila, C.J. Pierce Colfer, W. de Jong, G. Galloway, P. Pacheco & G. Winkel, eds. *Restoring Forests and Trees for Sustainable Development: Policies, Practices, Impacts, and Ways Forward*. Oxford University Press. <https://doi.org/10.1093/9780197683958.003.0009>

six common categories of forest and landscape restoration interventions. Each source compiles restoration cost estimates for these intervention categories to derive indicative cost ranges, often drawing on large numbers of projects or studies. Verhoeven *et al.* (2024),²⁴⁰ by contrast, report only global average values. The wide ranges reported in Table 3.3, therefore, reflect not only differences among restoration approaches but also variations in implementation periods, cost definitions and accounting boundaries across studies. In addition, many restoration interventions relevant to FLR are not represented here due to the lack of published cost estimates.

3.3.2 Effectiveness, trade-offs, opportunity costs and the cost of inaction

To be effective, restoration must meet the needs of multiple stakeholders

Discussions about restoration often refer to “success”, a term that can imply a binary outcome, a single benchmark or an endpoint to restoration activities. While success attracts significant global attention – given the financial investments and societal transformations involved – it can undersell the inherently dynamic and long-term nature of restoration. In this chapter, the focus is instead on restoration effectiveness, understood

as the extent to which interventions achieve their agreed objectives and intended outcomes. Effectiveness depends not only on biophysical results but also on whether restoration delivers the ecological, social and economic outcomes that motivated action in the first place. This perspective offers a more nuanced and flexible framework that allows restoration to be assessed in terms of different stakeholder objectives and degradation drivers, and the evolving needs of both nature and economies, across varying spatial and temporal scales.

Objectives of restoration

Effective restoration actions address discrete objectives. Restoration is not an objective in itself but a means to an end – it is undertaken to achieve outcomes that fulfil stakeholder-defined objectives.²⁴¹ For some stakeholders, ecological or habitat restoration represents the primary objective. For others, restoration delivers equally valuable outcomes across the restorative continuum (Chapter 1), ranging from the full recovery of native ecosystems to reducing societal impacts and improving ecosystem management. These approaches can be implemented within most existing land uses, including farms, pastures and forests and other working or productive lands.⁷ Others still, emphasize

restoration's essential contribution to climate change mitigation, noting that land-based climate measures could provide more than one-third of the cost-effective emissions reductions needed by 2030 to follow low-impact climate pathways.^{47, 242} At the same time, there are often trade-offs among different objectives, especially between restoration for biodiversity and for ecosystem function and resilience,^{243–245} as well as within integrated approaches, such as watershed management.²⁴⁶ Achieving effective restoration, therefore, requires balancing multiple stakeholder needs and objectives through time, coordination and compromise, often extending beyond the restoration interventions themselves to address the underlying drivers of degradation. A useful way to conceptualize these interactions is provided by the FAO and World Resources Institute (WRI) Restoration Monitoring Wheel,⁶⁵ which illustrates how restoration objectives, interventions, stakeholders, costs and outcomes are interconnected.

Drivers of degradation

If not effectively reduced, diverted or eliminated, the causes that prompted the need for restoration are likely to undermine any progress made towards achieving restoration goals. The drivers of degradation can be grouped into five broad categories identified by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (2018)⁴⁸: land-use change, over-exploitation, invasive species, climate change and pollution. Identifying these drivers is useful for acknowledging and mitigating degradation risks in all restoration work; addressing them where they exist helps ensure that financial commitments in restoration are not wasted.

Restoration in perpetuity

Continued attention to threats, such as invasive species, illegal exploitation and unmanaged disturbance, is often necessary to safeguard long-term outcomes, even when natural regeneration is a central component of the intervention. Reducing these pressures can be critical not only for ecological sustainability but also for the long-term economic viability of restoration. From a policy and planning perspective, this highlights the importance of strategically targeting areas where opportunity costs are lower, or of designing restoration

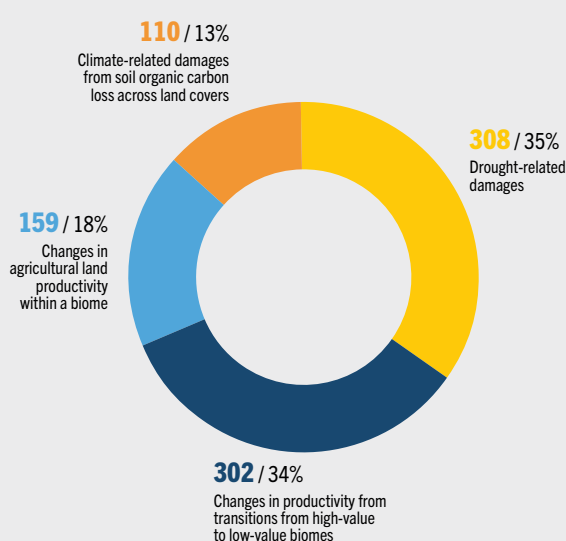
approaches that allow compatible land uses alongside ecological recovery. Such approaches can reduce long-term financial pressures, increase acceptance among land users, and improve the likelihood that restoration delivers sustained benefits over time. The perpetuity of a restoration intervention, meaning the extent to which it continues to serve its objectives in the future, is based on both the degree to which the degradation drivers are neutralized and the self-sufficiency of the intervention type.

Eliminating or reducing the drivers of land degradation can lessen pressures from competing land uses, thereby lowering the opportunity costs of land restoration – that is, the foregone income or production from alternative land uses – which often pose a direct threat to sustainable land-use and management practices. This is important in reducing the overall cost-of-restoration interventions. By strategically targeting degraded areas where these opportunity costs are lower – or by designing interventions that allow complementary land uses – restoration can be made more economically attractive to landowners and communities, improving adoption rates and the overall cost-effectiveness of investments. Therefore, reducing opportunity costs is central to both financial viability and the scalability of restoration interventions. This is why, when considering the costs of restoration interventions, it is crucial to fully understand the sustainability and perpetuity of such investments. Otherwise, the costs may be misunderstood or impossible to calculate, or they could outweigh the benefits.

Trade-offs exist among restoration interventions and the intended objectives they represent

Because restoration is a long-term investment, it involves opportunity costs and trade-offs. For example, prioritizing biodiversity can reduce the land available for income generation and affect food security. Some forest restoration may decrease water availability,²⁴⁷ and carbon focused restoration can compromise biodiversity when fast growing non-native species are used.²⁴⁸ These choices are not inherently wrong, but they require a clear understanding and careful optimization of interventions to minimize trade-offs among stakeholder objectives. Given the diverse objectives of various stakeholders, balanced scenarios are needed – ones that

FIGURE 3.6 TOTAL COST OF INACTION WITH REGARD TO DESERTIFICATION, LAND DEGRADATION AND DROUGHT BY COST CATEGORY, IN USD BILLION AND AS A PERCENTAGE OF THE TOTAL



SOURCE: UNCCD. 2024. *Investing in Land's Future: Financial needs assessment for UNCCD*. Bonn, Germany. https://www.unccd.int/sites/default/files/2024-12/58587%20UNCCD_Financial%20needs%20assessments-WEB2.pdf

conserve, restore and sustainably use ecosystems, reduce pollution, and support climate change mitigation and adaptation.²⁴⁹ Optimization helps model and manage trade-offs.^{27, 223} Identifying places where multiple objectives align can improve cost-effectiveness in conservation and restoration. Because restoration spans many land use types and stakeholder interests, finding compromises or win-wins can greatly reduce costs, although trade-offs often depend on local context (e.g. temperate versus tropical systems).^{244, 250} Stakeholder intervention choices can create synergies or conflicts.²⁴⁹ Effectiveness increases when interventions are understood individually, in combination and over time, as some actions enable or amplify others. Restoration efforts implemented in isolation risk yielding fewer benefits across biodiversity, water, food, health and forest-related outcomes – the core

nexus elements.²⁴⁹ Optimizing restoration requires estimating place-based impacts using new local and global datasets. Ecosystem service models can assess current and potential carbon sequestration under natural regeneration or improved land management. Global models can evaluate carbon,⁵² species,²⁵¹ soil erosion²⁵² and opportunity costs.^{197, 253} Various tools apply these datasets to generate local,²⁵⁵ national²⁵⁵ and global^{27, 256} assessments that identify optimal restoration areas capable of lowering overall costs and meeting multiple stakeholder objectives.

Doing nothing costs more than restoration: the hidden price of inaction

Land degradation and desertification are persistent and significant issues locally and globally. These are ecological problems that also generate significant economic, social and environmental losses when degraded land is not restored or sustainably managed. These losses disproportionately affect poor and vulnerable populations, particularly in rural areas where livelihoods and food security rely directly on land productivity. Declining agricultural productivity, reduced ecosystem services, increased vulnerability to climate shocks, soil carbon loss, and long-term damage from drought, deforestation and land conversion undermine incomes, increase food insecurity and exacerbate poverty, especially for smallholders and land dependent communities.

The combined cost of inaction globally – defined here as the continuation of land degradation in the absence of effective restoration or sustainable land management interventions – is estimated to be approximately USD 878 billion to USD 6.3 trillion per year, depending on the scope of valuation, and can be generalized as representing 2 percent to 8.3 percent of annual GDP^{82, 86} (Figure 3.6). The wide range of the estimates of the cost of inaction reflects differences in methodology, scope and valuation approaches. The differences in underlying studies include variations in ecosystem scope, the types of ecosystem services assessed and whether estimates include offsite impacts and long-term losses. Studies vary in the ecosystem services they consider (e.g. agricultural productivity, carbon storage, water regulation and health impacts), the spatial scales they

assess and whether they include only on site losses or also offsite and long-term impacts. Some estimates focus on foregone production, while others incorporate the economic value of lost ecosystem services and increased exposure to climate and health risks. More conservative estimates typically focus on immediate and directly measurable impacts, while higher estimates incorporate broader, longer-term and system-wide costs of degradation. This distinction is important for interpreting what the range captures and for understanding the full economic implications of inaction.

The UNCCD recognized this threat and has been ratified by nearly all countries, which is a testament to its gravity. The cost of inaction may affect stakeholders differently, but it represents a huge burden that has built up and will keep growing over time, if restorative measures are not taken.

In comparison, the total costs of achieving current global restoration targets are estimated at USD 311 billion to USD 2.1 trillion over the period 2024–2035, equivalent to approximately USD 28–190 billion per year when annualized over 11 years,²⁴⁰ representing only a small fraction of the annual cost of inaction, estimated at USD 878 billion to USD 6.3 trillion per year under a business-as-usual scenario.^{82, 86}

Framing restoration costs in relation to the cost of inaction provides an essential reference point for decision-making across stakeholders. The cost of inaction captures the expected economic, social and environmental losses associated with continued degradation. Comparing these recurring annual losses with the one-off or time-bounded investments required for restoration offers a practical and transparent basis for assessing both the value and urgency of restoration interventions.²⁵⁷

However, in assessing the global and local costs of restoration, including the cost of inaction, most assessments differ in the way they define the monetary and social investment required to ensure effective restoration. How these costs are calculated depends not only on the different cost types integrated into cost assessments, but also on how different stakeholders place

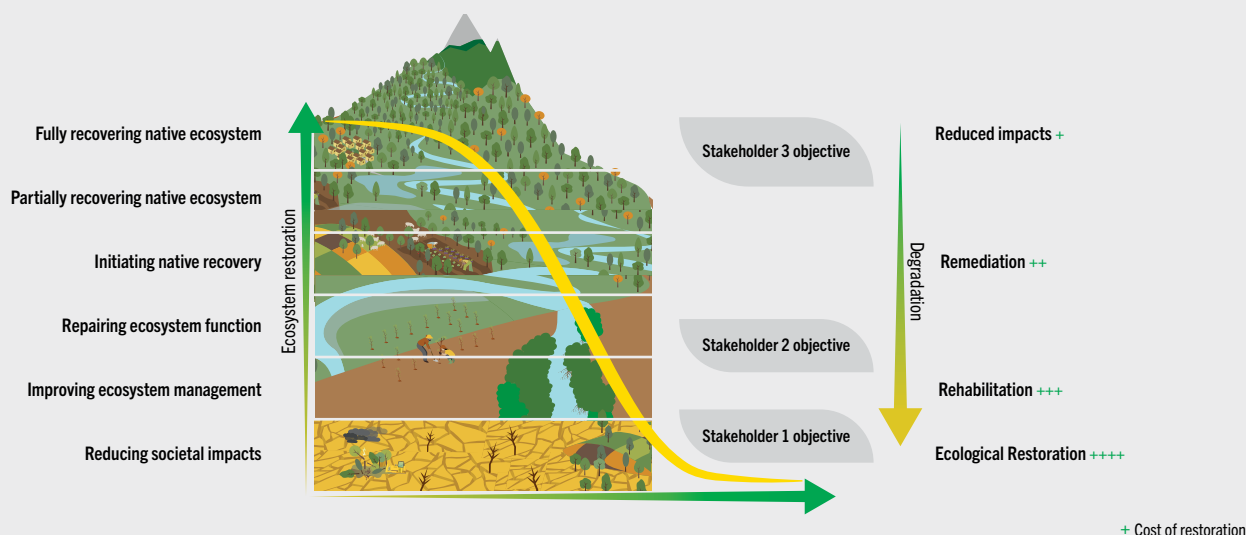
value on different costs. Local communities, businesses and governments differ not only in their perspectives on restoration but also in the types and magnitudes of costs they are willing or able to bear.

The prevention of emerging and novel infectious diseases illustrates the potential of restoration to help avoid large societal costs. On a global scale, the role of ecosystem degradation in disease emergence, and the public-health benefits of restoration are well substantiated.^{90, 258} However, in the context of specific restoration initiatives, public health considerations are rarely central to decision-making by local communities, businesses or government ministries, even though investments in prevention represent only a small fraction – around 1 percent – of the estimated USD 2 trillion cost of a future pandemic.⁶²

This represents a generalized restoration cost that, although important to everyone, is not included in cost-of-restoration assessments conducted by local communities, businesses or governments. Calculating the cost of restoration requires all stakeholders to make judgments – often implicitly – about which costs are accounted for and which remain unaccounted for (Figure 3.7). In practice, both direct costs and opportunity costs are frequently excluded, complicating the estimation of the full or “true” costs of restoration. For example, the cost of unpaid labour, particularly that contributed by women, is often omitted when local communities assess restoration investments.

The private sector similarly tends to exclude costs related to engagement, landscape planning, capacity building, policy and governance support, coordination, and long-term monitoring, reflecting a historical focus on short-term financial returns. Governments and the multiple ministries involved in restoration – including those responsible for environment, mining, infrastructure, finance and agriculture – must also negotiate which activities are recorded as costs and which are treated as benefits. Expenditures on labour, materials and interventions may be considered costs by some actors, while others view the associated employment, income generation and tax revenues as benefits rather than costs.

FIGURE 3.7 CONCEPTUAL ILLUSTRATION OF HOW RESTORATION COSTS AND OUTCOMES ARE PERCEIVED DIFFERENTLY BY STAKEHOLDERS OVER TIME



NOTES: Inputs refer to the direct and indirect costs associated with restoration interventions, including labour, materials, planning, coordination and long-term monitoring. The figure highlights how stakeholders with different objectives account for costs and benefits differently, and how some direct costs (e.g. unpaid labour) and opportunity costs may remain unaccounted for in cost assessments. As restoration progresses, the balance between costs and benefits shifts, but the extent to which these are recognized depends on stakeholder perspectives, time horizons and sectoral priorities.

SOURCE: Nkonya, E., Gerber, N., Baumgartner, P., von Braun, J., De Pinto, A., Graw, V., Kato, E., Kloos, J. & Walter, T. 2011. The Economics of Desertification, Land Degradation, and Drought Toward an Integrated Global Assessment. *ZEF- Discussion Papers on Development Policy*, 150. <http://dx.doi.org/10.2139/ssrn.1890668>

The costs of inaction refer to the economic, social and environmental losses incurred when restoration is delayed, insufficient or not undertaken at all. Unlike external costs, which arise from restoration activities and are borne by actors outside those financing or implementing interventions, the costs of inaction stem from the continued degradation of ecosystems and the compounding effects of foregone restoration. These costs accumulate over time and often exceed the direct costs of restoration itself. They include declining ecosystem services, reduced productivity, increased vulnerability to climate extremes, biodiversity loss, heightened food and water insecurity, and growing risks. Because the costs of inaction are typically diffuse and distributed across multiple sectors and populations, they are rarely captured in appraisals or estimates.

In practice, decisions framed narrowly around minimizing short-term restoration expenditures may unintentionally increase inaction costs by postponing intervention or selecting less effective approaches. As degradation gets worse, restoration becomes more complex and costly, while the benefits that could have been secured through earlier action are irreversibly lost. These dynamics mean that apparent cost savings from delaying or avoiding restoration often simply shift costs to future stakeholders, sectors or generations. The costs of inaction are particularly difficult to internalize within existing planning and financing frameworks, as they do not appear as explicit budgetary outlays and are seldom borne by a single decision maker. Nevertheless, recognizing and articulating these costs is essential for informed restoration planning, as it shifts the focus from minimizing immediate expenditure to assessing the long-term consequences of taking action versus delaying.

3.3.3 Balancing costs across stakeholders and governance modalities

Equity between costs and benefits is hard to achieve given the disparities between who bears the costs and who reaps the benefits

While restoration actions are implemented locally, FLR explicitly links site-level interventions to broader landscape-scale objectives, and local communities often bear the greatest personal and opportunity costs. Many Indigenous Peoples also face the same challenges. These come in the form of physical costs, time devoted to restoration activities, opportunity costs and risks. Similarly, costs are also borne by governments, financial institutions, companies, non-governmental organizations (NGOs) and other stakeholders that bring the rationale, funding and strategic processes of restoration to places. As costs are distributed differently, so too are benefits. Restoration that allows local communities to bear the brunt of the costs, while third parties capture the restoration benefits can generate resentment at best and rights violations at worst. Who bears these costs and who receives the benefits of restoration can be demarcated along gender lines, socioeconomic status, political affiliation, stakeholder group and many other categories. Responsibly connecting costs and benefits to the extent possible by stakeholders looking to calculate restoration costs is paramount for ensuring equity. Facilitating an assessment of costs is necessary for restoration planning, but it also allows stakeholders to understand the types of costs that they value and the types of benefits they look to generate. These can be in support of local needs, economic development, supply-chain resilience, regional or national objectives, or any number of other rationales. Understanding what costs are included and recognized, and what costs are not, allows for a more honest attempt at equity between costs and benefits for different stakeholders. It also tends to reveal the multiple benefits of restoration actions that can be generated by a single action – when restoration both achieves a local objective and also benefits other stakeholders (e.g. carbon sequestration). Recognizing these distributional asymmetries highlights the need for governance and financing modalities that align incentives, manage trade-offs and ensure fair cost–benefit sharing.

Cost-effectiveness is locally dependent

In addition to the variability among stakeholders and how they evaluate costs, the unique combination of restoration drivers, interventions, stakeholders, geographies, climates, benefits and communities, makes the cost-effectiveness of restoration difficult to predict. To be effective, intervention actions have to be adapted to local and context-specific conditions, and the benefits must eventually, if not immediately, outweigh costs. It is also well recognized that assessments of restoration cost-effectiveness should consider cost and benefit trajectories over time, as different stakeholders apply different intrinsic discount rates when evaluating restoration investments.²¹² Smallholder farmers and households often place greater weight on immediate or near-term costs and returns, whereas public institutions and state actors typically apply lower discount rates reflecting longer planning horizons. As a result, the perceived cost-effectiveness of restoration options may differ across stakeholders, raising the need for time-sensitive compensation and incentive or financing mechanisms to address delayed benefits for smallholders. The cost-effective restoration solutions are a global need that can only be supplied through local engagement.²¹⁷

Cost assessments for restoration interventions and programmes found in the peer-reviewed literature alone are not sufficient to generalize restoration cost estimates for planning purposes. Moreover, they rarely include the full set of restoration objectives from multiple stakeholder groups that are required for a comprehensive cost assessment. Instead, they tend to focus on thematically relevant costs for ecosystem restoration,²⁴⁵ climate,¹⁹⁷ and national-scale planning and reporting documentation, such as the Application of the Restoration Barometer in Mexico.²⁵⁹ Other restoration opportunities assessments²⁵⁴ (Appendix 1) tend to provide a broader treatment of restoration planning, enabling conditions and funding structures than is typical of project-level cost studies. These assessments reflect nationwide engagement in restoration planning by practitioners who apply scientific evidence to their specific contexts. However, they generally do not provide a detailed or standardized disaggregation of restoration cost categories across the design, implementation

and monitoring phases. Unfortunately, most of these assessments are currently perceived as relevant only at the national scale or are not publicly available.

This broad incompatibility of cost estimates also clearly demonstrates the differing objectives behind reporting restoration costs across governments, the private sector, local communities, NGOs, intergovernmental organizations and researchers. Researchers, NGOs and countries could accelerate understanding of the costs of restoration by cooperating to evaluate these costs in the context of the frameworks outlined in this section, through TEER assessments, and by assessing and communicating their estimates of direct, transaction, opportunity and external costs, and the costs of inaction.

No proposed solutions can omit restoration – transforming “costs” into “investments”

There is no solution to the climate, desertification and biodiversity crises that does not place restoration at the centre. Restoration serves multiple objectives across stakeholder groups and scales, offering a proactive response that can build trust, collaboration and justice in an increasingly degraded world. Its effectiveness depends on meeting the diverse objectives of governments, companies, civil society and local communities today and over the long term. Although stakeholders perceive costs differently, evidence shows that restoration costs can be estimated and optimized. Generating cost profiles that capture the full range of costs associated with restoration actions – including direct, transaction, opportunity and external or inaction costs – requires engaging all relevant actors. Because restoration actions generate costs and benefits that are often distributed unevenly across stakeholders, public actors and policies play a key role in identifying and managing these trade-offs, including organizing compensation between those who benefit and those who bear the costs.

Costs are often valued unevenly: what seems negligible to one actor may be significant to another. Costs borne by one group – such as labour, maintenance or monitoring – may become benefits for others, including employment or tax revenue. Some costs are diffuse and rarely counted yet

yield major local or global benefits (e.g. pandemic prevention). Comprehensive assessments should, therefore, consider direct, transactional, opportunity and external costs, and the cost of inaction. While conserving intact ecosystems is preferable, restoration becomes essential when continued degradation under business-as-usual scenarios remains the prevailing pattern.

Restoration can generate ecological, social and economic benefits by supporting livelihoods, strengthening value chains and enhancing the productivity and resilience of landscapes. In many contexts, restoration contributes to income generation, employment, and long-term economic stability alongside environmental outcomes. Understanding these benefits is essential for assessing the overall value of restoration investments and their contribution to development objectives.

Cost estimation helps stakeholders assess expected returns, yet many existing estimates exclude key cost categories. Stakeholders may internalize or externalize different costs depending on their responsibilities and the benefits they receive. Cost-effectiveness assessments typically presume successful restoration, but because short- and long-term costs and benefits differ across locally specific contexts, cost-effectiveness is inherently place-based. In some cases, higher cost sites may be deprioritized so that limited resources can be directed towards areas where restoration is more feasible and cost-effective. At the same time, restoration can support people and nature while also reshaping the distribution of power and wealth. Ensuring equity between those who bear the risks and costs of restoration and those who benefit must remain central. Trade-offs among ecological, economic and social objectives are inevitable. However, well-designed, place-based interventions can reduce these trade-offs and increase overall effectiveness. A range of tools and approaches exists to help practitioners identify and manage such trade-offs during planning and implementation. ■

3.4

OPTIMIZING BENEFITS AND BALANCING COSTS ALLOW HIGH-IMPACT FOREST AND LANDSCAPE RESTORATION

Forest and landscape restoration delivers a wide range of ecological, social and economic benefits, but these benefits differ across communities, governments and private actors. Local communities often derive benefits related to food security, cultural identity, well-being, and improved soil and water resources, while companies tend to benefit primarily through risk reduction, more resilient value chains and alignment with corporate sustainability targets. Governments tend to emphasize climate change mitigation, biodiversity recovery and progress towards international commitments. Recognizing these varied perspectives is key to designing inclusive and context appropriate restoration strategies, especially as many benefits – such as social cohesion, strengthened local institutions and revitalized traditional knowledge – are non-monetary yet essential for long-term stewardship. Restoration also acts as a catalyst for rural development and resilience, generating employment, diversifying livelihoods and strengthening landscape productivity in ways that help buffer communities and economies against environmental and economic shocks.

Effective and equitable restoration requires long-term, landscape level approaches that align ecological, social and economic priorities across sectors. Strong, transparent and participatory governance ensures continuity, trust and shared responsibility among actors with different expectations, capacities and costs. Because the benefits and burdens of restoration are unevenly distributed equity considerations are central to FLR. This includes the fair allocation of risks, secure tenure, and attention to economic and social outcomes, including gender and socioeconomic disparities. It also means recognizing that local communities and other local actors often bear significant upfront

costs, while respecting Indigenous Peoples as distinct collective rights holders – often with local communities and other groups, in particular Indigenous Peoples bearing the greatest upfront costs – including fair allocation of risks, clear tenure rights and attention to economic and social outcomes, as well as gender and socioeconomic disparities. Trade-offs are inevitable, as different restoration interventions influence biodiversity, carbon, water and land-use options differently, requiring careful optimization to minimize negative impacts and identify win–wins. When these conditions are met, restoration efforts reinforce one another across scales, enabling countries and stakeholders to turn degraded landscapes into engines of resilient, inclusive and sustainable development.

The evidence presented in this chapter points to four essential enabling conditions that can optimize and sustain desired restoration outcomes: i) the meaningful involvement of communities as well as Indigenous Peoples in defining, implementing and monitoring restoration actions; ii) explicit recognition of territorial and ecological dynamics, and their implications for cost–benefit relationships across landscapes and over time; iii) the financial mechanisms needed to unlock and sustain investments across restoration phases; and iv) enabling policies that ensure resources, incentives and governance structures are aligned with long-term impact rather than short-term metrics. FAO's earlier work on sustainable financing for FLR provides a conceptual foundation for understanding how public finance, private investment and local mechanisms can be combined and sequenced across restoration phases – a logic that remains relevant even as financing instruments and scales have evolved.²⁶⁰ When these conditions are in place, restored landscapes are more likely to deliver lasting gains for biodiversity, climate objectives and resilient livelihoods, while strengthening local institutions and supporting more equitable development outcomes. Long-term investment in these social, institutional and organizational foundations, therefore, is as critical as investment in increasing ecological integrity. ■

A photograph showing three women working on a grassy hillside. They are planting small trees in holes that have been dug into the soil. The woman in the foreground is wearing a light green long-sleeved shirt and a pink shirt underneath, and is using a large, curved metal tool to dig. The woman in the middle is wearing a grey hoodie and a wide-brimmed straw hat. The woman in the background is wearing a colorful patterned shirt and a red cap. The background shows rolling green hills under a clear sky.

PHILIPPINES

Members of the
Bayong Farmers
Association plant trees
in holes made by a soil
auger machine.
© FAO/Mark Anthony
Perandos

CHAPTER 4

INTEGRATING KEY PATHWAYS FOR IMPACTFUL RESTORATION

4.1 INTRODUCTION

The Global Partnership on Forest and Landscape Restoration (GPFLR) articulated six principles underlying forest and landscape restoration (FLR) interventions²⁶¹ that when considered in their entirety can greatly improve outcomes.²⁶² These principles were subsumed into those drafted for the United Nations Decade on Ecosystem Restoration 2021–2030 (UN Decade).⁸ To support adoption of the principles, standards of practice for ecosystem restoration⁶ identify practices that should be considered to increase the probability of achieving lasting restoration outcomes. A standards-based approach to restoration is necessary to shift from simple consideration of the area under restoration to the delivery of long-term ecological integrity, social inclusion and resilience.^{263, 264} Practices for spatial prioritization and ensuring an enabling environment are not included in the UN Decade standards of practice but are considered here.

The multiple benefits of FLR described in **Chapter 3** can best be achieved when the inherent complexity of landscapes is considered. Landscapes can contain, for example, agricultural and production areas, human developments and natural ecosystems, which must be understood in relation to each other. To enhance ecosystem integrity, the provision of ecosystem services and

human well-being in deforested and degraded areas, restoration cannot be treated as a series of disconnected projects with their own targeted funding streams (**Figure 4.1**). Harmonizing the diverse needs and strengths of stakeholders and integrating the ecological, social and economic benefits of restoration requires a holistic, systemic approach. This chapter examines how long-term restoration goals are achieved by navigating the intricate relationships between four interlinked pathways: people, land, finance and business, and policy coherence and law. These pathways are inherently interconnected and must be integrated to achieve impact. Multistakeholder partnerships are intrinsic to the landscape approach; they support integration of the four pathways of FLR and promote vertical and horizontal coherence to address their restoration objectives. By design, an FLR programme may be stronger for one pathway, but its effectiveness will be determined by consideration and integration of the other pathways. This chapter is an invitation to construct holistic approaches that weave together the four pathways. Although the pathways are examined separately, given the need for distinct tools and approaches for each, the effectiveness of restoration initiatives requires their integration.

While these pathways provide a useful framework for structuring restoration efforts, their application varies significantly across contexts, particularly in fragile and conflict-affected settings. Restoration in fragile

FIGURE 4.1 FOREST AND LANDSCAPE RESTORATION REQUIRES NAVIGATING THE INTRICATE RELATIONSHIP OF FOUR INTERLINKED PATHWAYS: PEOPLE, LAND, FINANCE AND BUSINESS, AND POLICY COHERENCE AND LAW



SOURCE: Authors' own elaboration.

and conflict-affected settings presents distinct governance, financing and operational challenges that are not fully captured by global approaches. Limited institutional capacity, insecurity and social fragmentation can constrain long-term planning, coordination and sustained investment, while also increasing risks for implementation. At the same time, experiences from countries such as Burkina Faso and the Niger demonstrate that restoration can still advance when approaches are adapted to local conditions (**Case Study 1**) including through flexible financing, strengthened community-based governance and risk-aware project design. These contexts require tailored strategies that prioritize resilience, inclusivity and continuity under conditions of uncertainty.

Human and ecological systems are deeply interconnected. Placing people and their local knowledge systems at the centre of the restoration process through a co-creative approach can be seen as a sustainable development pathway delivering the needed ecological recovery

of degraded landscapes alongside inclusive economic and social benefits. The people pathway focuses on the human dimensions of restoration, including the social, cultural, political and economic factors that shape and sustain outcomes. It addresses who participates, whose rights and knowledge count, how decisions are made and how benefits are distributed. Inclusive governance frameworks, equitable benefit-sharing mechanisms and socially just empowerment of local actors who are attentive to intersecting identities and power relations are essential to maintaining FLR gains over time.²⁶⁵

Landscapes form the spatial basis for restoration and are characterized by their multifunctional and multidimensional nature. The land pathway recognizes that landscapes are mosaics of many different land types and uses that may vary in their degree of degradation. Similarly, tenure and governance systems may change across a landscape. Effectively responding to the drivers of degradation and achieving desired FLR outcomes requires both spatial planning and

the prioritization of restorative interventions. Ensuring ecosystem services like pollination, seed dispersal and water filtration requires the consideration of more than restoring forests.

Restoration finance needs to quadruple from 2022 levels of USD 64 billion per year to USD 296 billion per year by 2030 to meet global restoration targets while contributing to climate and biodiversity goals. Current finance is dominated by public sources, which account for around three-quarters of restoration funding, while private finance remains comparatively limited but has significant potential to scale through mechanisms such as biodiversity and carbon markets, regenerative agriculture and impact investment.

The finance and business pathway focuses on mobilizing finance (both public and private) to bridge the existing funding gap and implement economically viable options to sustain long-term restoration. By moving beyond traditional grants for restoration projects towards sophisticated mechanisms²⁶⁶ like blended finance, restorative value chains and nature-positive economies aligning supply/value chains with ecological recovery, we will be able to scale up the investment needed to restore at scale and for the long term.

Finally, the policy coherence and law pathway considers how coherent policies, effective regulatory and fiscal frameworks, and shifts in underlying mindsets create the conditions for restoration success. It explores how policy coherence, legal certainty and integrated governance arrangements²⁶⁷ can improve efficiency while strengthening legitimacy and community rights. This calls for a long-term vision, and support across stakeholders to reduce trade-offs and resolve conflict.²⁶⁸ It also looks at how alignment of national strategies, such as nationally determined contributions (NDCs) and national biodiversity strategies and action plans (NBSAPs) and emerging legal innovations, like the rights of nature, can embed restoration in long-term planning and intergenerational commitments, ensuring that FLR contributes meaningfully to climate, biodiversity and development, among other goals. ■

4.2 THE PEOPLE PATHWAY: PEOPLE AT THE CENTRE FOR INCLUSIVE FOREST AND LANDSCAPE RESTORATION THROUGH MEANINGFUL ENGAGEMENT

4.2.1 People, forests and restoration

Forests and forest landscapes are social ecological systems shaped by interactions between people and ecosystems.^{269, 270} An estimated 4.17 billion people, or about 95 percent of all people outside urban areas, live within 5 kilometres (km) of a forest, and 3.27 billion live within 1 km. In many tropical countries, forest-adjacent people earn about one-quarter of their income from forests. Smallholders, different local communities as well as Indigenous Peoples own or manage nearly half the world's forest and farm landscapes, about 4.35 billion ha, and are central to scaling up FLR.⁵⁸

At the same time, the roles of forest-adjacent people in restoration are shaped by demographic change, including urbanization, migration and ageing rural populations and by context-specific conditions affecting participation, labour availability, representation and benefit-sharing.

Although human activities can drive deforestation and degradation, people are also fundamental to restoration, including to natural regeneration. Ecosystem restoration is a social priority as well as an ecological one; it contributes to the Food and Agriculture Organization of the United Nations (FAO) four betters as explained in **Chapter 1** by improving ecosystems, reducing land-use-related health risks, and supporting well-being through One Health approaches.⁵⁸ Restoration emerges through both locally led processes and planned interventions, and priorities often differ across decision-making levels, shaping objectives, trade-offs and accountability.²⁷¹

The human dimensions of FLR concern how and why people value forests and trees, how they want landscapes managed, and how governance shapes processes and outcomes.^{272, 273} They include political, cultural, economic, institutional, emotional and behavioural factors shaping relationships with forests and restoration actions.²⁶⁵ Restoration decisions redistribute access, responsibilities, costs and benefits unevenly across stakeholders and rights holders who have recognized or customary rights. Understanding whose rights must be respected, who influences decisions and how power and legitimacy shape outcomes is critical to effective, equitable and durable restoration.^{274, 275}

This pathway examines how inclusive engagement, rights recognition and social contexts shape restoration and how a people-centred, intersectional approach can reduce exclusion risks, strengthen accountability and support equitable and durable FLR outcomes.

4.2.2 People in forest and landscape restoration: defining actors and designing inclusive engagement

Stakeholders and rights holders: towards legitimate engagement

Restoration involves many actors across scales, from multinational investors and private companies to governments, non-governmental organizations, Indigenous Peoples and other land users, including local communities whose livelihoods and identities are tied to forest landscapes.²⁰⁶ Some actors shape and experience restoration directly within the landscape, whereas others finance it, set rules or benefit from outcomes such as carbon credits or ecosystem services from beyond it. This diversity of interests and roles makes actor recognition and engagement design central to effective governance. Multistakeholder platforms can support coordination by aligning objectives, negotiating trade-offs and integrating actions across sectors and scales, as illustrated by initiatives such as the Mexican Alliance for Ecosystem Restoration (AMERE) and the Trinational Atlantic Forest Pact (**Case study 17**). However, multistakeholder processes do not in themselves ensure rights-based participation or equitable influence within landscapes or between local and external actors.^{276, 277}

Across the restoration cycle, effective engagement requires distinguishing stakeholders, who may influence or be affected by restoration, from rights holders, whose recognized or customary rights and legitimate claims require specific safeguards. Since actors differ in rights, motivations and constraints, and because power relations shape who can participate and influence decisions, engagement must be context-specific and sequenced over time, rather than treated as a standardized step.²⁷⁶ It should move beyond consultation towards collaboration in design, implementation, monitoring and benefit-sharing, supported by policies and legislation that enable equitable outcomes.^{261, 273, 278, 279}

Indigenous Peoples are distinct collective rights holders with inherent rights recognized in international instruments. In FLR, this requires attention to customary or legally recognized rights, including the right to free, prior and informed consent (FPIC), legitimate claims, institutions and decision-making authority in their territories. Indigenous Peoples may also be stakeholders, but their rights holder status requires specific safeguards, including recognition of legitimate institutions and decision-making authority where applicable (**Case study 18**). In specific national contexts, some local communities may also be recognized as rights holders where they hold customary or legally recognized rights and legitimate claims, requiring safeguards and accountable representation. The rights and status of Indigenous Peoples must not be conflated with those of local communities. In both cases, groups are rarely uniform, and representation may involve multiple local institutions and social groups that need to be identified in context.³⁰⁸

Decisions about whom to engage in restoration governance requires first determining the legitimacy of actors within the landscape, including rights, responsibilities, decision-making authority, knowledge and accountability to the groups represented. Engagement does not in itself confer legitimacy, as those involved may not be perceived as accountable to, or representative of, the wider group whose views they are intended to convey.²⁸⁰ The legitimacy of the engagement process also matters. It should rest on ethical, reciprocal and rights-based approaches that respect knowledge

systems and decision-making institutions, including FPIC wherever relevant.^{277, 281} More broadly, simply calling for “stakeholder engagement” risks oversimplifying the social, economic and cultural dynamics that shape restoration choices.

Local rights holders’ perspectives, aspirations and needs often differ from those of external actors, including implementing agencies, government institutions, donors, private companies and external investors. These differences are shaped by power and whose knowledge counts, and by who bears the costs and receives the benefits. Local actors may prioritize immediate livelihood needs, seasonal variability and established land-use practices, while external actors may focus more on longer-term gains in carbon, biodiversity or other ecosystem services. Early engagement with Indigenous Peoples as well as local communities can help ensure that FLR does not overlap with land used for farming, grazing or other livelihood purposes, and can bring differing understandings to the surface about degradation, improvement and acceptable restoration practices before interventions are designed.^{282, 283} In drylands, for example, land users may interpret degradation differently from external actors, as local understandings are often shaped by seasonal variability, livelihood use and longstanding management practices rather than by externally defined biophysical indicators alone. When such differences are overlooked, interventions may face low uptake or opposition.²⁸² (In some contexts, initiatives have favoured control-oriented, top-down solutions such as green belts and tree planting, including where approaches better suited to uncertainty, local variability and livelihood systems, such as pastoralism, may be more appropriate.)²⁸²

Beyond participation: inclusion, equity and meaningful engagement

Building on the distinction between stakeholders and rights holders, inclusion in FLR requires more than inviting “the community” to participate. It requires attention to who is represented, whose voices are heard, and how barriers to participation and benefit-sharing are addressed, and an understanding of intersectionality, and the conditions for inclusion and empowerment in FLR. Intersectionality helps explain how exclusion emerges through overlapping social factors

and power relations, rather than from a single characteristic in isolation.²⁸⁴

In FLR, people’s ability to engage in planning, access resources, contribute labour and benefit from restoration is shaped by interacting factors such as gender, age, ethnicity, disability, migration status, income and geographic location, together with the institutions and norms that organize land use, resource control and governance. Exclusion operates at multiple levels, from the individual and household circumstances to social norms, institutions, governance arrangements and broader ecological conditions.^{285, 286}

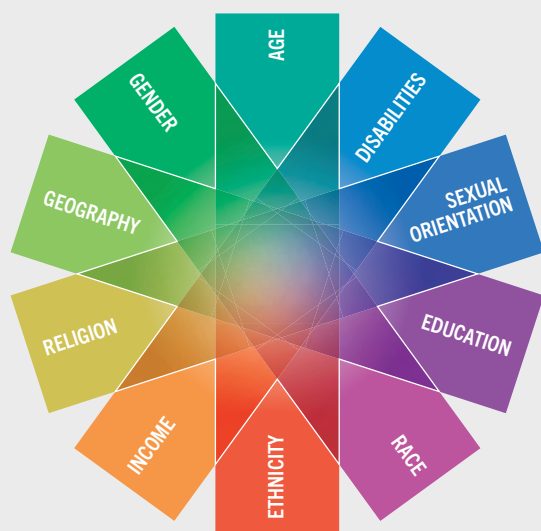
Inclusion can be understood as a principle, a process and an outcome: ensuring that all people can participate in, contribute to and benefit from social, economic, cultural and political life, irrespective of identity or status.¹⁹ In FLR, this requires more than nominal participation: meaningful engagement means that rights holders and other affected actors can access information, express priorities and influence decisions in ways that are legitimate, informed and responsive to changing conditions (Figure 4.2). This provides a foundation for empowerment, understood as the process through which marginalized groups become more able to make strategic decisions affecting their lives and landscapes.²⁸⁷ Section 4.2.4, including Figure 4.3, discusses the operationalization across planned FLR interventions.

4.2.3 Key social dimensions shaping restoration impact

Analyses of FLR outcomes have often prioritized biophysical objectives and metrics such as vegetation cover, species composition and ecosystem functions.²⁸⁸ Yet, social dimensions are equally important in determining whether restoration is feasible, legitimate and sustained over time.^{282, 289}

Forest and landscape restoration is embedded in place-based social contexts shaped by history, tenure, institutions, livelihoods, identities and knowledge systems.²⁶⁵ These are not obstacles to overcome but defining conditions for implementation. This section highlights

FIGURE 4.2 INTERSECTING SOCIAL FACTORS INFLUENCING INCLUSION IN FOREST AND LANDSCAPE RESTORATION



SOURCE: FAO. 2024. *Intersectionality: A pathway for more inclusive, youth-oriented and gender-responsive agrifood systems*. Rome. <https://doi.org/10.4060/cd1375en>

three interlinked dimensions: sociopolitical, socioeconomic and sociocultural. These dimensions influence restoration choices, uptake and scale by shaping legitimacy, risk-bearing and the distribution of costs and benefits. Evidence from Ethiopia, India, Madagascar, Nepal and the Sahel as well as the pastoralist landscapes shows that externally designed interventions that ignore these dynamics often face resistance or limited uptake.^{290, 291} Greater attention to how different people use, value and relate to landscapes can clarify the drivers of degradation and support restoration strategies that are both durable and equitable.²⁷³ Short-term funding cycles rarely allow meaningful engagement, yet long-term success depends on co-designed restoration efforts that work through local institutions, address exclusion and align with local livelihoods and cultural contexts.

Socioeconomic context: livelihood outcomes and equity

Socioeconomic conditions strongly influence whether FLR is sustained over time. Restoration affects livelihoods by shaping access to resources, employment and income, and by redistributing risks and benefits. It can also affect access to food-producing trees and medicinal plants that support household food access, which may have benefits for health and provide informal safety nets, including subsistence livelihoods.^{17, 149} Restoration can generate employment and create entry points for women (**Case study 4**) and youth, but skills gaps and mismatches can limit job quality, continuity and longer-term benefits.

Targeted capacity development can address these constraints and strengthen livelihood outcomes, including skills development along restoration supply chains such as seed collection, nursery production and restoration services.^{292, 293} In the Philippines, integrated reforestation and agroforestry programmes, combined with skills development, supported livelihood diversification while strengthening restoration outcomes.²⁹⁴ Evidence suggests that women's leadership in nurseries, producer groups, cooperatives and local governance committees can support more consistent management, strengthen decision-making and broader benefit-sharing. Youth engagement can also strengthen mapping, monitoring and communication especially when supported through skills development and local leadership.^{134, 135, 204, 205, 295}

Across cases, a consistent pattern emerges: women's participation can significantly strengthen restoration outcomes, but participation alone does not automatically translate into influence or long-term benefits. Experiences from countries such as Burkina Faso, Kenya, the Niger, Senegal and Zimbabwe (**Case studies 1, 3 and 4**) indicate that durable agency and empowerment are more likely when women have secure access to land and resources, equitable benefit-sharing arrangements and meaningful roles in decision-making processes. Access to finance, training and organizational support further enables women to assume leadership roles and sustain engagement over time. These findings highlight that moving beyond participation towards agency requires deliberate attention to enabling conditions,

including governance arrangements, tenure security and targeted capacity development.

Local incentives and benefits can be strengthened by developing restoration supply chains and services, together with livelihood-compatible uses of areas under restoration where appropriate. When designed with transparent benefit-sharing arrangements and safeguards, these approaches can support local enterprise and longer-term stewardship.⁹³ Benefit-sharing is central to socioeconomic equity in FLR.

Fair and transparent arrangements can reduce conflict, align incentives and enhance legitimacy. Mechanisms can include employment, local procurement, co-ownership and community development funds, and should reflect Indigenous Peoples' rights to self-determination, FPIC and local community development priorities.²⁸⁰

Sociocultural context: values, knowledge and identity

Culture defines locally rooted knowledge systems

Culture can be understood as a shared web of meanings through which groups interpret the world and guide behaviour, expressed through beliefs, knowledge, norms and values and often embedded in informal institutions and everyday practice, rather than codified rules.^{296, 297} Since culture is fluid and historically situated, it should be discussed in context and without essentializing its effects.²⁸³ In FLR, culture shapes locally rooted knowledge systems and customary norms that influence how people relate to landscapes, define problems and judge restoration options.

Indigenous Peoples' food and knowledge systems, and some traditional local knowledge held by local communities, are understood as cumulative bodies of practices and beliefs concerning relationships among living beings, including humans and their environments, transmitted across generations.²⁹⁸ Such knowledge systems are place specific, culturally embedded and practical. They are dynamic and holistic, integrating knowledge with practices, values and worldviews, spiritual beliefs and cosmogonies, rather than constituting discrete information separable from context. Differences in how knowledge is formed, used and validated are central to legitimacy in restoration.²⁹⁹

Such knowledge systems express culture in land and resource management.³⁰⁰ conceptualizes the knowledge–practice–belief complex, organized across four interacting levels:

1. local and empirical knowledge of species, soils and landscapes;
2. resource management systems, practices, tools and techniques, including understanding of ecological processes such as functional relationships among key species and forest succession;
3. traditional systems of management, including social institutions such as rules-in-use, norms and codes of social relationships; and
4. worldview, including ethics, religion and broader belief systems that give meaning to environmental observations.

Since knowledge is inseparable from practice, institutions and worldview, treating it as extractable information can undermine meaning, legitimacy and applied outcomes. Documentation and application of species lists or practices should attend to the institutions, values and decision processes that give them meaning.^{299, 300}

Multiple knowledge systems and legitimacy in restoration

Although FLR is often framed as balancing ecological and social outcomes, delivery models oriented to rapid execution can marginalize locally rooted knowledge systems, cultural dimensions and equity considerations.²⁸² Restoration decisions draw on multiple knowledge systems, yet bridging differences between dominant scientific approaches grounded in Western epistemologies and the experiential, place-based and transgenerational knowledge systems of both Indigenous Peoples and some local communities, including Indigenous science and relational ways of knowing, remains difficult.^{17, 279, 301}

Scientific assessments often privilege what is measurable, whereas Indigenous Peoples' food and knowledge systems and locally rooted knowledge systems are grounded in practice, social relations and worldviews, and may diverge from scientific framings and from each other.^{17, 279, 302} Degradation and restoration are socially constructed and may be interpreted

differently by local actors than they are in scientific assessment or policy design,³⁰³ shaping what is framed as a problem, what counts as improvement and which authorities are seen as legitimate.

Legitimacy is strengthened when engagement is based on equitable partnership rather than knowledge extraction, with agreed protocols for how knowledge is accessed, used and protected.²⁸¹ Addressing these gaps requires interdisciplinary approaches that connect ecological and social sciences and support participatory processes, including dialogue between Indigenous Peoples' knowledge systems and scientific approaches using qualitative and quantitative methods.^{48, 279} It also requires enabling locally led decision-making and respecting Indigenous Peoples' data sovereignty to support restoration that is scientifically robust and socially legitimate.^{17, 304}

Worldviews and relational understandings in forest and landscape restoration

Worldviews shape how environmental change is interpreted and what is considered legitimate and meaningful in land and resource management.³⁰⁰ Among many Indigenous Peoples, relational worldviews grounded in ancestral norms, rituals and spiritual ties to place, can strengthen stewardship by framing restoration as reciprocal responsibility. Locally rooted norms among some local communities can also shape what is feasible and accepted, particularly where restoration affects customary access, culturally important species or local governance arrangements. Relational paradigms such as Ubuntu and Buen Vivir illustrate approaches that emphasize reciprocity, collective well-being, stewardship and intergenerational equity.³⁰⁵ Sacred natural sites, including sacred groves, express shared meanings, rituals and place-based knowledge that shape which species are protected, harvesting rules and which areas are off-limits, and often function as biocultural refugia.^{306, 307} More broadly, such knowledge systems can inform species choice, site matching and day-to-day management when engagement follows agreed protocols.^{93, 308}

Language as an enabling condition for effective forest and landscape restoration

Language affects FLR because it determines whose knowledge is accessible and used in planning, who can engage meaningfully and which outcomes are measured. Indigenous Peoples' languages and local languages encode ecological knowledge. When languages decline, intergenerational transmission and customary stewardship institutions can weaken, alongside broader declines in ecological knowledge.^{309–312} This can lead to species choices and indicators that overlook medicinal plants and food trees central to local food habits, livelihoods and cultural identity, reinforcing indicator bias when monitoring prioritizes what is easiest to quantify over locally valued benefits.^{17, 305, 309} Designing engagement and monitoring in accessible local languages can support biocultural diversity and long-term stewardship.^{312, 313}

Sociopolitical context: rights, tenure, legitimacy and governance

Sociopolitical contexts shape who can decide, whose priorities count, how risks are managed, who benefits from restoration, whether restoration is perceived as legitimate and whether stewardship can be sustained over time. Evidence from sacred natural sites and other culturally protected areas, together with land system research on rules-in-use, shows that spiritual and social norms, including informal rules, taboos and local monitoring grounded in shared meanings and perceived legitimacy, regulate resource use and sustain biodiversity.^{221, 283, 308}

In Timor-Leste, Tara Bandu similarly illustrates how spiritually grounded rules can support forest protection when aligned with legitimate local authority. Working with legitimate customary institutions, rather than overriding them, can strengthen restoration durability and reduce governance friction, especially where formal systems are contested or only partially trusted.

Tenure and resource rights are central conditions for restoration, influencing outcomes over time and reducing the risk of reversals.³¹⁴ Secure, clear and legally recognized rights, including rights to associated benefits, can strengthen incentives for long-term stewardship and reduce reversal risks.^{122, 148, 203, 206, 315, 316} Evidence from North India

associates substantive local influence over planning and sustained control over management with improved livelihood benefits and increased forest canopy cover over time.³¹⁷ Rights vary by resource type, and tree tenure can be decisive. In Western Africa, women play central roles in managing shea (*Vitellaria paradoxa*) parklands that support livelihoods, food security and income generation. Programmes that introduce alternative species into these systems without recognizing customary rights and gendered norms, risk marginalizing women's roles and weakening stewardship incentives. Disaggregating tenure and rights by resource type and by gender is important, therefore, for inclusive and effective restoration.^{278, 318, 319}

Legal recognition on paper does not always translate into rights that are respected and exercised in practice. However, the relationship between formal recognition and effective rights is context-dependent and may vary significantly depending on how legal frameworks are interpreted, mobilized and applied. Initiatives can underperform when formal arrangements are prioritized without sufficient attention to power relations, locally legitimate institutions and social context.³²⁰ Because statutory law and customary rules often operate in parallel, efforts to articulate customary tenure and local governance with statutory frameworks may, in some contexts, contribute to strengthening rights and reducing conflict, particularly where conventional land registration is costly, complex or exclusionary. At the same time, such interactions can take diverse forms and do not always lead to the expected outcomes. Where restoration weakens customary tenure or local resource governance, grievance and conflict risks can arise even when ecological targets are achieved.³²¹ This also highlights that beyond the design of legal frameworks, effective outcomes depend on the ability of actors to understand, navigate and mobilize existing legal arrangements in practice.

Restoration is shaped by political and economic incentives, power imbalances and competing values. Prioritizing production forestry or carbon sequestration can narrow ecosystem services and locally valued benefits²⁸² and, when advanced by powerful actors, heighten risks of dispossession or exclusion of customary rights holders through land acquisition or other forms of expropriation.

In contexts where restoration generates new value linked to carbon, biodiversity or other ecosystem services, unclear tenure and weak governance can create exclusion risks, including forms of green grabbing. These dynamics heighten the importance of rights recognition, legitimate representation and accessible remedy mechanisms in restoration governance.^{322, 323}

National recognition of collective rights determines the scope for participation in governance and influence over restoration priorities. For Indigenous Peoples, political recognition and legal acknowledgement of collective rights affect whether self-identification and governance systems translate into decision-making authority and accountability in practice.³²⁴ Where recognition is absent or incomplete, decision-making authority and accountability in practice are often weakened. At scale, sociopolitical context is mediated through policy coherence, institutional mandates and accountability across levels. Political leadership, policy frameworks and institutional arrangements can enable restoration at scale, but people-centred implementation depends on whether decision-making power is meaningfully shared and locally legitimate. Without accountable participation and coordination across levels, top-down directives risk misalignment with social and ecological realities.^{17, 325}

The Great Green Wall illustrates both the catalytic role of political leadership and the limits of centralized ambition when governance capacity, institutional coordination and locally legitimate stewardship are insufficient. Reported constraints include fragmented responsibilities, weak coordination and limited engagement of rights holders and other local actors in planning and decision-making. The African Union's 2024–2034 strategy responds to this challenge by strengthening governance mechanisms, clarifying institutional roles and enhancing multistakeholder and community participation (**Case study 1**) to support more effective and equitable implementation.^{326, 327}

4.2.4 Operationalizing meaningful engagement and legitimate governance across the restoration cycle

For planned FLR interventions, outcomes depend on decisions made across the restoration cycle. Operationalizing meaningful engagement requires attention not only to whether people are consulted, but also to who is recognized, who is represented, how influence is exercised and under what conditions rights holders and other affected actors can shape priorities, negotiate trade-offs and hold implementers accountable over time. Where applicable, FPIC should be understood as a substantive and ongoing process, especially when objectives, boundaries, activities, species choices or benefit-sharing arrangements are revised.³²⁰

Applying an intersectional lens helps identify practical barriers to engagement, including unequal access to information, time, language, mobility, tenure security and decision-making spaces. Because barriers often overlap and can reinforce one another, restoration initiatives that rely on standardized participation models may unintentionally reproduce existing inequalities.

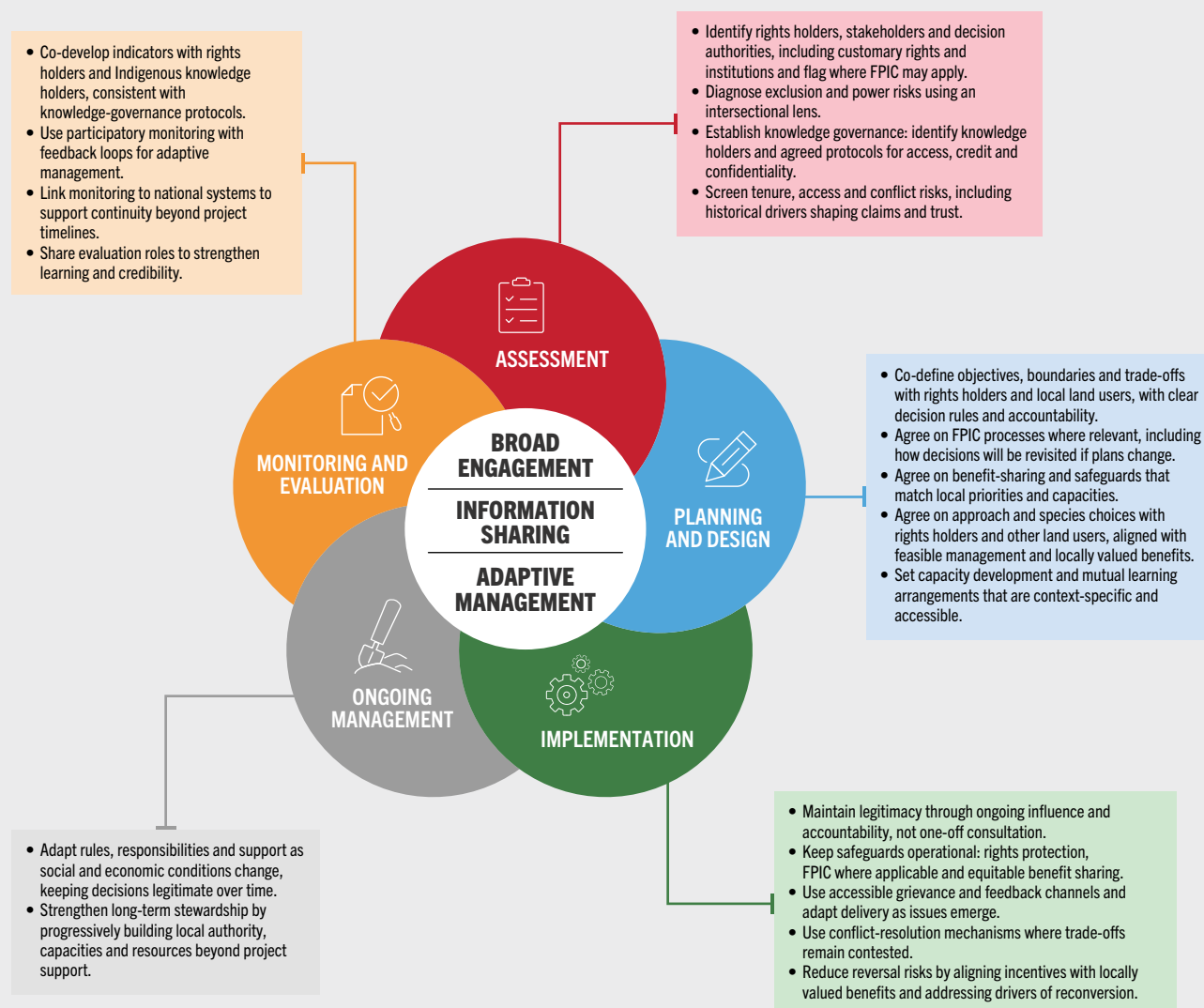
For example, Indigenous women and women from marginalized ethnic groups may face overlapping constraints related to insecure tenure, unpaid care burdens, limited mobility, language barriers and exclusion from customary or formal institutions. Other groups, including youth, older people, people with disabilities and displaced populations, may also face reinforcing barriers to effective participation in restoration planning and implementation. Identifying groups at risk of exclusion is a foundational step in inclusive restoration. Because FLR redistributes access to land, labour, time, resources, knowledge and benefits, an intersectional approach helps ensure that restoration does not reinforce existing inequalities.³²⁸

Across stages, legitimacy depends on recognized rights and decision-making authority, accessible information and the ability of people to influence decisions as conditions change. This requires meaningful engagement adapted to each stage. An intersectional lens must shape practical access to decision-making, including representation,

time and language accessibility, and the distribution of costs, risks and benefits; otherwise, participation can reproduce exclusion.³²⁹

In this pathway, meaningful engagement refers to informed, accessible and ongoing processes through which rights holders and other relevant actors can influence decisions. It includes feedback, accountability and remedy mechanisms, and should follow locally agreed protocols for how knowledge is accessed, credited, protected and, where relevant, kept confidential.^{281, 328} In practice, this concerns not only how restoration initiatives and facilitating actors engage with those affected by, or holding rights and legitimate claims in, the landscape, but also who initiates, convenes and defines the process. Where rights holders and local actors hold legitimate rights, authority and institutions, they should not be treated simply as participants in externally designed initiatives. Their agency in shaping restoration objectives and the rules of engagement is central to legitimate and inclusive FLR. Grievance and feedback channels are core infrastructure for accountability and early resolution of grievances,^{330, 331} reinforced by participatory monitoring and feedback loops that support adaptive management, including where tenure is contested.³³²

Capacity development supports meaningful engagement when it enables stakeholders, rights holders and other local actors to participate on an informed basis and equips project teams and facilitators to work with rights, FPIC, power asymmetries and intersectional barriers in context. Approaches should be culturally and context appropriate, including through local languages, accessible formats and dialogue-based learning, and should respect agreed rules for engaging and protecting Indigenous Peoples' food and knowledge systems.²⁹² Sustained investment in capacity and long-term learning is also needed so local actors and project teams can co-develop, monitor and respond to social outcomes over time.³³³ **Figure 4.3** summarizes key human-dimension priorities across the restoration cycle, drawing on the UN Decade standards of practice and staged FLR frameworks.^{6, 265}

FIGURE 4.3 HUMAN DIMENSIONS ACROSS PLANNED FOREST AND LANDSCAPE RESTORATION INTERVENTIONS

NOTE: FPIC = free, prior and informed consent.

SOURCE: Nelson, C.R., Hallett, J.G., Romero Montoya, A.E., Andrade, A., Besacier, C., Boerger, V., Bouazza, K. et al. 2024. *Standards of practice to guide ecosystem restoration – A contribution to the United Nations Decade on Ecosystem Restoration 2021–2030*. Rome, FAO, Washington, DC, SER, and Gland, Switzerland, IUCN CEM. <https://doi.org/10.4060/cc9106en>

Attention to human dimensions across the FLR cycle is critical to achieving effective, equitable and durable impact. What is feasible, legitimate and sustainable is shaped by socioeconomic, sociocultural and sociopolitical contexts, while legitimacy, rights security and fair benefit-sharing underpin sustained stewardship and reduce reversals.^{320, 321} ■

4.3 THE LAND PATHWAY: DESIGNING AND MANAGING MULTIFUNCTIONAL LANDSCAPES

4.3.1 Advocating for a mosaic landscape approach that integrates diverse land uses, from natural forests to productive systems

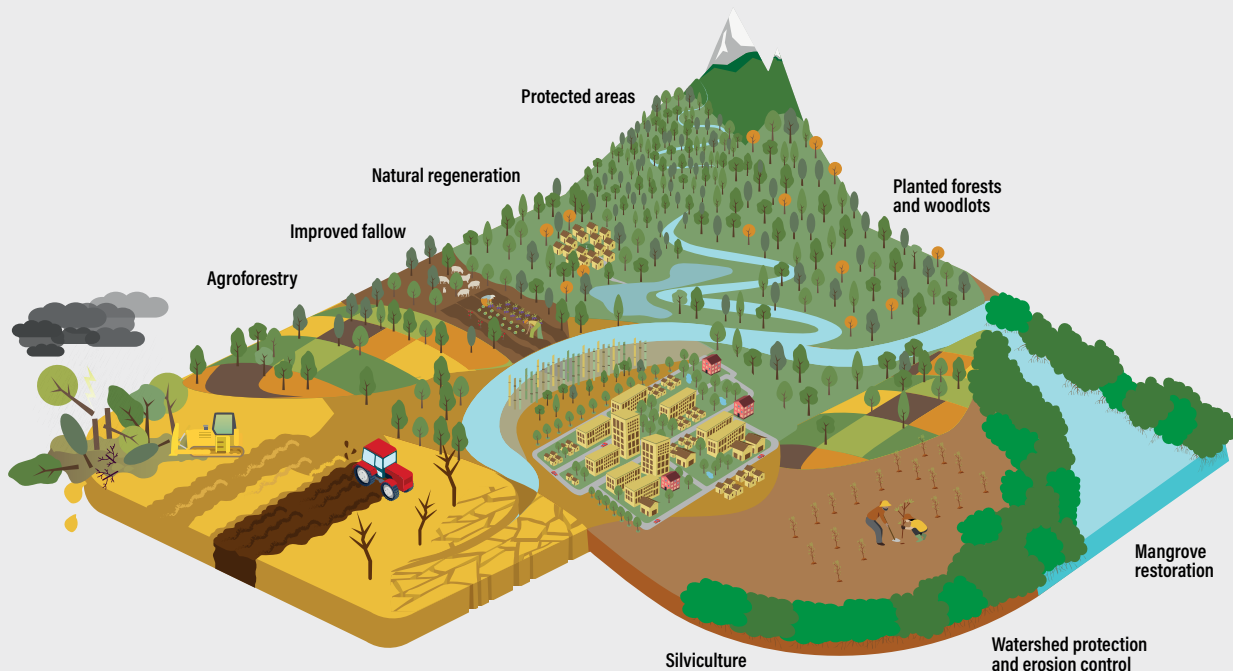
FLR considers both ecological and socioeconomic outcomes,³³⁴ so that restoration can balance the attainment of multiple goals, for example, food production, livelihoods and human well-being in tandem with biodiversity conservation, resilience and climate change mitigation. Synergies and trade-offs across these sometimes-competing goals lay at the core of the notion of landscape multifunctionality.³³⁵ Landscape multifunctionality is characterized by Selman (2009)³³⁶ as: (1) the pursuit of different goals on the same parcel of land either simultaneously or successively in time; (2) the integration of different land-use goals at the beginning of a project and constantly revisiting these objectives to accomplish them simultaneously; and (3) the spatial combination of separate land units with different functions. Landscape multifunctionality is addressed in the first of the six GPFLR principles²⁶¹ (Figure 4.4). Adoption of this concept allows restoration practitioners to reconcile agriculture, conservation and other competing land uses.

Particularly in rural landscapes, several land uses cohabitate, and the bundle of ecosystem

services to be restored may reflect different needs and objectives. In such contexts, adopting a landscape approach will enable reconciling production and conservation outcomes. Mosaic restoration, which integrates trees into mixed-use landscapes³³⁷ can support local communities by improving water quality, increasing soil fertility or providing other ecosystem services and products, including timber or non-timber forest products. Integrated landscape management tools and approaches are essential to designing restoration strategies that are evidence-based and built on consensus. Agroforestry and smallholder tree-farming systems, which include a variety of systems from woodlots and small-scale plantations, to intercropping, boundary plantings and many others, are considered a key restoration opportunity across many contexts³² and when quality materials are being used. Beyond the ecological benefits of agroforestry systems, which provide permanent tree cover in contexts in which natural forest restoration or full sun crops are not viable, agroforestry can enhance livelihoods in rural communities by providing a variety of food, fodder and tree products. However, key constraints to upscaling the adoption of agroforestry include the lack of supportive policies, technical capacities, investments and value chains.¹³⁰

Planted forests, which encompass a broad range of production systems and management intensities, also have the potential to deliver on multiple restoration objectives. Although intensively managed tree monocultures can hardly be considered as restored stands, they may be considered as a relevant management option within some landscapes.³³⁸ Indeed, establishing highly productive plantations to meet the industrial roundwood demand increase by 2050 would be needed over at least 33 million ha.⁵⁸ Simplified or monoculture planting approaches may increase biomass and carbon stocks but typically deliver weaker biodiversity outcomes and lower ecological resilience.^{97, 228} In addition, models of multifunctional planted forests, including mixed-species planted forests, which produce diverse packages of ecosystem goods besides wood, such as non-timber forest products for food for medicinal use, fibre, biofuels or fuelwood, or closer-to-nature forest management should be operationalized on a larger scale.³³⁹

FIGURE 4.4 A MOSAIC LANDSCAPE APPROACH UTILIZES SPATIAL PLANNING TO IDENTIFY EFFECTIVE RESTORATION APPROACHES TO SUPPORT THE MULTIFUNCTIONAL NATURE OF LANDSCAPES



SOURCE: Adapted from Garrett, L., Lévyte, H., Besacier, C., Alekseeva, N. & Duchelle, M. 2022. *The key role of forest and landscape restoration in climate action*. Rome, FAO. <https://doi.org/10.4060/cc2510en>

4.3.2 Spatial planning to support multifunctionality

As millions of hectares of deforested and degraded land are committed to restoration globally, it is crucial that FLR effectively deliver the environmental and social multifunctionality it promises. Prioritizing areas that maximize synergies between biodiversity conservation, climate change mitigation and ecosystem services can deliver conservation gains up to three times greater than non-strategic approaches.^{27, 340} In achieving multifunctional restoration outcomes, FLR is naturally poised to overcome some of the inherent limitations of site-only focused restoration by virtue of the landscape scale at which it operates and crucially, its position to spatially plan and coordinate land uses across different sites, including different forms of restoration.³⁴¹

Spatial land-use planning is crucial to ensuring multifunctional restoration outcomes for three reasons. First, spatial heterogeneity in biophysical and socioeconomic conditions means that sites most likely differ in their achievable restoration outcomes (e.g. biodiversity, livelihoods, goods and services), as well as in the extent to which various outcomes are desired by different local communities and stakeholders.^{342, 343} Additionally, because degradation drivers vary spatially, they must be addressed in view of this spatial heterogeneity and the interplay of other factors. Second, the landscape context can strongly shape ecological patterns and processes at the local scale, resulting in landscape effects on the outcomes (biodiversity, ecosystem services, social benefits) of restoration.^{92, 341} To date, the best available evidence for these effects concerns biodiversity, with the field of landscape ecology having long established the strong influence of landscape composition and configuration

on various aspects of biodiversity,^{344, 345} including under the specific context of forest restoration.^{346, 348} Landscape connectivity is a critical determinant of restoration success, as actions that reconnect fragmented habitats facilitate species movement, gene flow and recolonization, thereby increasing population persistence and reducing local extinction risk.³⁴⁸ When restoration interventions are adapted to local ecological dynamics, these benefits extend across ecosystem types.¹⁷

The third reason concerns likely trade-offs between ecological considerations and the commodity production (e.g. agricultural and forestry products) outcomes of restoration, which limit the extent to which a site can simultaneously deliver all desired functionalities.¹⁵¹ Further complicating such trade-offs is the fact that with regard to biodiversity, many – if not most – forest ecosystems around the world have at least some species that are highly sensitive to habitat change, such that their persistence can only be guaranteed by setting aside mature, largely intact forest habitat.^{349, 350} Land-use planning achieves such desirable landscape-scale outcomes by capitalizing on the complementary ecological and production profiles of different land uses³⁵¹ – including among different modes of restoration (e.g. natural forest, agroforestry, versus high-yield plantations) and more broadly, among restoration, the protection of existing habitats and productive use of existing production lands³⁴¹ (Box 4.1).

Overall, effective spatial planning enables FLR to avoid suboptimal outcomes that can occur with site-focused restoration (Case study 2). At landscape scales, it enhances functional connectivity, particularly in fragmented biomes,³⁵² whereas at finer scales it integrates restoration into production lands without compromising viability and generating conservation co-benefits in agricultural lands.³⁵³

Spatially explicit land-use models can simulate alternative scenarios and identify options that optimize multiple objectives.^{90, 255, 354} However, robust modelling depends on reliable data quantifying multiple land-use functions, which remain limited for many landscapes.³⁴¹ Effective planning must also account for socioeconomic constraints, land tenure, equity

and the meaningful participation of local communities.^{134, 270} FAO (2024)³⁵⁵ provides a nine-step operational framework for: problem identification and stakeholder mapping; characterization of resource potential and multicriteria analysis of land-use options; negotiated consensus; and implementation and adaptive monitoring. Users of this framework can use this ready-made process architecture to translate FLR spatial planning commitments into practice at national, subnational and landscape scales.

4.3.3 Adaptive land management strategies

Beyond landscape-scale spatial planning, successful restoration of multifunctional landscapes depends on the sustainable and adaptive management of individual land parcels that is reflective of their specific uses. Across the spectrum of land uses, from intact forests to highly modified agricultural and forestry systems,³⁵⁶ FLR management decisions strongly influence the delivery of desired outcomes and the avoidance of negative ones.^{357, 358} These decisions must reflect the current understanding of future climate suitability and the risk assessment of potential changes to disturbance regimes (e.g. precipitation, fire, pests).

Fortunately, a strong evidence base exists for how diverse land uses can be sustainably managed and for ensuring effectiveness through adaptive management.³⁵⁹ For existing native forests, especially intact ones, protection from loss and degradation is paramount. These ecosystems contain near-complete species assemblages and complex vegetation structures, maintain exceptional biodiversity and provision of ecosystem services³⁶⁰ and serve as sources of plant and animal propagules for nearby areas.⁹² Degradation includes not only vegetation loss but also faunal decline from threats such as extraction and hunting, which disrupt species interactions, as well as ecosystem functioning and resilience.^{152, 361}

For sites that are targeted for ecological restoration, interventions should match site conditions, including degradation level, seed banks, proximity to native ecosystems, and both current and expected future climate.^{362, 363}

BOX 4.1 COMPAÑÍA AGRÍCOLA Y FORESTAL EL ÁLAMO: INTEGRATING NATIVE FOREST RESTORATION WITH COMMERCIAL FORESTRY IN CHILE

The *Compañía Agrícola y Forestal El Álamo Ltda.* (CAF)* is established over 3 083.4 ha in the central part of Chile and comprises 2 671.7 ha of forests under the Forest Stewardship Council (FSC) certification and 374.7 ha of agricultural land under the Rainforest Alliance Certification Standard for Sustainable Agriculture. Poplar cultivation is common across this highly anthropized landscape, largely considered devoid of native vegetation. Remaining native trees are now generally found as individuals or in small patches, near the banks of rivers, streams and estuaries, on steep slopes and in hedges. The restoration of Chile's native forest is a national priority, and maintaining and enhancing water quality for agricultural production

is paramount in this landscape. In this context, CAF embarked on a restoration project currently covering 158.1 ha that is expected to reach 244.1 ha by 2037. It focuses on enrichment by planting native species, such as quillay (*Quillaja saponaria*), maqui (*Aristotelia chilensis*) and maitén (*Maytenus boaria*), on the banks of watercourses, and removing non-native species. Restoration plays a crucial role in the company's business model. CAF recognizes that healthy ecosystems underpin production and has adopted the guidelines of the Preferred by Nature Ecosystem Restoration Standard, which aligns with good production practices promoted by FSC and Rainforest Alliance.

NOTE: *See <https://cafelalamo.cl/documentos/>

Where conditions are favourable (e.g. low levels of degradation, available propagule sources, favourable temperature and rainfall), natural regeneration should be prioritized.¹⁰⁷ Where barriers impede recovery, assisted natural regeneration can remove constraints such as invasive species or grazing pressure to initiate recovery.⁹⁵ Active planting of native species should be reserved for severely degraded sites. Restoration interventions are best viewed as a continuum of intensity aligned with site conditions.³⁶⁴

For lands primarily dedicated to production, notably agriculture and forestry, the critical aspects of sustainable management concern reducing the negative ecological impacts of production and improving their capacity to support biodiversity and other benefits. Benefits include a range of ecosystem services and also increased landscape connectivity without sacrificing production capacity.³⁶⁵ As highly modified systems that can drive the conversion of natural ecosystems⁴⁸ and form the extensive degraded matrix of fragmented landscapes,³⁶⁶ unsustainably managed production lands are known to have limited capacity to support

biodiversity or deliver ecosystem functions and services.^{151, 367} Under modern agricultural or forestry practices, their high chemical-input nature also renders them sources of pollution, with negative external impacts on surrounding ecosystems.³⁶⁸ Extensive measures have been proposed and proven effective at mitigating these negative impacts and improving the biodiversity or other ecological performances of agricultural and forestry lands.³⁶⁹ These include soil conservation (e.g. no or reduced tillage, cover crops and crop rotation),^{370, 371} sustainable fertilization (e.g. green manure, biochar),³⁷² sustainable pest control (mixed or intercropping, crop rotation, physical rather than chemical pest control, and natural enemies),^{373, 374} as well as sustainable forest management and harvest (retention or partial harvest and extended rotation cycles).³⁷⁵ The above management strategies should be designed, implemented and their outcomes assessed following an adaptive management approach to inform their continued relevance and success³⁵⁹ (Box 4.3). Adaptive management prioritizes iterative learning³⁷⁶ and can help identify the most effective management pathway for a given site and mitigate the impact of drivers that may result in unintended

outcomes.³⁷⁷ Under FLR, adaptive management involves identifying possible management strategies, implementing the selected options, monitoring their results, using the findings to reduce uncertainties and adjusting future interventions accordingly.³⁷⁸ Embedding robust monitoring and assessment frameworks is therefore essential for FLR implementation.³⁷⁹

4.3.4 Importance of high-quality genetic material for impactful restoration initiatives

Restoration outcomes are fundamentally determined by the quality, diversity and suitability of inputs (species and genotypes within species). Technical knowledge is key to ensuring genetic diversity, provenance and locally adapted planting materials that form the foundation of resilient ecosystems.^{380–382} Yet, in many global initiatives these elements remain weak and lead to restoration failure.^{224, 383} Without high-quality biological and technical inputs, the billions of dollars being mobilized for restoration risk producing fragile, short-lived outcomes that neither sustain biodiversity nor deliver benefits for people locally or society globally in terms of climate and biodiversity.

From tree planting to ecosystem restoration

Moving from a focus on hectares restored to the quality of restoration requires reversing the global failure to invest in diversity despite its importance.³⁸⁴ Shifts are needed from tree planting to tree growing, and from monocultures to multifunctional landscapes. This transition depends on quality genetic material and sustained monitoring and adaptive management, but also farmer behavioural change.³⁸⁵ Together, these can ensure that restoration delivers climate, biodiversity and livelihood benefits over decades, not just the first rainy season.

Biodiversity is not only an outcome of restoration but also a key driver of ecosystem functioning, resilience and long-term sustainability, enhancing ecosystem stability under varying disturbance regimes and thus has a foundational role in high-quality restoration.^{17, 386}

Genetic diversity and provenance: the invisible foundation of resilience

Species diversity and the appropriate species selection, especially native, are an essential part of restoration planning. Genetic diversity within and among species underpins the capacity of restored systems to adapt to pests, diseases and a changing climate. However, currently applied approaches to produce germplasm or forest reproductive material are often opportunistic or lack management, resulting in a narrow genetic base by sampling a few seed trees and often of unknown origin. This can create restoration “dead ends” – stands that may survive initially, but that fail to reproduce or adapt over time.^{381, 383} Provenance is equally critical because individuals of the same species may perform very differently across sites depending on their genetic origin. Selecting the right provenance can mean the difference between thriving forests and failed plantations. Systematic provenance testing remains limited in most tropical regions, but emerging digital tools now allow practitioners to combine ecological, climatic and genetic information to guide sourcing decisions.

Species–site matching and seed zoning tools and methods

Restoration planners require data-driven approaches to move beyond intuition and convenience. The Diversity for Restoration (D4R) tool,³⁸⁷ for example, provides a spatially explicit framework for matching species and provenances to local site conditions and restoration objectives, and that integrates traditional ecological knowledge. By integrating climate projections, soil data and species’ ecological traits, D4R helps identify combinations of native trees and their seed zones³⁸⁷ that are ecologically appropriate, climate-resilient and valuable for local livelihoods. Embedding such science-based species–site matching into restoration planning ensures that investments are more likely to become self-sustaining, biodiverse landscapes.

Locally supplied planting materials and community enterprise

Global restoration commitments are largely disconnected from national seed systems and availability of seeds and seedlings of native species^{385, 388, 389} (Box 4.2). Restoration succeeds when it is rooted in local landscapes and

BOX 4.2 STRENGTHENING NATIVE TREE SEED SYSTEMS FOR MULTIFUNCTIONAL LANDSCAPE RESTORATION IN INDIA AND SOUTH-EAST ASIA

Across India and South-east Asia, large-scale forest and landscape restoration (FLR) is increasingly constrained by limited access to diverse, locally adapted native tree seeds.²²⁴ Restoration efforts have often depended on opportunistic sourcing, leading to poor survival, low genetic diversity and limited livelihood benefits.³⁸³ Informal seed collectors and community nurseries remain weakly connected to formal restoration supply chains, while information on seed origin and suitability is fragmented.

The Darwin Initiative's "Strengthening collaborative tree seed supply systems for restoration in Asia," funded by the Government of the United Kingdom of Great Britain and Northern Ireland, addressed these constraints in India, Indonesia and the Philippines, by using seed zone mapping, digital information systems, capacity development and community engagement. Spatial analyses revealed major gaps in seed source

availability for priority native species. These data were embedded in government-managed platforms, enabling restoration planners to better match species and provenances to site conditions. Training and targeted support strengthened the role of community-based and smallholder seed producers, including on Indigenous lands, while national agencies are now adopting the resulting tools and approaches. The programme has helped improve the sourcing of native seeds, enhanced genetic resilience and reduced reliance on exotic species. It has also created new livelihood opportunities linked to restoration supply chains, seed collection and nurseries. This example highlights that effective multifunctional landscape restoration depends on sustained investment in quality seed systems as foundational infrastructure for biodiversity, climate resilience and rural development.

economies. Locally managed nurseries and seed enterprises reduce costs and build ownership and livelihood opportunities within communities.²⁸⁰ They also enable the production of species that are culturally valued, locally relevant, nutritious and ecologically functional, rather than relying on a narrow palette of exotic or fast-growing species.³⁹⁰ Developing *smart seed and seedling systems* that connect national seed centres, private suppliers and community nurseries creates circular economies around restoration and strengthens supply-chain accountability. Building awareness of these issues is also critical.³⁸⁰

Long-term monitoring and adaptive learning

Even with high-quality inputs, restoration is a long-term process. Continuous monitoring of restoration progress that integrates ecological socioeconomic indicators, both remote sensing and community-based data, enables adaptive management and verification of outcomes (Box 4.3). Regular reporting, even if simple, helps maintain trust and supports learning across landscapes and programmes. Transparent monitoring systems also build credibility and support access to climate and nature finance by demonstrating progress towards national targets, reinforcing continuity across seasons and political cycles.

Too often, projects end before trees or forests mature, leaving no mechanism to assess survival, ecosystem recovery and impacts on communities. Embedding monitoring into project design ensures accountability, learning and sustained impact. Large-scale initiatives reinforce the fact that such systems form the basis for adaptive decision-making and sustained engagement.¹⁴⁰

Approaches that combine biophysical and socioeconomic indicators, use straightforward and scalable tools and involve communities in data collection provide information that is practical for adjusting management.^{391, 392} Effective monitoring, reporting and adaptive management are also essential for sustaining policy alignment over time. Transparent systems that track restoration outcomes across environmental, social and economic dimensions can help build accountability, support learning and strengthen the case for continued public investment. Where monitoring frameworks are linked to national reporting obligations and development planning cycles, they can reinforce coherence between domestic priorities and international commitments, increasing the durability of restoration efforts. ■

BOX 4.3 TOOLS FOR MONITORING FOREST AND LANDSCAPE RESTORATION

At the local level, farmers, communities and Indigenous Peoples use practical, participatory tools to monitor soil health, biodiversity, productivity and livelihoods. Although not originally designed for restoration, sustainability frameworks such as the Food and Agriculture Organization of the United Nations (FAO) Sustainability Assessment of Food and Agriculture (SAFA) tool^{393, 394} and its Spatial Monitoring and Reporting Tool (SMART) enable standardized assessments across farms and landscapes.

Others like FAO's Tool for Agroecology Performance Evaluation (TAPE)^{132, 133} assess agroecological and regenerative practices, while MESMIS^{395, 396} helps communities identify environmental, social and economic strengths and weaknesses during sustainability transitions. Numerous other models exist.³⁹⁴ Technologies such as the MyFarmTrees digital platform can make quality inputs visible, traceable and rewarding for local stakeholders. Farmers record seed sources and planting sites via mobile phones, linking their activities to verified tree performance. QR-coded seed lots and blockchain-based traceability ensure that each tree's origin, species and survival can be verified.³⁹⁷ Collectively, these tools support community-led restoration by assessing environmental

integrity, social well-being, economic viability and governance.

In contrast, tools at the regional and national scales rely on geospatial information systems (GIS), remote sensing and modelling to support planners and governments. Google Earth Engine, Open Foris,³⁹⁸ the Framework for Ecosystem Restoration Monitoring (FERM), land degradation neutrality (LDN) indicators³⁹⁹ and Restor allow the tracking of land cover, biomass and ecological change over large areas. Models like InVEST estimate ecosystem service outcomes, including carbon, water regulation and erosion control.^{102, 400} Digital and AI-enabled systems, such as DINOv3,⁴⁰¹ accelerate monitoring and improve data reliability, increasing investor confidence. Additional frameworks such as the restoration opportunities assessment methodology (ROAM)⁶¹ and natural capital accounting,⁴⁰² along with platforms like Restor, support policymaking, and community and private sector engagement. However, the effectiveness of even the most technologically advanced tools depends on transparent governance, participatory monitoring and contextual interpretation.^{138, 403} Persistent data gaps, especially linking restoration to socioeconomic impacts,¹⁹⁹ highlight the need for stronger local capacity and continued innovation.

4.4 THE FINANCE AND BUSINESS PATHWAY: FINANCIAL OPTIONS FOR THE SCALE AND NATURE OF RESTORATION NEEDED

4.4.1 The financing challenge for large-scale restoration

Global assessments consistently show that investment in FLR falls far short of international targets. The United Nations Environment Programme (UNEP) and the UN-REDD Programme (2025)⁴⁰⁴ estimate that total annual finance reached approximately USD 84 billion

in 2023, less than a quarter of what is required. Most of this funding currently comes from public sources,⁴⁰⁴ estimated at almost three times the finance coming from private sources (respectively USD 47 billion versus USD 17 billion).

However, it is widely recognized that the private sector needs to be a more important funding source for restoration than it has been in the past.^{134, 172, 199, 405–407}

Over the past decade, countries, companies and international coalitions have made increasingly ambitious pledges to restore degraded forests and landscapes. Yet, despite mounting academic evidence and general consensus that financing restoration makes social, ecological and economic sense,⁸⁶ progress on the ground has consistently lagged behind these commitments.^{58, 404, 406, 408}

The resulting gap primarily reflects a deeper misalignment between the economic characteristics of restoration (nature of benefits and costs) and the way economic systems and financial instruments are currently designed. Therefore, addressing this misalignment is not only a question of mobilizing more finance, but also of ensuring that appropriate forms of finance are directed to the actors, locations and stages of restoration where they are most effective.

This requires greater attention to the suitability, targeting and sequencing of finance, rather than focusing on scale alone.⁴⁰⁹ Restoration is fundamentally different from many other forms of investment. It is capital-intensive in its early phases, generates benefits unevenly over long time horizons, and produces a large share of value in the form of public goods such as climate regulation, biodiversity conservation, water security and resilience (Figure 4.5 and Chapter 3).

These features sit uneasily with dominant financial models that prioritize short-term cash flows, rapid turnover and monetizable returns.⁴¹⁰ As a consequence, restoration has remained heavily reliant on fragmented public funding, while private capital engagement and philanthropic support have been selective, cautious and limited in scale.^{404, 408}

Even when restoration yields development impact, capital flows are hindered by a structural risk–return mismatch characterized by the following issues: (1) high upfront expenditures combined with delayed returns necessitate “patient capital” that is rarely available in commercial markets; (2) uncertainties in potential returns from timber, agroforestry or ecosystem services might be split across multiple, disparate streams; and (3) complexities and costly project aggregation, due diligence, and performance monitoring – especially at small scales – discourage engagement.^{409, 411, 412} Overcoming these barriers requires financial mechanisms that reduce or mitigate risk, improve liquidity, lower transaction costs and bundle multiple revenue streams into bankable cash flows.

This pathway examines how finance can be made to fit the scale of restoration needed. It argues that scaling restoration is not simply

a matter of mobilizing more finance, but of reshaping financial architectures so they align with the ecological, social and temporal realities of restoration. It also highlights the changing role of public finance, which is increasingly seen as a catalyst to leverage and incentivize the mobilization of private capital. The pathway follows a progressive logic. It first diagnoses why current economic and financial conditions constrain the financing of restoration and how the conditions to incentivize restoration investments can be improved. It then examines how, under certain conditions, restorative businesses enhance both the sustainability of restoration interventions and the attractiveness to restoration for private capital. The next section looks at how emerging markets can further improve the viability of FLR. The pathway then explores how different forms of finance can be sequenced and combined to unlock durable, large-scale restoration outcomes for local actors. It concludes with a look at blended finance solutions to align private interest with public goals.

4.4.2 Creating the conditions for incentivizing and accelerating the transformation of private-sector business models

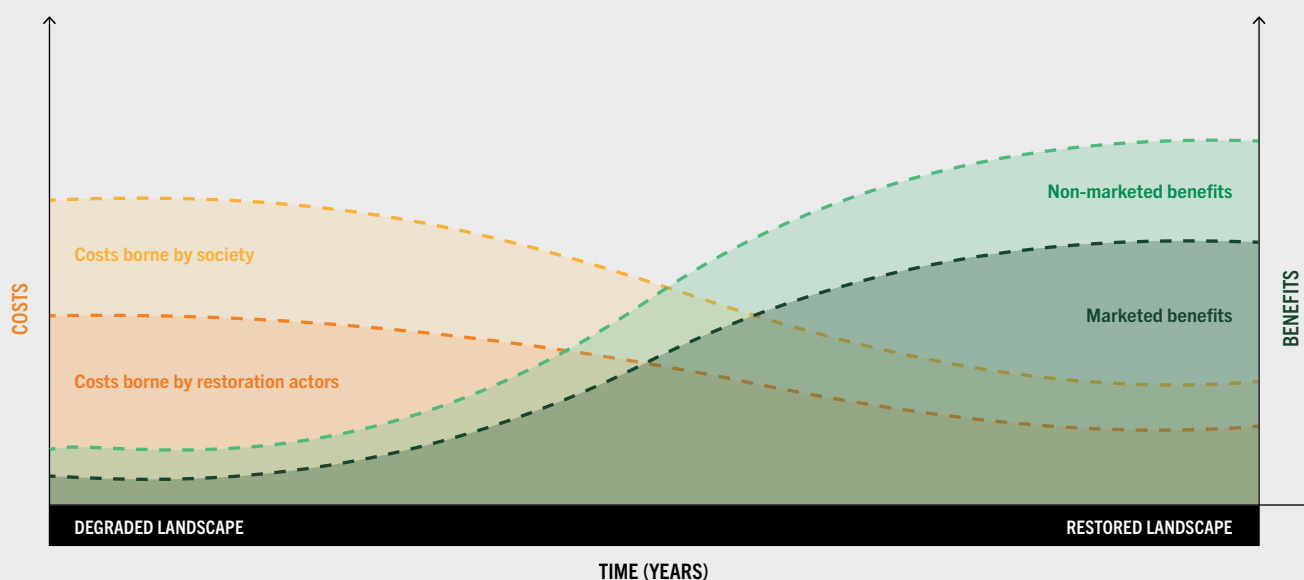
While many restoration cases provide evidence of multiple commercial and environmental benefits, these successes remain anomalies within a global system built on extraction. Transitioning the private sector from niche engagement to systemic adoption requires addressing key conditions to scale up private investments. In the absence of improvements on these conditions, private-sector engagement and finance in forest restoration will remain confined to limited geographies (Box 4.4).

Below, six critical mechanisms are highlighted that can incentivize restoration investments: (1) fiscal reform; (2) regulatory alignment; (3) market segmentation; (4) technological innovation; (5) improved finance data and evidence; and (6) pre-competitive coordination among firms.

Using fiscal reforms to realign private sector and finance flows with restoration needs

Governments are vital in optimizing the investment environment to bridge the gap

FIGURE 4.5 DEFINING THE COSTS AND BENEFITS OF FOREST AND LANDSCAPE RESTORATION



SOURCE: Adapted from Raes, L., Buffle, P., Williamson, Z., Benson, S. & McBreen, J. 2023. *A guide to investing in landscape restoration to sustain agrifood supply chains: reducing risks, raising resilience, reaping returns*. First edition. Gland, Switzerland, IUCN. <https://doi.org/10.2305/HRZZ8888>

between destructive and restorative practices. A well-known case is Costa Rica's payments for ecosystem services (PES) programme. The programme, funded by a fuel tax, helped double forest cover.^{412, 413} Similarly, the United States of America's reforestation tax credits and Ugandan cash payments have proven effective for improving tree planting returns in the first case and halving deforestation rates in the second.^{413, 414} The role of governments is also essential to enhancing market access by investing in infrastructure and fostering demand through green public procurement. For example, over 30 countries now require that timber for public use come from verified legal or sustainable sources, creating market demand for restoration-friendly goods.⁴¹⁵ Another powerful fiscal intervention consists in reforming the USD 2.6 trillion in annual harmful subsidies. These perverse incentives make destructive land uses artificially profitable, undermining restoration efforts. Target 18 of the Kunming–Montreal Global Biodiversity

Framework (KMGBF) calls for reforming at least USD 500 billion of such subsidies by 2030. Redirecting harmful subsidies yields a fiscal double dividend: it stops policy-driven financing of degradation while freeing resources for restoration. By redirecting existing funds from destructive to regenerative activities, governments can massively increase restoration financing while also correcting market distortions.⁴¹⁶

Ecological fiscal transfers are also a promising fiscal reform. These reward local governments with differentiated fiscal transfers depending on their effectiveness in protecting and restoring forests – essentially a polluter-pays in reverse (a conserver-gets-paid principle). Brazil (Ecological ICMS) and India (USD 6–12 billion per year) are two countries that reward subnational governments for their conservation performance.^{58, 106}

BOX 4.4 ENABLING CONDITIONS TO SCALE UP PRIVATE INVESTMENTS IN FOREST RESTORATION

Despite growing interest, private finance for forest restoration remains limited to those places where trees can grow profitably, securely and sustainably. Vincent *et al.* (2025)²⁶⁶ assessed the conditions that are key for attracting private investments in 155 low- and middle-income countries. These were tree growth rates (for wood), potential carbon sequestration (for carbon markets), market access, restoration costs, parcel size (economies of scale), tenure security and country risk factors. They concluded that less than 1 percent of restorable land is attractive to private investors under current conditions. Furthermore, investment hotspots are concentrated in upper-middle-income countries like Brazil, China and South Africa, with low-income countries, where restoration needs are often greatest, lagging far behind. However, areas

with strong investment potential also tended to offer significant local livelihood benefits, such as higher forest sector employment. Their study concludes that private investment can complement but not replace public policy and funding. Governments play a vital role in improving the underlying investment environment, for example, by:

- ▶ enhancing market access (e.g. investing in roads and infrastructure);
- ▶ reducing investment costs (e.g. offering tax incentives or restoration subsidies);
- ▶ strengthening land tenure and property rights to provide investors with security; and
- ▶ boosting demand (e.g. promoting wood use in public procurement).

SOURCES: Adapted from CIFOR-ICRAF Forests News. 2025. Can private investment drive forest restoration at scale? In: *Forests News*. [Cited 14 April 2026]. <https://www.forestsnews.org/92044/can-private-investment-drive-forest-restoration-at-scale>; and Vincent, J., Aga, Y., Boscolo, M., Chang, K., Cheng, Z., Dilger, J., Guerrero Machado, D. *et al.* 2025. Assessing conditions to scale up private investment in forest restoration. *Journal of Forest Business Research*, 4(1): 37–72. <https://doi.org/10.62320/jfbr.v4i1.64>

Align regulation and voluntary standards

A “smart mix” occurs when voluntary system audit practices and regulations codify these practices into law.^{417, 418} Regulations are critical to ensuring that laggards meet the benchmarks set by early adopters.⁴¹⁹ Examples include the European Union Deforestation Regulation and the European Union Nature Restoration Law.⁴²⁰ For audit practices and implementation of regulations to succeed, effective meso-level institutions are also critical to manage land-use trade-offs^{121, 273} and secure land tenure.^{314, 421}

Leverage market and price segmentation as responses to demand and preference shifts

Market and price segmentation via ecolabels (e.g. FSC, Klongpang Rubber Cooperative [PEFC], Fairtrade) allows producers to capture value from sustainability-conscious consumers.^{422, 423} Evidence suggests that smallholders working with these standards can obtain 20–30 percent higher prices.⁴²⁴ Examples include Thailand’s Klongpang Rubber Cooperative and Bolivian organic Brazil nuts, which command 15–30 percent premiums.⁴²⁵

Currently, only 13 percent of global forests are eco certified. Shifting these from “premium niches” to “standard costs of business” requires coupling voluntary demand with mandatory minimum standards.^{86, 426}

Boost restoration profitability and investability with new technologies

Technological advances reduce risk premiums and operational costs, making restoration more “investable”. For example, remote sensing and distributed ledgers improve verification and reduce double counting.^{427, 428} Precision planning tools identify areas where restoration is both ecologically viable and economically attractive, allowing small enterprises to overcome capital constraints through better performance data.

Strengthen data and evidence on the economic and financial performance of restoration

Scaling finance for restoration is constrained by fragmented and incomplete data on costs (Chapter 3), returns, risks and performance across different restoration contexts and business

models. Limited and inconsistent evidence has historically led to unrealistic assumptions in forest and land-based investments, contributing to project underperformance and investment failure. For restoration, more systematic and comparable data on both financial performance and restoration outcomes are essential to support project appraisal, risk assessment and due diligence, and to improve the bankability of restoration activities, particularly for small-scale operators. Emerging initiatives such as the Science Based Targets Network (SBTN) and the Nature Positive Initiative^{an} are contributing to the development of indicators and metrics, but further innovation is needed to translate monitoring data into decision-relevant financial information. Without more robust and standardized data systems, due diligence remains costly, transaction costs remain high and many financial institutions will continue to perceive restoration investments as opaque and high risk.

Fostering coordination through private-sector platforms to facilitate joint action

Individual firms rarely possess the incentive to absorb sustainability costs, while competitors can have a “free-ride”. Pre-competitive platforms^{ao} allow rival firms to align on standards before competing on implementation.⁴¹⁷ An example is the Amazon Soy Moratorium of 2006, which drastically reduced deforestation by excluding non-compliant products.⁴¹⁷ Similar impacts are seen in palm oil⁴²⁹ and beef.

Another example is the Atlantic Forest Restoration Pact which coordinates over 270 members via shared governance,^{430, 432} while digital forums co-develop investment pipelines.^{134, 432} In sum, integrating climate, biodiversity and livelihood goals requires intersectoral policy coherence.⁴³³ When fiscal incentives, infrastructure investments and legal protections for land tenure align, restoration moves from a peripheral pledge to the structural baseline of the global economy.

^{an} See Nature Positive Initiative. *A global goal for nature: securing a nature-positive world by 2030*. <https://www.naturepositive.org/>

^{ao} Pre-competitive private-sector platforms are collaborative forums where companies, often direct competitors within the same industry, work together to solve shared, systemic challenges that no single business can address alone.

4.4.3 Foster a new generation of restorative businesses that put nature and people at the heart of their value proposition

Restorative businesses integrate restorative production practices in working lands to generate goods and services while maintaining or enhancing ecosystem functions. Examples include agroecology-based and agroforestry systems that improve soil health, diversity and resilience, sustainable forestry operations that combine restoration with timber production, non-timber forest product value chains and landscape-based enterprises that link production, conservation and livelihoods. When linked to sustainable value-chain development, restoration has the potential to tangibly benefit local stakeholders and increase their stake in its success and sustainability.⁴³⁴

This is challenging in degraded landscapes where restoring productivity may require multiple years during which farmers may experience income reductions, and where providing financial compensation for some years remains necessary.⁴³⁴ However, even in dryland ecosystems, evidence shows that locally established green enterprises can provide income-earning opportunities and incentivize communities to participate in restoration and sustainable management.⁴³⁵

The potential for restorative businesses to integrate production and environmental stewardship vary systematically along gradients of ecosystem degradation. In landscapes where forest structure, soils, seed sources and hydrological functions remain partially intact, restoration interventions are generally less expensive, less technically complex and more likely to succeed, often relying on assisted natural regeneration, protection and low-input management. As degradation intensifies, restoration shifts towards more capital-intensive and technically demanding interventions, including site preparation, soil rehabilitation, planting and long-term maintenance, with higher financial costs, longer time horizons and greater risks of failure. This creates a strong economic and ecological rationale for prioritizing early action and for protecting moderately degraded

landscapes before they cross biophysical and socioeconomic thresholds that make restoration substantially more costly and uncertain.

Landscapes also differ markedly in their exposure to implementation and financial risks, and in their capacity to attract different forms of investment. Contexts where degradation remains moderate and governance, tenure security, market access and baseline productivity are relatively strong are generally more attractive to private and blended finance, as restoration interventions tend to be less capital-intensive, generate returns more rapidly, and carry lower delivery risks. By contrast, highly degraded, remote or institutionally weak landscapes typically require higher levels of public, concessional and philanthropic finance to underwrite early action, absorb risk and establish the biophysical and socioeconomic foundations needed before commercial investment can realistically be engaged.

This differentiated risk and investment profile across landscapes has been documented in FAO's work on sustainable finance and local financing mechanisms for FLR, which highlights the importance of aligning financial instruments with local risk profiles and restoration interventions (Box 4.5).

Not all restoration activities can or should be organized around commercial business models. Many restoration interventions deliver benefits that are primarily social or ecological, generate limited cash income, or require long time horizons before revenues materialize. Treating all restoration as a potential business risks excluding important interventions and placing unrealistic expectations on local actors. Where restorative businesses are viable, they can contribute significantly to scaling restoration. By generating income and employment, they strengthen local incentives for long-term stewardship and create demand for finance that supports sustained management rather than one-off interventions. Their success depends on ecosystem productivity as well as access to markets, appropriate finance, knowledge, technical capacity and supportive policies, laws and regulations.^{412, 434, 436}

Crucially, restorative businesses differ widely in scale, risk profile and financing needs. Smallholder-based enterprises, community organizations and small and medium enterprises often require patient, flexible finance and technical support, while larger operations may access more conventional forms of capital once risks are reduced. Recognizing this diversity is essential for designing finance solutions that support, rather than distort, restorative economic activity.⁴³⁴ Empowering entrepreneurship at the local level – where most land and resource management decisions are made – is a critical enabling condition for restorative businesses. Targeted incubation and acceleration, combining technical assistance, mentoring and organizational strengthening, can help translate restoration practices into viable business models. Supporting collective enterprises and producer organizations can be a strategy to enable aggregation, reduce transaction costs and improve bargaining power within value chains.⁴³⁵

Facilitating access to market opportunities is equally essential. Restorative businesses often face weak demand, price volatility and limited market access, particularly in the early stages. Integrating small-scale and community-based enterprises into larger value chains through partnerships with processors, traders and lead firms can stabilize revenues and reduce market risk. Instruments such as offtake agreements, out-grower schemes and long-term sourcing commitments can provide predictable demand while enabling companies to secure resilient, nature-positive supply.^{437, 438} For many restorative enterprises, predictable market access is the primary driver of bankability, as lenders and investors typically require stable cash flows and contractual demand before engaging with commercial or private finance.^{134, 434} Together, these forms of enterprise support are critical for building pipelines of restoration-linked businesses that are sufficiently mature and bankable to engage with commercial and non-commercial lenders, development finance institutions and impact-oriented funds.

Finally, restorative businesses should be understood as part of broader ecosystem-building processes that support long-term economic and social resilience. Restoration strengthens the natural asset base – soil, water, biodiversity and

BOX 4.5 LOCAL FINANCING MECHANISMS TO ALIGN RESTORATION RISK AND INVESTMENT READINESS

The Food and Agriculture Organization of the United Nations' (FAO) review of local financing mechanisms for forest and landscape restoration (FLR) shows that landscapes differ fundamentally in their risk profiles and investment readiness, and that restoration finance must be tailored to local biophysical, institutional and socioeconomic conditions. The analysis highlights that in highly degraded or institutionally constrained contexts, early public, concessional and philanthropic finance is often required to support enabling investments, including stakeholder coordination, technical assistance, tenure arrangements and initial restoration actions. These early investments are critical to absorb risk, reduce transaction costs and establish the foundations needed before commercial investment can realistically engage.⁴⁰⁹ The publication documents multiple local case studies in

which locally anchored financing mechanisms were used to aggregate smallholders, de-risk restoration activities and progressively mobilize private capital. Examples include specialized credit lines for community forest enterprises, blended finance facilities combining guarantees and concessional funding, and public finance instruments that redirected fiscal flows to incentivize restoration. Across these cases, the sequencing and coordination of finance were central, with public and civic investments underpinning later private engagement as landscapes recovered and business models matured. This study shows how differentiated local financing mechanisms can operationalize risk-informed restoration interventions, enabling early action in higher-risk landscapes while progressively improving their capacity to attract blended and private finance as restoration advances.

climate regulation – on which local economies depend. By embedding business development within healthier and more resilient landscapes, restorative enterprises help sustain livelihoods over time and reduce the risk of resource depletion that undermines future production, thereby providing a foundation for durable local economic development.⁵⁸

4.4.4 Leveraging new environmental markets to enhance economic viability and resilience

The previous section examined how restorative businesses can combine restoration objectives with commercial development, empowering entrepreneurship, boosting income and employment while maintaining ecosystem functions. However, not all restoration outcomes translate into marketable goods. Many benefits are diffuse, accrue over long time horizons, or serve public rather than private interests. Environmental markets partly address this gap by creating direct revenue streams from outcomes that conventional product markets cannot price. Markets are developing for three critical restoration functions: carbon sequestration, biodiversity recovery and avoided disaster losses.

Harnessing carbon markets to monetize restoration outcomes and create durable funding streams

Many restoration interventions (e.g. tree planting, soil enrichment) remove carbon from the atmosphere (sequestration). Such carbon credits can be acquired by countries and corporations through carbon markets, which offer a mechanism to incentivize FLR at scale. By placing a price on sequestration and avoided emissions, they transform forests from assets to be liquidated into assets that yield returns through stewardship, aligning private incentives with ecological recovery.⁴⁰⁵ Payments for carbon sequestration are additional to eventual revenues that can be generated by restored landscapes and can enhance the bankability of enterprises that incentivize sustainability and ecosystem recovery. As most carbon projects (specifically on afforestation/reforestation/restoration) take time and money, they require significant initial investment from other sources and should be considered in the business model.

Voluntary markets allow the financial flow from companies achieving corporate climate commitments to restoration projects. Compliance carbon markets operate under legal mandates, typically through domestic or regional

cap-and-trade systems in which regulated entities must surrender allowances or offsets against their emissions. In most compliance systems, the use of forestry offsets remains limited; New Zealand's Emissions Trading Scheme (NZ ETS) is an exception, where forest sequestration has played a significant role due to relatively high allowance prices and the comparatively low cost of forest-based removals. Separately, Article 6 of the Paris Agreement establishes an international framework for cooperation between countries. Article 6.2 enables the bilateral or multilateral transfer of internationally transferred mitigation outcomes (ITMOs) between countries towards their nationally determined contributions (NDCs), while Article 6.4 establishes a centralized UN-supervised carbon crediting mechanism for generating tradable emission reductions and removals. Both mechanisms can include nature-based solutions such as restoration activities, provided robust accounting safeguards are in place to avoid double counting and ensure environmental integrity. Unlike domestic emissions trading systems, Article 6 mechanisms operate primarily through accounting and cooperation between countries in support of NDC implementation, rather than through direct compliance obligations imposed on regulated firms. Article 6 explicitly allows nature-based solutions to generate credits, signalling that restoration can sit at the centre of national climate strategies rather than at their margins.⁴³⁹

Although carbon finance remains relatively small compared with the overall scale of global restoration financing needs, it can provide an important complementary and performance-based revenue stream for restoration and forest conservation activities. The World Bank's Forest Carbon Partnership Facility (FCPF) has supported tropical countries in developing REDD+ programmes that generate payments for verified emissions reductions, primarily through avoided deforestation and forest degradation, while also supporting forest conservation and enhancement of carbon stocks. In some cases, these programmes include restoration and agroforestry activities as part of broader landscape approaches. While carbon finance alone is insufficient to fund restoration at the scale required globally, it can provide additional and recurring revenues that improve the financial viability of long-term restoration investments.

Crucially, carbon revenues are recurring revenues: as long as projects deliver verifiable outcomes, additional credits can be issued over time, covering costs of planting, monitoring and long-term management. This creates a funding model fundamentally different from one-off grants, one capable of sustaining restoration across decades and attracting private capital seeking predictable yield.

Realizing this potential is not without its challenges, the most critical being the need to provide robust integrity safeguards that everybody can trust. Additionality ensures that crediting from carbon removals (or emissions reductions) would not have occurred without carbon finance.⁴⁴⁰

It needs to be reinforced with conservative baselines and leakage controls to prevent loopholes and adverse play, which could undermine the mechanism if left unchecked for too long. Buffer pools insure against reversals from fire, pests or policy failure. Where these safeguards succeed, carbon credits become credible financial instruments; where they fail, markets risk reputational collapse and capital flight.⁴⁴¹

Mobilizing biodiversity credit markets to finance nature-positive outcomes beyond carbon

Carbon markets have demonstrated that pricing and marketing ecosystem services can channel private capital into improved land stewardship. Biodiversity credit markets aim to extend this logic to outcomes that carbon alone cannot capture – species recovery, habitat connectivity, ecosystem function – creating additional revenue streams that make restoration investable on multiple fronts simultaneously.^{271, 442} Unlike mandatory biodiversity offsets, which compensate for habitat loss under regulatory requirements implemented at the national level, international voluntary biodiversity credit schemes seek positive-contribution investments in net gains.^{442, 443} A credit typically certifies a measurable, time-bound biodiversity improvement, like restored hectares, increased species populations and enhanced ecosystem integrity, that is additional to business-as-usual. This framing aligns with a growing corporate demand for “nature-positive” commitments that go beyond compliance towards demonstrable

TABLE 4.1 EXAMPLES OF ONGOING EFFORTS TO SET UP BIODIVERSITY CREDIT INFRASTRUCTURES

Australia	The New South Wales biodiversity credit scheme has transacted AUD 763 million since 2010, including AUD 285 million in 2024 alone.
Colombia	Voluntary schemes developed by Terrasos and ClimateTrade issue credits representing 30-year protection commitments.
Kenya	The community-led seagrass conservation project (Vanga Seagrass project) is testing models through Plan Vivo to channel ethical investment to local communities with the aim of incentivizing the conservation and restoration of nature and biodiversity where carbon credits are difficult to measure.
South Africa	Fynbos restoration in South Africa is increasingly using biodiversity credits (biocredits) as an innovative, sustainable financing mechanism to combat invasive alien plant encroachment and restore the unique, highly biodiverse Cape Floristic Region.
Uganda	In partnership with the Darwin Initiative and the International Institute for Environment and Development (IIED), ECOTRUST is developing a biocredit-based incentive arrangement in support of community-based restoration of the connectivity between the Budongo and Bugoma Central Forest Reserves in the Northern Albertine Rift.
United Kingdom of Great Britain and Northern Ireland	The Biodiversity Net Gain law, effective February 2024, requires developers to deliver a 10 percent gain on new projects, which is projected to generate GBP 135–274 million annually once fully operational.

SOURCES: Association for Coastal Ecosystem Services. 2025. Vanga Seagrass Project. In: *Association for Coastal Ecosystem Services*. [Cited 9 June 2026]. <https://aces-org.co.uk/projects/vanga-seagrass-project>; ClimateTrade. 2022. ClimateTrade and Terrasos jointly promote Voluntary Biodiversity Credits to support biodiversity conservation. In: *ClimateTrade*. [Cited 9 June 2026]. <https://climatetrade.com/climatetrade-and-terrasos-jointly-promote-voluntary-biodiversity-credits-to-support-biodiversity-conservation/>; ECOTRUST. 2023. The ECOTRUST Bio-Credits Program. In: *ECOTRUST*. [Cited 9 June 2026]. <https://upgrade.ecotrust.or.ug/the-ecotrust-bio-credits-programme/>; Independent Pricing and Regulatory Tribunal. 2024. Understanding the biodiversity credits market. In: *New South Wales Government*. [Cited 9 June 2026]. [https://www.environment.nsw.gov.au/topics/animals-and-plants/biodiversity-offsets-scheme/biodiversity-credits-market/understanding-biodiversity-credits-market#:~:text=The%20total%20value%20of%20all,2010%20and%2028%20November%202023](https://www.environment.nsw.gov.au/topics/animals-and-plants/biodiversity-offsets-scheme/biodiversity-credits-market/understanding-biodiversity-credits-market#:~:text=The%20total%20value%20of%20all,2010%20and%2028%20November%202023;); Rampling, E.E., Zu Ermgassen, S.O.S.E., Hawkins, I. & Bull, J.W. 2024. Achieving biodiversity net gain by addressing governance gaps underpinning ecological compensation policies. *Conservation Biology*, 38(2): e14198. <https://doi.org/10.1111/cobi.14198>; and Table Mountain Fund. 2026. Fynbos Forever Programme. In: *Table Mountain Fund*. [Cited 9 June 2026]. <https://www.thetablemountainfund.org.za/fynbos-forever-programme/>

environmental leadership.^{444, 445} However, important questions remain about whether international voluntary biodiversity credits can achieve meaningful financing levels with reasonable levels of complexity.

Current voluntary biocredit transactions remain modest, with an estimated USD 0.3–1.9 million globally by late 2024 according to the Pollination Group. Yet, the architecture is being laid for expansion (Table 4.1). More than 50 countries now have biodiversity-offset laws, and mandated schemes already move substantial capital. The pathway to scale runs through integration with carbon market infrastructure (registries, verification systems, methodologies) and the stacking of multiple ecosystem services within single projects.²⁷⁰

For instance, France is amending legislation to permit stacking carbon and biodiversity credits from the same intervention, a model that could significantly enhance project-level returns and attract investors seeking diversified environmental portfolios. This diversification reduces dependence on any single market,

improves project resilience to price volatility and expands the range of landscapes and interventions that can attract private capital.⁴⁴⁶ For the private sector, biodiversity credits offer a route to meet nature-positive commitments with measurable, third-party-verified outcomes. For restoration practitioners, they represent an additional funding channel that rewards ecological complexity rather than carbon monocultures.

The trajectory points towards a restoration economy in which degraded landscapes become multi-asset portfolios. At this moment, these instruments are new and untested and measuring, reporting and verification systems are not yet sufficiently mature to scale markets. Lessons learned from REDD+ and carbon markets must be carefully considered for biodiversity markets to become a core pillar of the financial architecture needed to make restoration standard practice rather than an exceptional initiative.

TABLE 4.2 EXAMPLES OF INSURANCE-LINKED FINANCE FOR RESTORATION

Mexico	Mexico's Quintana Roo reef insurance triggers when hurricane winds exceed 96 knots, funding immediate coral restoration. ⁱ In San Crisanto, Yucatán, a parametric policy pays up to USD 100 000 directly to communities managing restored mangroves when qualifying storms strike. ⁱⁱ
Switzerland	Protection forest schemes finance sustainable management of mountain forests that shield communities from avalanches, rockfall and mudslides. ⁱⁱⁱ Federal and cantonal authorities invest in forest maintenance (thinning, regeneration, structural diversification), as they recognize that intact forest cover delivers protection services far more cost-effectively than engineered barriers. ^{iv}
United States of America	California's Forest Resilience Bond experimented and extended this principle to terrestrial systems, pooling capital to treat fire-prone forests, with repayments tied to flood control and water supply benefits. ^v
Nature restoration and conservation	Ecological Restoration Insurance Solution ^{vi} offers a way to bridge the "gap" between the need and desire to finance ecological restoration projects by de-risking financing opportunities, making them more attractive and viable for public and private stakeholders.

SOURCES: ⁱSchelske, O., Bohn, J.R. & Fitzgerald, C. 2021. Insuring Natural Ecosystems as an Innovative Conservation Funding Mechanism: A Case Study on Coral Reefs. In: S. Eslamian & F. Eslamian, eds. *Handbook of Disaster Risk Reduction for Resilience*, pp. 435–452. Cham, Springer International Publishing. https://doi.org/10.1007/978-3-030-61278-8_19; ⁱⁱMridul, A. 2023. AXA & Climate Seed Unveil Insurance Policy for Mangrove Forest Protection in Mexico. In: *Green Queen*. [Cited 26 January 2026]. <https://www.greenqueen.com.hk/axaclimate-adaptation-finance-insurance-mexico-mangrove/>; ⁱⁱⁱBrang, P., Schonenberger, W., Frehner, M., Schwitter, R., Thormann, J. & Wasser, B. 2006. Management of protection forests in the European Alps: an overview. *Forest Snow and Landscape Research*, 80(1). https://www.researchgate.net/publication/252406689_Management_of_protection_forests_in_the_European_Alps_an_overview; ^{iv}Olschewski, R., Bebi, P., Teich, M., Hayek, U.W. & Gret-Regamey, A. 2011. Lawinenschutz durch Wälder – Methodik und Resultate einer Zahlungsbereitschafts-analyse (Avalanche protection through forests – methodology and results of a willingness-to-pay analysis). *Schweizerische Zeitschrift für Forstwesen*, 162(11): 389–395. <https://doi.org/10.3188/szf.2011.0389>; ^vGartner, T. & Reed, C. 2016. The Forest Resilience Bond: Leveraging Innovative Finance, Science, and Partnerships to Fight Drought and Wildfire. In: *WRI*. London. [Cited 26 January 2026]. <https://www.wri.org/insights/forest-resilience-bond-leveraging-innovative-finance-science-and-partnerships-fight>; ^{vi}SCOR. 2025. SCOR launches its second Ecological Restoration Insurance Solution Product: "Manage". In: *SCOR*. [Cited 28 January 2026]. <https://www.scor.com/en/news/scorlaunches-its-second-ecological-restoration-insurance-solutionproduct-manage>

Insurance instruments to unlock new finance streams

Insurance-linked finance for restoration has advanced furthest in coastal ecosystems (reefs, mangroves, seagrasses) where protective value against storm surge and floods is well documented and readily quantifiable. Forests present a more complex case: their risk-reduction services operate through flood attenuation, slope stabilization and wildfire mitigation rather than direct wave-energy absorption. Yet the underlying logic, that healthy ecosystems reduce disaster exposure and this value can be monetized, applies across biomes.⁴⁴⁷

Table 4.2 provides some examples of schemes that exemplify the risk-reduction services that healthy forests and ecosystems can provide, and examples of finance that is tied to these services while maintaining ecosystems as infrastructure assets.

The route to scale will ultimately depend on the ability of governments, the private sector and civil society to come together to turn these ambitious pilots into mainstream instruments embedded in the global finance and insurance systems.

The Restoration Insurance Service Company (RISCO) exemplifies how this integration could work, by contracting with insurers to

pay resilience fees for mangrove preservation while generating blue-carbon credits from the same projects.⁴⁴⁸

Despite remaining challenges (basic risk, regulatory recognition of ecosystems as insurable assets, data gaps in developing countries), the upside potential is clear. Framing healthy ecosystems explicitly as disaster risk infrastructure opens vast opportunities to finance FLR. Empirical pilots, from protection forests in Switzerland to mangrove networks in Asian countries, demonstrate that well-designed risk-reduction nature-based PES schemes can deliver faster recovery and attract private capital.

4.4.5 Aligning finance with local restoration realities: sequencing finance to unlock scale

Smallholders, Indigenous Peoples, and other groups, including local communities, are crucial for scaling up restoration.^{ap, 58} However, most of these actors continue to rely on informal finance (household savings, reinvested earnings,

^{ap} According to one estimate, smallholders on such lands generate a gross annual income of up to USD 1.29 trillion. More than 8.5 million producer organizations now exist to help local actors participate in and support a green recovery.⁵⁸

and loans from family or local moneylenders), which is insufficient for longer-term and higher-risk investments in restorative practices and businesses.

High transaction costs, limited collateral, informal or incomplete documentation and inconsistent cash flows make small-scale producers and community enterprises appear risky. Importantly, these financing barriers are not experienced equally across social groups. Women, Indigenous Peoples and other marginalized actors often face additional structural constraints in accessing restoration finance, including unequal land and tree tenure rights, lower access to collateral, limited financial literacy, weaker representation in producer organizations and discriminatory lending practices. As a result, gender-blind restoration finance risks reproducing or even deepening existing inequalities within restorative value chains and local economies. Making restoration finance more inclusive requires deliberate design features that address these structural barriers. These may include tailored credit products for women-led enterprises, flexible collateral requirements, blended finance structures that absorb higher perceived risks, targeted technical assistance and incubation programmes, gender-responsive eligibility criteria within grant and incentive schemes, as well as the strengthened participation of women and marginalized groups in producer organizations and financial governance mechanisms.⁴⁴⁹

Embedding social inclusion considerations within restoration finance may also contribute to improving the effectiveness and long-term sustainability of restoration efforts, particularly in contexts where women and marginalized groups play important roles in land management, local economies and stewardship of restored landscapes.⁴⁴⁹ At the same time, national systems often lack the enabling conditions (secure tenure, streamlined disbursement procedures, predictable regulatory frameworks and standardized monitoring systems) required for public, private and blended capital to operate effectively.^{266, 450} In practical terms, unclear or insecure land and resource rights increase investment risk, limit access to finance and weaken incentives for long-term stewardship, thereby constraining both the scale and durability of restoration investments.

Many producer organizations also face internal constraints, including limited financial literacy, weak aggregation, and low capacity to manage or absorb finance. As a result, a financing bottleneck exists whereby large volumes of climate, biodiversity and impact-oriented funds do not reach small-scale actors.^{58, 119} At the same time, local financing institutions remain highly risk-averse and conventional, maintaining high interest rates and limiting financial outreach to smallholders. Addressing these constraints requires a combination of financing approaches that are tailored to different actors, risks and stages of restoration, and that can be sequenced over time as enterprises and landscapes mature. The following are four complementary and synergistic solutions for mobilizing finance for local communities, smallholders, Indigenous Peoples, their organizations and micro, small and medium enterprises:^{409, 434}

- ▶ catalytic grants coupled with technical assistance ([Box 4.7](#) and [Box 4.8](#));
- ▶ collective financing mechanisms such as cooperative savings schemes, microfinance and Village Savings and Loan Associations;^{451, 452}
- ▶ external financing from commercial banks, development finance and international funds – while they are traditionally difficult to access by restoration enterprises, local financial institutions are making efforts to “green” their portfolios, align with sustainable finance initiatives and develop national taxonomies on green investments (and, as of November 2025, nine of the world’s most influential development banks published the Common Nature Finance Taxonomy⁴⁵³ as a first attempt at a standardized framework for identifying, tracking, and deploying capital towards activities that restore ecosystems; and
- ▶ supply-chain finance throughout grower schemes and offtake agreements.^{437, 438, 451, 454}

These solutions are not mutually exclusive and can form a progression and layering of finance over time, reflecting differences in risk, scale and investment readiness, with early-stage restoration and enterprise development typically relying on grants, technical assistance and internal savings to build capacity and reduce risk. As producer organizations and enterprises mature and enter value chains, supply-chain finance

and commercial lending can follow, supported by blended finance structures that absorb early losses and lower the risk for banks and investors. Blended finance mechanisms can also play an important role in reducing exclusionary barriers faced by women-led and community-based enterprises that are often perceived as higher risk by conventional lenders.

It is important to also consider that restoring the productivity of degraded ecosystems may require multiple years during which farmers may experience income reductions. Combining multiple revenue streams (e.g. annual, pluriannual, carbon and other ecosystem services) to improve cash flow and increase the economic attractiveness of restorative behaviour.

4.4.6 Blended finance and other solutions to align private interest with public goals

Blended finance models combine technical assistance, training, grants and guarantee mechanisms with concessional, philanthropic and private capital to help de-risk early-stage ventures and crowd in private capital¹⁷² (Box 4.7). Figure 4.6 provides a hypothetical example of how different financing sources can be combined to increase restoration investments. The specific blend of financing will depend on local contexts, the stage of development of the commodity value chains, the maturity of the restoration ventures and the objectives of the instrument itself.

For instance, the FAO-led African Forest Landscape Restoration Initiative (AFR100) support programme, funded by the German Federal Ministry for Economic Cooperation and Development (Box 4.6), emphasizes early-stage technical assistance, business incubation and catalytic grant support to help restoration enterprises run by micro, small and medium enterprises and producer organizations develop investment-ready models. It complements this support to restoration ventures with the direct engagement of local financial institutions via the organization of matchmaking events. Examples of additional cases can be found in World Bank (2024).¹⁷²

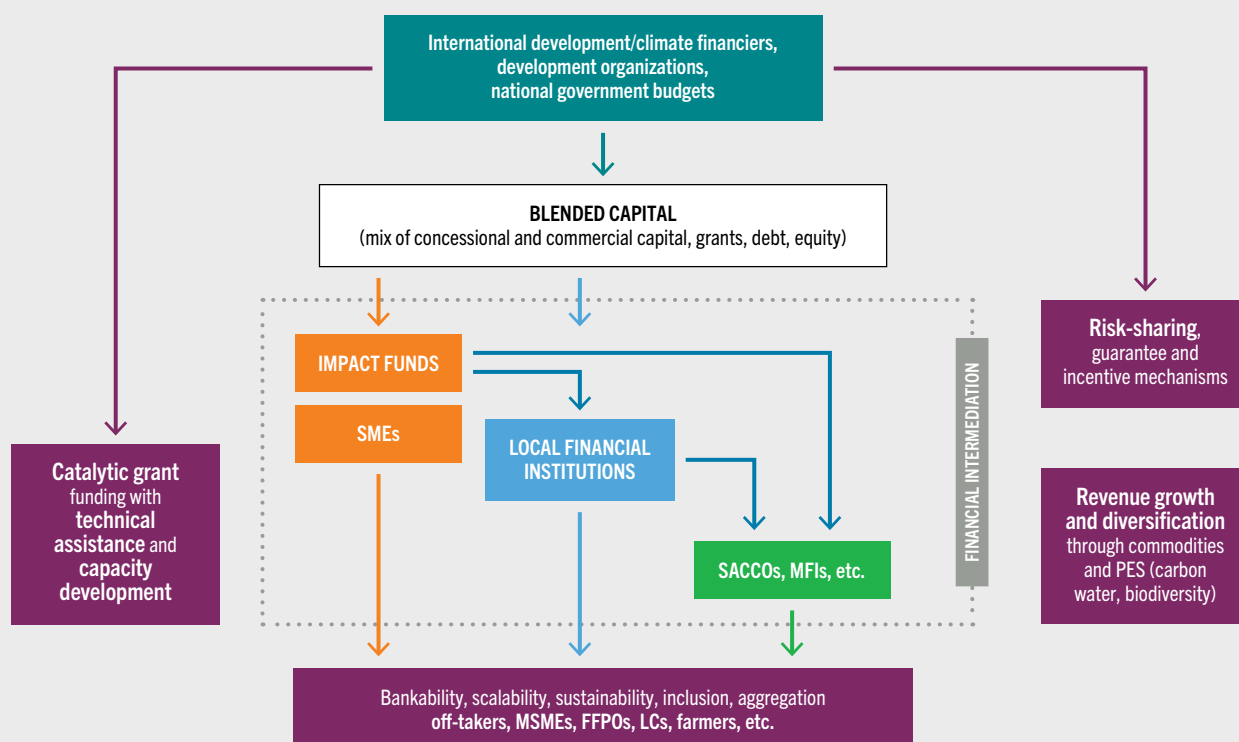
Successful blended finance solutions for restoration need innovative ways to reduce

risk for investors. The *Société Commerciale de Réassurance* (SCOR Insurance Company) has launched NatReCo, a new product that insures the physical restoration work (e.g. tree planting) from specific impacts (e.g. fire, drought, frost), thereby significantly reducing risk for project investors. Another mechanism to reduce risk for investment is restoration project certification, which is now available through several different approaches (with others under development), including The Global Biodiversity Standard, Preferred by Nature and Equitable Earth (formerly Ecosystem Restoration Standard). In some countries, Aceli Africa addresses the high risk of serving agricultural small and medium enterprises (most restoration ventures fit in this broader category) by providing portfolio first-loss cover, origination incentives (e.g. cover costs involved in learning about the borrower) and impact bonuses. Successfully scaling up finance for restoration also requires reducing the costs that financial institutions incur when they want to develop and deliver financial products for restoration.

These costs range from the costs of developing the product, identifying or developing bankable projects, carrying out due diligence processes, to monitoring performance and impacts. Given the high transaction costs, blended finance solutions require a minimum scale that, in turn, limits the applicability of blended finance to a few situations and contexts. Partnering with development agencies, simplifying and agreeing upon restoration key performance indicators, using digital tools to minimize transaction costs and improve supply-chain traceability, can greatly reduce the costs involved in developing, appraising, financing and monitoring restoration investments.

Successfully scaling finance for restoration also requires overcoming persistent constraints related to liquidity and insufficient standardization. Restoration investments are often perceived as illiquid, with capital locked into long-term land-based assets (e.g. trees planted) that are difficult to exit without loss of value, limiting their attractiveness to many investors. At the same time, the lack of standardized approaches to project design, financial structuring, performance metrics and impact measurement increases due diligence costs and hampers comparability

FIGURE 4.6 HYPOTHETICAL FINANCING FLOW TO INCREASE RESTORATION INVESTMENTS



NOTES: FFPOs = forest and farm producer organizations, LCs = local communities, MFIs = microfinance institutions, MSMEs = micro, small and medium enterprises, PES = payment for ecosystem services, SACCOs = savings and credit cooperative societies, SMEs = small and medium enterprises.

SOURCE: Authors' own elaboration.

across projects and portfolios. Addressing these barriers – through standardized frameworks, common indicators, aggregation mechanisms and innovative liquidity solutions – is essential to reducing transaction costs, improving risk assessment and enabling blended finance structures to operate at scale.¹³⁴

Recent innovations have addressed the “liquidity” barrier. An example is the Octobre Liquidity Guarantee Facility, which overcomes the liquidity barrier by providing a fast, reliable solution to seamlessly exit impact-driven investments, and exemplifies how alternative liquidity solutions can expand the restoration finance universe.

Africa Eats has overcome the liquidity barrier by listing the company in the Mauritius stock

exchange, making it possible for investors to buy and sell shares any week. While Africa Eats works with enterprises active in food and agriculture value chains and that source their raw materials from small farmers, their model could be potentially replicated to restoration ventures.

4.4.7 The case for reforming economic incentives for forest and landscape restoration

Taken together, the financing approaches described in this pathway illustrate that no single instrument, market or actor can deliver restoration at the scale required. Grants, microfinance, commercial credit, supply-chain finance and blended structures each address different constraints and operate at different stages of the restoration life cycle.

BOX 4.6 SUPPORTING THE COMMERCIAL VIABILITY OF RESTORATION ENTERPRISES THROUGH INCUBATION AND CATALYTIC FUNDING: THE AFRICAN FOREST LANDSCAPE RESTORATION INITIATIVE

The African Forest Landscape Restoration Initiative (AFR100) support programme illustrates how sequencing finance and technical support can help improve the commercial viability of restoration-linked enterprises while maintaining social and ecological objectives.

Implemented by the Food and Agriculture Organization of the United Nations (FAO) with financing from the German Federal Ministry for Economic Cooperation and Development, the AFR100 support programme operates across six African countries and supports selected micro, small and medium enterprises, forest and farm producer organizations

and community-based initiatives engaged in forest and landscape restoration. Through catalytic grants combined with structured incubation and mentoring, the programme strengthens business planning, organizational capacity and value-chain integration, helping enterprises move from informal or early-stage economic activities towards more viable and investable business models. This early-stage support addresses common barriers to finance, including weak aggregation, limited financial literacy, high transaction costs and difficulties meeting formal lending requirements, while laying the groundwork for progressive access to other sources of finance.

BOX 4.7 THE RESTORATION SEED CAPITAL FACILITY CATALYSES PRIVATE INVESTMENTS INTO EARLY-STAGE FUNDS AND PROJECTS

Since 2020, the Restoration Seed Capital Facility (RSCF) has supported impact fund managers working to manage investment funds and projects focused on forest and landscape restoration (FLR). Using a blended finance approach to accelerate private investments in frontier markets, the RSCF provides grants and reimbursable grants to help early-stage projects become investable. Only projects contributing to climate change adaptation and mitigation, reduced biodiversity loss and sustainable livelihoods are selected. *Aroma Café y Miel* developed by Ecotierra is one of these projects. Based on a mixed revenue model, it combines improved

forest management with coffee and cocoa agroforestry on degraded land and old coffee plantations, and beekeeping. *Aroma Café y Miel* is structured as a joint venture between Ecotierra's Urapi Fund and 12 producer cooperatives in Honduras. This set-up enables the producers to increase their incomes by transitioning to being sustainable entrepreneurs, with help from the project. Ecotierra will gradually leave the joint venture, which will be completely taken over by the partner cooperatives. This will ensure that investment ownership remains with the local producer communities.

SOURCE: Restoration Seed Capital Facility. 2025. *Bridging the early-stage investment gap in FLR: RSCF's four years in review (2022–2025)*. [Cited 9 June 2026]. <https://restorationfacility.org/our-impact-report-is-here/>

Treating them as interchangeable or competing options risks fragmentation and inefficiency.

The central challenge is not the absence of financial tools, but the lack of coherent financing architectures that sequence and combine these

tools in ways that reflect the realities of restoration. Early-stage, risk-bearing public finance is essential to build pipelines, strengthen institutions and absorb uncertainty. As initiatives mature, more structured finance can support expansion, aggregation and long-term management, while

markets and value chains provide revenue streams that anchor restoration in productive economies. A finance system fit for the scale of restoration needed must also recognize the public-good nature of many restoration outcomes. Even at scale, restoration will continue to rely on public investment to sustain benefits that cannot be fully monetized. The objective is not to replace public finance with private capital, but to use public finance strategically to mobilize, guide and discipline private investment where it is appropriate.

Ultimately, scaling restoration requires learning from the experimentation and innovation of isolated projects and instruments and moving towards integrated, long-term financing strategies embedded in national development pathways. This shift demands coordination across policy domains, financial institutions, market actors and local realities, as well as patience to align financial time horizons with ecological ones. Without such a strategic vision, restoration finance will remain episodic and insufficient; with it, finance can become a powerful enabler of durable, large-scale FLR. ■

4.5 THE POLICY COHERENCE AND LAW PATHWAY: COHERENT POLICIES, LAWS AND REGULATORY FRAMEWORKS FOR EFFECTIVE RESTORATION

This section addresses the policy and legal environment for landscape restoration – anchored in coherent policies and laws, effective regulatory and fiscal frameworks, and transformative mindset shifts. Together with the people, land and finance and business pathways outlined in this chapter, these elements form the foundation for restoration that is impactful, durable, inclusive and fair for the people on the ground.

4.5.1 The role of policy coherence, law, and regulatory and fiscal frameworks in driving restoration success

Forest and landscape restoration can be led by a wide range of actors operating at international, national, subnational and local levels. It typically spans multiple sectors, crosses administrative boundaries, and involves diverse actors and communities, making coherent policies essential.⁴⁵⁵ When policy responses to interconnected challenges (e.g. biodiversity loss, climate change, food insecurity, water scarcity and health risks) are fragmented, they can create conflicting incentives, weaken coordination, and introduce inefficiencies and scale mismatches.⁴⁵⁶ Although policy coherence is widely recognized as essential, progress remains limited because technocratic solutions that prioritize technical tools, formal coordination, and institutional design cannot, on their own, resolve intersectoral challenges. Political and cognitive factors – such as trust, ownership and learning – are key to translating knowledge of policy interactions into meaningful decision-making.⁴⁵⁷

Moreover, the long time frames required to achieve significant restoration outcomes mean that initiatives often extend across different staff cohorts and even generations. As a result, existing policies, laws and regulatory frameworks may become inadequate, outdated or conflicting over time. These gaps undermine restoration outcomes and perpetuate ecosystem degradation, posing a major barrier to effective restoration efforts.⁴⁵⁸ Integrated, holistic, intersectoral policy and multilevel regulatory frameworks are fundamental to creating the enabling conditions necessary for effective and socially just ecosystem restoration in landscapes.²⁶⁴

Policy coherence can be defined as the systematic promotion of synergies among policies, law, strategies and actions across sectors (horizontal coherence), levels of governance (vertical coherence) and time horizons (temporal coherence) (Figure 4.7). Although definitions vary, achieving policy coherence generally involves maximizing synergies over conflicts,⁴⁵⁹ reducing trade-offs and enabling mutually reinforcing outcomes.²⁶⁸

FIGURE 4.7 DIMENSIONS OF POLICY COHERENCE FOR INTEGRATED LANDSCAPE MANAGEMENT



SOURCE: Gutierrez, V., Palmegiani, I., Long, I., Bakhtary, H., Ferwerda, W., Bradby, K., Carver, M., Chazdon, R. et al. 2025. *Advancing Landscape and Seascape Restoration: the case for Policy Coherence and Good Practice Sharing*. Amsterdam, Commonland and Climate Focus. https://purews.inbo.be/ws/portalfiles/portal/133359338/Advancing_L_S_Restoration_The_Case_for_Policy_Coherence_and_Good_Practice_Sharing_25.pdf

Coherent policies reinforce one another, minimize unnecessary redundancies and enhance implementation efficiency.⁴⁶⁰ For example, a government's efforts to meet biodiversity, food security and climate goals are more likely to succeed when its biodiversity strategy safeguards natural ecosystems, its food policy promotes agroecology practices and its climate policy incentivizes carbon-sequestering land management, creating mutually reinforcing actions across sectors. In contrast, policy incoherence is closely associated with fragmented decision-making, inefficient resource use, and ineffective and unequal outcomes.²⁶⁸

Policy coherence can generate substantial economic benefits by reducing duplication and improving the efficiency of restoration efforts (Box 4.10). In Central Asia, aligning actions across the Rio Conventions could lower transaction costs by USD 6.2 billion out of a USD 26 billion total investment during 2020–2050 compared to uncoordinated efforts. This represents a 24 percent increase in implementation efficiency, demonstrating the value of coordinated action at scale.⁴⁶⁰ Coherent policy frameworks can support the achievement of stated policy goals⁴⁶¹ and strengthen legitimacy by improving transparency, consistency and trust,⁴⁶² which in turn enhances restoration effectiveness.^{133, 462}

Policy coherence is both a prerequisite for effective FLR and a domain that FLR initiatives can help strengthen. This is because the inherently intersectoral, multilevel and long-term nature of restoration positions landscapes as integrative platforms that align ecological, social, economic and other objectives across space, governance scales and time.^{275, 463}

Intersectoral coordination mechanisms (e.g. interministerial committees, joint taskforces, shared landscape plans and supra-departmental policy-setting bodies) help align fragmented mandates, streamline implementation and ensure that restoration targets are integrated across sectors.⁴⁶⁴ This is particularly important at the basin level, where land-use and water management decisions directly influence ecosystem outcomes. At the same time, locally driven restoration initiatives can also enhance policy coherence. For example, data from community-managed forest commons in 15 tropical countries show that inclusive governance arrangements can generate synergies among carbon, biodiversity and livelihood outcomes.⁴⁶⁴ Real-world examples presented in **Case study 12** further illustrates how locally led restoration efforts translate landscape governance principles into tangible ecological and socioeconomic benefits.

Evidence from successful restoration initiatives further highlights the importance of integrated governance arrangements. Costa Rica's development of agriculture–environment policy frameworks, for example, illustrates

BOX 4.8 RESTORATION OPPORTUNITIES ASSESSMENT METHODOLOGY

Rwanda is facing challenges on several fronts as land degradation, biodiversity loss and climate change threaten food security and sustainable development. Forest and landscape restoration (FLR) in Rwanda is a core component of the country's integrated land restoration agenda, aligned with the Rio Conventions. Rwanda has committed to restoring 1 069 476 ha under land degradation neutrality (LDN), 805 000 ha via its nationally determined contribution (NDC), and 2 million ha under the African Forest Landscape Restoration Initiative (AFR100) and the Bonn Challenge, which supports the implementation of its National Biodiversity Strategy and Action Plan (NBSAP). By harmonizing restoration efforts across sectors and the Rio Conventions (i.e. CBD, UNCCD and UNFCCC), Rwanda can leverage synergies to maximize ecological and social outcomes while minimizing inefficiencies. Harmonizing restoration efforts in this way creates an enabling environment for scaling FLR by reducing transaction costs and facilitating cross-sector

collaboration. This integrated approach could help reduce transaction costs by nearly 56 percent, equivalent to an estimated annual savings of about USD 45.6 million.⁴⁷⁰

Financial instruments and incentives play a pivotal role in Rwanda's restoration strategy. Payments for ecosystem services, climate finance from the Green Climate Fund and funding through the Global Environment Facility are key incentives for catalysing restoration activities. These instruments provide financial rewards to landholders and communities for maintaining ecosystem functions, thereby incentivizing sustainable land use and attracting private sector investments. Integrating these fiscal mechanisms across environmental objectives enhances cost-effectiveness and promotes resilience within agrarian landscapes, supporting both restoration and food security goals.⁴⁷⁰ These policy and fiscal integration efforts underpin Rwanda's commitment to a coherent, landscape-level approach to FLR, aligned with global conventions.

how intersectoral coordination and supra-departmental policy setting can reconcile competing objectives and operationalize landscape approaches in practice.⁴⁶⁵ Similarly, nested governance structures that link national authorities, subnational governments and local actors have been instrumental in implementing landscape restoration objectives and in securing tenure rights and benefits for local communities.^{275, 466} Other factors such as FLR plans, tailored financial incentives, collaborative multi-actor arrangements, clear land and resource tenure, specialized agencies, and embedding restoration mandates within local institutions have been shown to facilitate effective implementation and scaling.⁴⁶⁷ Illustrative examples of intersectoral integration and multi-country collaboration are presented in **Case study 2** and **Case study 10**.

Although evidence on specific practices that most effectively promote coherence remains limited, efforts are underway to strengthen the knowledge base. Global surveys conducted under the UN Decade, for example, are beginning to identify good practices, such as integrated spatial

planning, intersectoral information systems, and nested governance arrangements, that appear adaptable across diverse country contexts.²⁶⁷ Emerging evidence shows that coherent policy frameworks play a central role in enabling effective, scalable landscape restoration. Over the past decade, policy instruments and tools designed to promote coherence have increasingly emphasized support across the full restoration cycle – from initial landscape assessments and opportunity mapping, through planning and implementation, to monitoring, learning and adaptive management⁴⁶⁸ (**Box 4.8**). Frameworks such as the restoration opportunities assessment methodology (ROAM),⁶¹ integrated land-use plans and national restoration strategies have contributed to aligning priorities across sectors and governance levels, helping to reduce policy conflicts and improve long-term coordination.⁴⁶⁹ Unfortunately, coordination mechanisms can become largely symbolic or procedural rather than functional when resources are insufficient, mandates are unclear or stakeholder participation is limited.²⁶⁸ Such gaps weaken implementation and undermine the coherence necessary to restore landscapes.

4.5.2 Legal, regulatory and enabling mechanisms

Enforceable regulatory measures lay the groundwork for consistent restoration action. They clarify institutional responsibilities, set binding targets and provide mechanisms for compliance and enforcement.^{467, 471} Such measures also supply legal certainty – one of the strongest predictors of durable private and public investment in restoration and conservation.⁴⁷² The European Union's Nature Restoration Law (**Case study 13**) exemplifies a comprehensive regulatory framework that links clear restoration targets with monitoring obligations, reporting requirements and compliance mechanisms. Similar approaches appear in other contexts, where national restoration laws, forest codes or land-use regulations (**Chapter 2**) have been shown to support coordinated action and reduce policy fragmentation.⁴⁷³

Regulatory incentives further enhance restoration outcomes by aligning economic signals with ecological objectives. Evidence points to the value of combining regulatory instruments with non-monetary incentives, such as non-price procurement criteria, technical assistance, certification systems and preferential permitting, to encourage compliance and reduce barriers to participation.⁴¹⁷ Safeguards, including social and environmental standards, play an additional role by ensuring that restoration delivers equitable and sustainable outcomes, particularly for communities with existing land and resource rights.⁴⁷⁴

Inclusive governance mechanisms (also see the people pathway) strengthen restoration outcomes by ensuring meaningful engagement in decision-making. This includes engaging Indigenous Peoples in ways that respect their status as distinct collective rights holders, as well as enabling the effective engagement of local communities, civil society and private actors. Evidence shows that meaningful engagement and participation enhances legitimacy, facilitates knowledge exchange and improves compliance with regulatory requirements.⁴⁷⁵ In Latin America and the Caribbean, the Escazú Agreement (in force since 2021) provides a binding regional framework for environmental participation, access to justice

and protection of environmental defenders. Institutions that function as integrators, such as intersectoral committees, watershed authorities or landscape partnerships, help harmonize mandates across agencies and reduce fragmentation. These integrative institutions are especially effective when backed by legal mandates, sustained financing and long-term coordination capacities.⁴⁷⁶

At the international level, initiatives such as the Bonn Challenge and the New York Declaration on Forests have helped catalyse national-level reform, encouraging governments to adopt restoration targets, strengthen land-use regulations and develop supportive monitoring systems. At the national scale, countries including Brazil, the Republic of Korea and Rwanda have used legislation, such as forest restoration acts, land-use zoning and forest codes, to drive large-scale ecosystem recovery.⁴⁷⁷

At the landscape level, legally mandated landscape partnerships and watershed councils have supported restoration by coordinating actors, mediating conflicts and ensuring that local priorities inform national strategies.⁴⁷⁸

4.5.3 Encourage alignment of national development, climate- and biodiversity-related plans and strategies with restoration efforts

Aligning national strategies and plans, including NDCs, National Adaptation Plans (NAPs), NBSAPs and other biodiversity strategies with landscape restoration commitments is critical for achieving coherent, well-resourced and durable restoration pathways. Evidence from countries applying landscape approaches in NBSAPs shows that embedding restoration objectives within spatially explicit, multisector planning frameworks helps bridge biodiversity, climate and development agendas.⁴⁷⁹ Integrating landscape restoration targets directly into national policy frameworks – as is done in countries such as Burkina Faso, Kenya, Peru, Uganda and Viet Nam – helps ensure that restoration is not treated as a stand-alone environmental initiative but as a core component of national priorities for climate resilience, rural development, water security and sustainable livelihoods. This integration strengthens

BOX 4.9 MULTISECTORAL APPROACH IN KENYA TO COORDINATE FOREST AND LANDSCAPE RESTORATION ACTION FROM THE NATIONAL TO THE LOCAL LEVEL

Kenya exemplifies intersectoral policy alignment for forest and landscape restoration (FLR). Its Forest and Landscape Restoration Implementation Plan (FOLAREP) 2023–2027, developed by the Ministry of Environment, Climate Change and Forestry, is the operational tool for implementing the National Landscape and Ecosystem Restoration Strategy to coordinate restoration action across sectors and levels of government.⁴⁸⁰ FOLAREP supports Kenya’s African Forest Landscape Restoration Initiative (AFR100) and the Bonn Challenge pledge to restore 5.1 million ha by 2030, and contributes to the broader national ambition to restore 10.6 million ha of degraded land and achieve a tree cover of 30 percent by 2032, including through the “15 billion tree” campaign.

Anchored in the Forest Conservation and Management Act (2016) and aligned with the National Forest Policy (2023), the plan promotes interministerial coordination across the forestry, agriculture, water,

energy and land sectors, helping harmonize restoration objectives with nationally determined contributions (NDCs), national biodiversity strategies and action plans (NBSAPs) and National Adaptation Plans (NAPs). Implementation is decentralized through county governments, with counties such as Taita Taveta (226 420 ha) and Makueni (200 000 ha) integrating FLR targets into local development planning. A national monitoring framework, developed with technical support from partners including the Center for International Forestry Research and World Agroforestry (CIFOR–ICRAF), tracks ecological, social and economic outcomes to support adaptive management and accountability.⁴⁸¹ Together, these reforms illustrate how legal mandates, coordinated governance, decentralized approaches and diversified financing can enable restoration at the landscape scale while delivering climate, biodiversity and livelihood co-benefits.

NOTE: See <https://panorama.solutions/en/solution/strengthening-national-and-county-level-policy-and-regulatory-frameworks-support-forest>

intersectoral coordination, enhances reporting consistency, and increases access to climate and biodiversity finance.

Greater harmonization of development, climate and biodiversity planning can unlock substantial co-benefits. Coordinated strategies can reduce policy inconsistencies, lower administrative and transaction costs and create synergies between adaptation, mitigation and conservation goals.^{460, 479} Alignment also facilitates international cooperation by linking national restoration actions to global goals under the Paris Agreement and the KMGBF, thereby improving eligibility for climate and biodiversity finance. However, pursuing coherence must be balanced with maintaining system resilience.

Efforts to streamline policies and eliminate duplication may improve short-term efficiency but can reduce a system’s capacity to absorb political, financial or environmental shocks and navigate uncertainty. Some degree of institutional

diversity and overlap between mandates acts as a buffer, ensuring restoration efforts remain viable when any single component fails. Beyond systemic risks, fiscal realignment and regulatory tightening can impose short-term costs on land dependent communities before alternative livelihoods or safeguards are in place, requiring sequenced implementation.

Recent cases illustrate the value of integrated approaches. The European Union Nature Restoration Law links biodiversity and climate objectives through binding national targets and coordinated monitoring systems. Kenya’s FLR reforms demonstrate how aligning sectoral policies can mobilize cross-government action and investments (Box 4.9).

Similarly, the mainstreaming of restoration within global climate finance mechanisms shows how harmonized national frameworks can attract sustained, long-term funding.

BOX 4.10 POLICY COHERENCE IN PRACTICE: THE CENTRAL AMERICAN DRY CORRIDOR WORLD RESTORATION FLAGSHIP

The Central American Dry Corridor World Restoration Flagship Initiative demonstrates how coordinated, intersectoral governance can drive policy coherence for landscape restoration at the national and regional levels. Implemented under the political leadership of the Central American Economic Integration System (SICA) and technically coordinated by the Food and Agriculture Organization of the United Nations (FAO), the initiative promotes the restoration of 100 000 ha across the region's dry and arid landscapes, with pilot actions in El Salvador, Guatemala and Honduras. Its designation as a World Restoration Flagship under the United Nations Decade on Ecosystem Restoration 2021–2030 reflects its strong alignment with the decade's principles and its contribution to national and regional commitments.

At the core of the effort is the AFOLU 2040 Regional Initiative, rooted in 2019 ministerial declarations committing SICA countries to a synergistic mitigation–adaptation agenda across agriculture, forestry and other land use (AFOLU). Through intersectoral multistakeholder platforms coordinated by the Executive Secretary of the Central American Agricultural Council (SECAC) and the Executive Secretary of the Central American Commission for Environment and Development (SECCAD), the flagship facilitates policy dialogue between ministries of environment and agriculture, thus enabling joint restoration agendas at the landscape level, harmonized monitoring and long-term financing across the region. These platforms support the alignment of policies and regulatory frameworks with restoration goals, address barriers to implementation and promote sustainable practices across productive landscapes. Priority dialogue areas include adapting financial mechanisms for resource mobilization, defining restoration priorities and estimating financing needs, sharing best practices and establishing a regional community of practice, and developing a common regional monitoring system anchored in national frameworks.

A regional investment plan is under development to guide restoration in pilot countries by prioritizing degraded areas, identifying costed interventions and aligning financing mechanisms. This shared analysis underpins a coherent regional vision for landscape restoration and helps streamline reporting across the region. The flagship also works to scale effective and traditional restoration practices, strengthen regulatory and institutional frameworks, and ensure the inclusive participation of local stakeholders. It promotes a regional development model built on sustainable land use and natural resource conservation, addressing the drivers of land degradation, including the climate impacts and unsustainable practices that disproportionately affect vulnerable rural communities.

By advancing policy coherence, intersectoral coordination and long-term investment, the initiative strengthens ecological resilience and supports sustainable livelihoods for communities facing climate stress, displacement and economic hardship. Documented good practices include El Salvador's interinstitutional National Programme for the Restoration of Productive Ecosystems and Landscapes (PREPP), soil restoration initiatives in Guatemala's Dry Corridor and community-centred governance models from the RECLIMA project that empower vulnerable groups.

Together, these efforts demonstrate how promoting policy coherence, integrated governance and long-term financing can accelerate landscape restoration at scale while improving social and ecological resilience across the Central American Economic Integration System (SICA) region. At the same time, these experiences also raise broader questions about the legal frameworks within which such approaches are developed and implemented, and whether further progress may depend not only on improved coordination, but also on rethinking how law is conceived and mobilized in relation to restoration processes.

4.5.4 Promoting a shift in mindset through legal innovation

The limitations of output-oriented metrics underscore the need for a paradigm shift towards high-quality, long-term restoration grounded

in ecological processes and social equity, and accountable governance. This involves moving from anthropocentric and fragmented approaches to integrated, holistic, systems-based perspectives that recognize landscapes as

complex socioecological systems. Such a shift champions values-driven responsibility for nature, highlighting the importance of ecological integrity, cultural relevance, community rights and adaptive capacity. It also encourages governments and institutions to embed restoration within long-term planning cycles – ensuring temporal coherence, policy continuity and intergenerational justice, all critical for sustaining recovery over decades.²⁸⁹

Emerging legal frameworks such as Rights of Nature and Earth Jurisprudence⁴⁸² reinforce this transformation by recognizing ecosystems as rights-bearing entities and strengthening accountability for long-term stewardship. These innovations extend beyond symbolic recognition: legal personhood enables ecosystems to be represented in court, establishes duties of care and can trigger cross-border enforcement. For example, Spain's Mar Menor Lagoon was granted legal personhood and the rights to protection and restoration in 2022,⁴⁸³ and in 2025 the Swiss State Secretariat for International Finance recognized the lagoon's legal standing as a foreign legal person in Switzerland, demonstrating growing international acceptance of ecosystem rights and obligations that transcend national jurisdictions.

Such developments signal a more ambitious and ethically grounded approach to restoration, one that prioritizes lasting ecological and social outcomes over short-term numerical gains. It calls for designing policies and governance structures that treat humans as part of ecosystems, prioritizes inclusive and participatory processes, and ensure equitable benefit-sharing, particularly for Indigenous Peoples, as well as for other groups, including local communities.

These approaches continue to evolve across legal and practical contexts, and their effectiveness will become clearer over time. At the same time, they invite reflection on the extent to which approaches grounded in established legal concepts – such as participation, consent and benefit-sharing – may encounter limitations when applied to relational and context-specific understandings of land and ecosystems. Addressing these limitations may not only require adapting existing legal frameworks, but also exploring alternative understandings of law, its role and its relationship with social and ecological systems.

4.5.5 Strengthening policy coherence and legal foundations for forest and landscape restoration

Policy coherence and law form the fourth essential pathway – alongside people, land, and finance and business – for achieving effective forest and landscape restoration. This section demonstrates that restoration success depends on policy coherence across sectors, governance levels and time, supported by aligned legal, regulatory and fiscal frameworks, and national strategies as well as a shift towards long-term, systems-based and rights-informed approaches. Crucially, policy coherence is not a static condition but an active pathway, continuously shaped through coordination, learning and adaptation across sectors, scales and time. While good practices and legal innovations are emerging, significant gaps remain, including fragmented and outdated policies, weak or symbolic coordination mechanisms, misalignment and weak linkages between national, subnational and local governance levels, unclear mandates, insufficient legal certainty and financing, and limited inclusion of local and Indigenous actors. Addressing these gaps requires recognizing that policy coherence and law demand sustained attention and investment at all levels of governance, supported by functional and well-resourced coordination mechanisms, binding and adaptive legal frameworks, strengthened tenure and rights, and legal innovation that reinforces long-term accountability and stewardship. ■

4.6 WEAVING THE FOUR PATHWAYS TOGETHER FOR EFFECTIVE FOREST AND LANDSCAPE RESTORATION

Forest and landscape restoration interventions must be tailored to each landscape, with each defined by its diverse peoples, ecosystems and land uses, economies, and governance structures. Extensive research and practical experience on the ground, as well as a broad range of sophisticated

tools, support FLR implementation. However, FLR is inherently empirical as it operates within complex ecosystems that are increasingly threatened and rapidly changing due to climate change and global market dynamics. It also involves intricate social processes, encompassing multiple dimensions ranging from public policy to value chains and market access.

Ultimately, effective FLR depends on deliberately addressing the four pathways – people, land, finance and business, and policy coherence and law – within a single, integrated framework.

The meaningful involvement of people grounds restoration in local knowledge, rights and livelihoods, action on the land translates commitments into tangible outcomes, finance ensures predictable and sustained resources for implementation, and policy coherence provides the foundation for aligning priorities, incentives and institutions. Strengthening these interconnections, rather than treating each pathway in isolation, reduces fragmentation, enhances accountability and supports the delivery of resilient and enduring ecological and social outcomes. Considering these interconnections is essential to effectively supporting FLR efforts:

- Interconnections across objectives make it challenging to reconcile trade-offs and require more than just the involvement of local actors. They demand dialogue across sectors at the landscape level and beyond. Despite the availability of land-use planning tools, reaching consensus on FLR objectives and approaches requires negotiation processes to foster multifunctionality at the landscape level (people pathway). One key element to ensure landscape multifunctionality is to explicitly integrate and prioritize biodiversity (genetic and species notably) as part of FLR efforts (land pathway).
- Interconnections occur across scales. Drivers of deforestation and forest degradation often originate at the national or even global scales, which can undermine the sustainability of restoration outcomes at the local level. Addressing these cross-scale dynamics is critical. This includes strengthening the enabling environment through appropriate policies, legislation and coordination

mechanisms, as well as promoting sustainable finance mechanisms that align incentives with long-term restoration goals (policy coherence and law, and finance and business pathways).

- There are interconnections over time. The restoration needs and strategies of today may not meet those of tomorrow. Adaptive management is essential, along with restoration strategies that evolve to reflect ecological processes, including, for example, the initial need to restore vegetation cover followed by enrichment planting in secondary forests, or shifting socioeconomic and political contexts within a landscape.

When the four pathways are considered together, they generate practical synergies that enhance their collective effectiveness and enable more coherent landscape governance. For example, coherent policies can unlock and direct finance towards landscapes, while sustained financing enables communities and land managers to implement restoration at scale.

In turn, locally grounded action, shaped by the knowledge and participation of Indigenous Peoples and other groups, including local communities, can inform adaptive policy design and strengthen accountability across governance levels. Similarly, inclusive governance processes help ensure that financial flows and land-based interventions are coordinated, equitable and aligned with landscape-level priorities. Strengthening these interconnections – rather than treating each pathway in isolation – reduces fragmentation, enhances accountability and supports the delivery of resilient and enduring ecological and social outcomes.

Although there is no universal recipe for FLR, principles and standards of practice exist to guide practitioners towards positive outcomes. Promoting their widespread dissemination is a key priority for the FLR community, alongside the continued collection of good practices and the ongoing refinement of tools and approaches. ■



MAURITANIA

Drone imagery supports the assessment of vegetation, terrain, biomass and canopy structure.

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CHAPTER 5

KNOWLEDGE, STANDARDS AND ADAPTIVE LEARNING FOR TRANSFORMATIVE CHANGE IN FOREST AND LANDSCAPE RESTORATION

5.1 INTRODUCTION

Global commitments to restore degraded forest ecosystems have expanded rapidly over the past two decades, yet implementation on the ground continues to fall far short of stated targets (**Chapter 2**). Bridging the divide between ambition and outcomes will require transformative change – shifting how restoration is understood, planned, practiced and evaluated. The four pathways explored in **Chapter 4** – people, land, finance and business, and policy coherence and law – highlight opportunities and challenges associated with implementing forest and landscape restoration (FLR) at scale. This chapter explores three pillars (**Figure 5.1**) – knowledge systems, standards and capacity infrastructure, and monitoring and adaptive learning – that are foundational to transformational change in FLR across the four key pathways. These pillars can help improve, accelerate and scale up effective FLR during the remaining years of the United Nations Decade on Ecosystem Restoration 2021–2030 (UN Decade) and beyond, contributing not only to the Food and Agriculture Organization of the United Nations (FAO) Strategic Framework 2022–2031 and the Forestry Roadmap but also to international frameworks such as the Sustainable Development Goals (SDGs), the three Rio Conventions and the United Nations Strategic Plan for Forests 2017–2030.

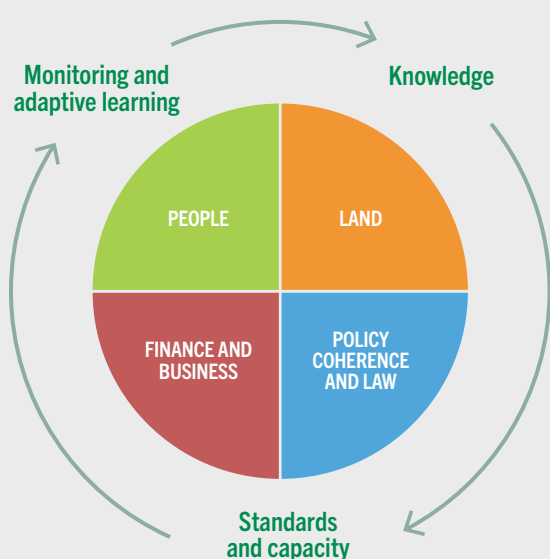
Importantly, the three pillars themselves are interconnected and enable positive feedback loops. Knowledge and knowledge-system innovations are critical for building capacity and for improving restoration design and delivery. Capacity building can help increase adoption and use of restoration standards, which will in turn reduce risk and uncertainty and improve restoration outcomes. But measuring those improvements requires commitment to and investment in monitoring and reporting which, when done effectively, advance restoration knowledge, information and understanding. ■

5.2 THE KNOWLEDGE PILLAR

5.2.1 Multiple knowledge systems for forest and landscape restoration

Achieving net gain for people and nature from all types of ecosystem restoration, including FLR – and avoiding adverse unintended consequences – requires a high degree of knowledge about the ecological, cultural and socioeconomic dimensions of landscapes. Recognizing this, the UN Decade included “incorporating all types of knowledge and promoting their exchange and integration throughout the process” as one of ten principles that underpin ecosystem restoration⁸ (Principle 6). The use of the term “all types of knowledge” recognizes the critical

FIGURE 5.1 THREE PILLARS THAT DRIVE TRANSFORMATIVE CHANGE IN FOREST AND LANDSCAPE RESTORATION ACROSS ALL FOUR PATHWAYS



NOTES: The knowledge pillar considers the types of knowledge and knowledge systems required for effective forest and landscape restoration (FLR), and the importance of integrating existing knowledge into practice and filling the priority knowledge gaps that constrain success. The standards and capacity pillar addresses the practical infrastructure that translates knowledge into consistent, high-quality restoration outcomes at scale: comprehensive standards of practice, verification and certification systems, and the trained workforce to apply them. The monitoring and adaptive learning pillar addresses not only the value of monitoring to assess FLR, but also how lessons from monitoring can be shared and disseminated to improve future practice. Integrating knowledge, standards-based practice and capacity investments through monitoring and adaptive practice and learning can create a self-improving restoration system over time.

SOURCE: Authors' own elaboration.

importance of multiple knowledge systems – from scientific knowledge developed through hypothesis testing, practitioner knowledge developed through design, implementation and assessment of restoration, locally generated knowledge by people in a given community and Indigenous Peoples' knowledge generated through intergenerational, place-based experience in sustainable environmental management rooted in relationships among people, land, culture

and spirit.^{6, 484} More broadly, the importance of multiple knowledge types has been recognized in global scientific and policy initiatives, including recent efforts by the Intergovernmental Panel on Climate Change (IPCC) to organize dedicated workshops to discuss how diverse knowledge systems can be integrated into its framework.^{aq} As mentioned in **Chapters 2, 3 and 4** of this report, a major barrier to effective FLR is a lack of integration of information from these knowledge systems into the assessment, planning, implementation and monitoring of FLR activities.

However, the availability of knowledge does not automatically translate into its effective use. Effective FLR depends on the integration and uptake of scientific, practitioner, local and Indigenous knowledge across policy, planning and implementation. Despite growing recognition of their complementarity, these knowledge systems remain underutilized due to barriers such as limited accessibility, weak coordination and lack of trust. Strengthening the interface between knowledge generation and decision-making is essential to ensure that restoration actions are evidence-based and context-specific. In this regard, guidance on strengthening national science–policy interfaces provides a useful framework to enhance the uptake of knowledge into policy and practice,⁴⁸⁵ enabling more inclusive and actionable restoration at scale.

In addition to the need to harness existing knowledge, previous chapters highlighted the urgent need to address substantial knowledge gaps, spanning ecological, cultural and socioeconomic domains.²⁶⁵ These gaps limit both the efficacy and cost-effectiveness of achieving FLR goals. Here we explore primary needs and transformational solutions for integrating existing knowledge into practice and for filling critical knowledge gaps that constrain effective ecosystem restoration, including FLR.

aq See <https://www.ipcc.ch/site/assets/uploads/2025/03/Doc.-7-Rev-1-Proposals-for-EM-Workshops-engaging-and-methods-of-assessment.pdf>

5.2.2 Integrating knowledge into forest and landscape restoration practice

We live in a moment of human history marked by an unprecedented amount of information. Yet there are multiple barriers that limit access to and integration of existing knowledge into ecosystem restoration and FLR activities. In many cases, existing scientific, practitioner, local and Indigenous Peoples' knowledge may be sufficient to inform better decisions, yet barriers to access, synthesis, translation and sharing outcomes, particularly lessons learned from setbacks and surprises, prevent this knowledge from being used, making the integration gap equal to or even more consequential than the information gap. Although employing discrete categories for knowledge systems is overly simplistic,⁴⁸⁶ given that in practice these systems may be held concurrently by individuals, doing so allows focus on the unique barriers to their integration into practice.

A major obstacle to integrating scientific knowledge into restoration practice is that research findings are often communicated in forms, such as scientific publications, that are not readily translated into concrete management actions or are not readily accessible.⁴⁸⁷ This situation is problematic, especially given that many scientists conduct studies with the explicit goal of contributing knowledge to improve ecosystem management. One contributing factor is that conventional scientific training does not sufficiently emphasize procedures or tools for conducting studies and communicating findings in ways that are actionable for conservation or restoration.⁴⁸⁸ Furthermore, the impact of scientific contributions is regularly measured by the number of citations to the study, rather than the frequency of use for – or impact on – land management. A key innovation for increasing the likelihood that research findings will be applied to management is co-production of research.^{487, 489} The process of co-production includes designing studies around practitioner or stakeholder-identified management uncertainties and engaging practitioners and stakeholders early and throughout the research process. There are clear benefits of the co-production model: restoration practitioners who engage with research scientists reported

higher rates of project-based innovation and improved ability to assess restoration outcomes compared to those who did not engage with scientists.⁴⁹⁰

Another requirement for actionable science is to include technical transfer in research plans from the outset. Knowledge mobilization requires time-intensive activities, including tailoring products and communication to user needs and innovating findings into management prescriptions; unless these activities are scheduled and funded, they may not occur. For instance, findings from a study that characterizes spatial patterns in overstory tree structure are more likely to be utilized for restoration if they are translated directly into planting prescriptions. Finally, scientific findings are sometimes locked behind paywalls, limiting their use in practice. Publishing in open-access forums and sharing results directly with practitioners and stakeholders can help overcome this barrier. Effective production of research for application to management requires training, planning and budgeting, and relationship building. Overall, actionable science depends as much on sustained engagement and taking the steps to innovate knowledge into prescriptions for practice as on the quality of the science itself.

Another challenge for FLR is integrating practitioner knowledge across projects and programmes. Practitioners have extensive knowledge developed through direct experience implementing restoration activities, including multiyear monitoring of intervention outcomes. However, this knowledge tends to be shared informally rather than systematically in publications,⁴⁸⁷ limiting its accessibility for broad integration into practice. A major focus of the UN Decade has been to create additional opportunities for practitioners to exchange knowledge of good practices (section 5.4.3). Sharing practitioner knowledge related to setbacks and surprises is equally as important as success stories to avoid repeating costly mistakes.

Indigenous Peoples' knowledge systems draw on centuries of place-based stewardship grounded in long-term observation, tested practices and deep understanding of ecological processes.⁴⁸⁴ The expertise of Indigenous Peoples in

biodiversity conservation and sustainable use and management, natural recovery, climate patterns and risk identification can substantially enhance ecological, cultural and socioeconomic outcomes of ecosystem restoration, including FLR. Although the importance of integrating Indigenous Peoples' knowledge in restoration has been highlighted in recent restoration guidance (see Gann *et al.*, 2019⁷; Nelson *et al.*, 2024⁶), many projects fail to include it. Existing barriers include imbalances in power that affect whose knowledge counts as well as lack of trust and willingness to share knowledge. Indigenous Peoples worldwide have long faced – and continue to face – misuse of their traditional and innovative knowledge, particularly those related to biodiversity, sustainable agrifood systems and environmental stewardship.

Their knowledge remains at ongoing risk of exploitation, appropriation and misrepresentation. Accordingly, there is a need for greater awareness in the restoration community about all aspects of braiding Indigenous Peoples' knowledge into FLR. Importantly, because this knowledge is inseparable from Indigenous data sovereignty, free, prior and informed consent (FPIC)⁴⁹¹ is essential in any effort to collect or apply it. Furthermore, all information-related activities – including documentation, management, reporting and communication – must recognize Indigenous Peoples as the rightful custodians and owners of their knowledge. Meaningful integration also requires supporting culturally appropriate engagement to sustain long-term restoration success.

Local knowledge, developed by people in a given community over time,⁴⁸⁴ also has barriers that limit its application to practice. First, local knowledge may be difficult to access by individuals outside the local community without investment in time-intensive interviews and site visits.⁴⁸⁶ And when information is collected, it may be treated as anecdotal or supplementary rather than as a valid basis for decision-making, creating a divide between the knowledge of local people and that of outside experts.⁴⁹² These barriers limit the meaningful application of local knowledge to restoration practice, despite the fact that local knowledge is critically important for effective ecosystem restoration and FLR.

The restoration community is aware of the substantial value and critical importance of including all types of knowledge into restoration practice (see Gann *et al.*, 2019;⁷ Nelson *et al.*, 2024⁶). Yet, doing so is highly complex, especially considering the technical, social and political challenges mentioned above. In addition to overcoming barriers, there is a need to shift focus from “knowledge integration products” to “knowledge integration processes”⁴⁸⁶ that move beyond recognition of multiple ways of knowing towards building a culture around inclusive approaches to knowledge to enhance their application to ecosystem and landscape repair. These processes should be grounded in principles (e.g. Norström *et al.*, 2020⁴⁹³) and practices (e.g. Raymond *et al.*, 2010;⁴⁸⁶ Olsen *et al.*, 2024⁴⁸⁹) that recognize that there are multiple ways of knowing, that differences in knowledge systems influence opinions of what constitutes evidence,⁴⁸⁶ and that shared learning is fundamental to success. Processes for inclusive approaches to knowledge should be explicitly included in ecosystem restoration and FLR plans, and after the processes are implemented, participants should reflect on the extent to which different types of knowledge were utilized during each component of restoration. This reflection will facilitate continuous improvement in including many types of knowledge in FLR.

5.2.3 Filling priority scientific and practitioner knowledge gaps

Forest and landscape restoration is inherently experimental, with substantial uncertainties in the fundamental dynamics of socioecological systems, including their assembly, degradation, recovery and delivery of ecosystem goods and services. The restoration agenda is too urgent to postpone management action; however, acting without sufficient information carries the risk that well-intended interventions could inadvertently exacerbate degradation or cause collateral damage. Given this trade-off, in addition to the urgent need to improve and develop processes to include many types of knowledge systems, there is also a need to increase the rate of knowledge production in identified priority areas, as detailed in previous chapters of this report. Here we review key knowledge needs with respect to scientific and

practitioner knowledge and suggest approaches to accelerating knowledge development.

Given that restoration is fundamentally about reassembling and managing ecosystems, a priority need for effective restoration is knowledge about how ecosystems assemble and change over time. Although these have been a major focus since the origin of the field of ecology,⁴⁹⁴ there is increasing understanding of the fact that ecosystems are not composed of a stable set of species that achieve a climax state but rather have complex equilibrium dynamics. There is a corresponding need for additional knowledge on the application of equilibrium dynamics to the restoration of both native and production ecosystems. For example, to develop realistic restorative targets and interventions, there is a need for scientific investigations of the factors that are predictive of multiple versus single equilibrium states;⁴⁹⁵ ecosystems that are likely to have multiple equilibrium states may require broader restoration targets and multiple reference models, while single equilibrium systems may have more predictable outcomes.⁴⁹⁶ Similarly, understanding alternative stable states and tipping points in agricultural and rangeland systems (**Case study 8**) can help prevent crossing thresholds, and can manage feedbacks, as production systems can exhibit alternative stable states in which gradual changes in management or environment trigger abrupt and often difficult-to-reverse shifts between productive and degraded conditions.^{497, 498}

Another area where knowledge is needed is in modelling degradation and ecological integrity at the landscape level, particularly given that change over time is an inherent aspect of ecosystems and landscapes and does not necessarily imply degradation. Accordingly, the goal of restoration is not about returning to past conditions but rather removing degradation and recovering the system's ecological integrity, measured as the reference condition or the condition the system would have been in now if degradation had not occurred.^{6, 7} Reference conditions, characterized by reference models, facilitate identifying the magnitude of degradation, setting restoration targets and prescriptions for implementation (e.g. species selection, planting patterns). Despite their importance, there is a general lack of

knowledge across most forest landscapes about how to develop reference models that adequately capture landscape characteristics. Currently, reference data from a limited number of sites or a single landform type are often generalized to entire landscapes.⁴⁹⁹ Research is particularly needed on the use of LiDAR and other forms of remote sensing to develop reference models based on high-resolution characterizations of forest structure by landform type over extensive areas. Research is also needed on developing reference models that reflect anticipated changes in environmental conditions due to anthropogenic climate change and other factors that must be accounted for in setting FLR targets.

Seed sourcing and maintaining forest genetic resources and evolutionary potential is another area where knowledge generation is needed,^{154, 500} as highlighted in **Chapter 4**. The selection of suitable seeds and seedlings for restoration requires understanding local selective pressures to ensure that native plant materials will be site-adapted. Specifically, utilizing local seed in restoration requires understanding “how local is local?” However, the answer to this question varies by species⁵⁰¹ and, therefore, there is a need for species-specific seed transfer zones (i.e. geographic areas within which plant materials can be moved with limited risk of maladaptation). In some areas of the world, information on the spatial scale of local adaptation is available for restoration-relevant species, while in others it is a critical research need.⁵⁰²

There is a corresponding need to understand the extent to which locally adapted populations are the most genetically appropriate plant materials, or whether climate-adapted populations⁵⁰³ or populations that are adapted to growing with invasive plants⁵⁰⁴ may be more appropriate.⁷ Similarly, there is a need to consider the genetic diversity required to conserve evolutionary potential.⁵⁰⁵ Generating information to support seed sourcing decisions for priority restoration species is a key step in developing a quality seed supply chain.

Forest and landscape restoration is grounded in a socioecological-systems perspective that integrates ecological integrity with the

human dimensions of restoration, including socioeconomic outcomes such as livelihoods and food security of local communities, stakeholder perspectives and governance processes. Despite this, current research remains heavily weighted towards understanding the ecological outcomes of restoration activities, with less knowledge about cultural and socioeconomic outcomes.²⁶⁵ For instance, **Chapters 2 and 4** highlight the lack of sufficient socioeconomic indicators of restoration success. In addition, **Chapter 3** highlights the lack of information on economic costs and benefits of restoration, the challenge of generating this information given that costs are always contextual and the urgent need for robust cost–benefit assessments to guide private investment in restoration. In addition to these gaps, there are relatively few studies of the business of restoration and practices that lead to innovation;⁴⁹⁰ there is a critical research need to conduct integrated assessments of the role of ecological condition, stakeholder networks and business practices in ecological and socioeconomic dimensions of restoration success for different restorative interventions. This is particularly important for FLR, given that it requires applying multiple approaches to ecosystem restoration across large landscapes.

An additional critical need is to improve the capacity for advancing knowledge through effective monitoring of restoration outcomes. Being able to make inferences about the efficacy and effects of restoration, as well as about the distribution of costs and benefits, requires more than just passive learning by doing. Rather, it requires explicitly building learning into project goals, and assessing, planning and implementing activities in a manner that allows for rigorous evaluation and inference.⁶ Given current limitations in the ability to design and implement effective monitoring and evaluation, capacity building is needed to increase understanding of the required elements of project design that enable answering questions about the ecological, cultural and socioeconomic outcomes of ecosystem restoration and FLR (see the monitoring and adaptive learning pillar below). Although effective monitoring requires financial investment, over the project lifetime, it can avoid or reduce potentially costly mistakes and large-scale failures, and it can promote efficiency

and effectiveness. For this reason, there is a need for a paradigm shift in the culture surrounding monitoring and evaluation. Rather than being treated as a “rounding error” on project budgets, a substantial percentage of project costs should be allocated to monitoring to enable appropriate design, systematic data collection, quality assurance, and all other elements of effective monitoring from data analysis to sharing lessons learned. While embedding monitoring into funding and project priorities may seem out of reach, it is imperative to improve restoration outcomes and, as mentioned in **Chapter 4**, to generate standardized data on the financial performance of restoration to support risk assessment and improve the bankability of restoration activities.

Another potential innovation for increasing knowledge is the creation of dedicated long-term research landscapes with ongoing FLR projects and a related research network that leverages data collected from these projects to address questions that require a high level of replication. Assessing the effects of management interventions is inherently difficult, due to high variability within and across ecosystems. For many questions, meta-analyses across a long-term research network would increase the ability to understand drivers and reliably detect trends. Furthermore, some information needs, like assessing the cultural and socioeconomic elements of restoration success, require collecting data from multiple independent local communities and would benefit from a network of independent restoration landscapes. The same is true for ecological variables for which values must be assessed at the landscape scale, such as water quality, which depends not just on the condition of the site where it is measured but rather on the entire watershed. Developing a strategic global system of long-term restoration networks that spans representative ecosystems should be a high priority. The UN Decade World Restoration Flagships could play a role in the creation of such a network. ■

5.3 THE STANDARDS AND CAPACITY PILLAR

5.3.1 Standards of practice: from guidance to application

Forest and landscape restoration takes place within complex socioecological systems, where outcomes depend on the context, scale and quality of design and implementation. When guided by evidence-based practices, FLR can deliver substantial benefits for biodiversity and human well-being. However, poorly planned or inadequately executed efforts may fail to achieve net gains and, in some cases, can exacerbate degradation. Recognizing this dual potential underscores the importance of utilizing best practices in assessing, planning, implementing and monitoring ecosystem restoration, including FLR, to maximize benefits. Towards this end, a major innovation needed within the global restoration community is to increase the use of effective restoration practices.

In recent years, innovative standards and certification programmes have been developed to improve outcomes from restoration. However, a challenge remains in increasing their use by all actors involved in restoration efforts, including implementers, government representatives and funders. Therefore, this section describes some of the most recent standards and certification programmes for restoration and highlights ongoing strategies as well as required innovations to increase their utilization for transformative change in FLR.

Standards of practice for the United Nations Decade on Ecosystem Restoration 2021–2030

As a contribution to the UN Decade, the International Union for Conservation of Nature's Commission on Ecosystem Management (IUCN CEM), FAO, and the Society for Ecological Restoration (SER) led a team of authors from 25 organizations to publish the *Standards of practice to guide ecosystem restoration*⁶ (hereafter, UN Decade Standards of Practice), with inputs from hundreds of restoration experts. The standards were built directly from a systematic

review of all available guidance documents for restorative activities, including standards of practice for ecological restoration,⁷ FLR^{506, 507} and multiple other types of restorative approaches for specific biomes and sectors. As such, they are the most comprehensive guidance available across the full restorative continuum, with over 300 recommendations classified by five components and 45 subcomponents of the restoration process, consistent with the principles of ecosystem restoration for the UN Decade.⁸ Members of the Global-Hub on Indigenous Peoples' Food and Knowledge Systems co-authored the document. Their participation enabled the inclusion of specific recommendations for the meaningful involvement of Indigenous Peoples throughout the entire restoration process, as well as for the proper integration of their knowledge (section 4.2.3; **Chapter 4**).

The development of the UN Decade Standards of Practice was a critical step to improving capacity for effective ecosystem restoration, including FLR. To maximize their adoption, the following online tools are being launched in 2026 under the umbrella of the UN Decade Task Force on Best Practices:^{ar}

- i) Explore tool: A navigation tool for exploring the UN Decade Standards of Practice that allows users to efficiently search for individual components, subcomponents and practices. Key functions include searching practices by key words and thematic areas, as well as links to specific restoration documents and tools through a resource archive.
- ii) Learn tool: A series of e-learning courses to train users on the concepts behind and application of the UN Decade Standards of Practice. The series includes six courses – one on the conceptual basis of restoration followed by one for each of the five components (assessment, planning and design, implementation, ongoing management, and monitoring and evaluation) of the restoration process. To maximize practical learning, the course series includes examples from case studies to illustrate the application of specific subcomponents and practices.

ar See <https://www.fao.org/in-action/forest-landscape-restoration-mechanism/un-decade/taskforce-on-best-practices/taskforce-on-best-practices/en>

iii) Apply tool: A decision-making and project appraisal tool to assist professionals with integrating practices into projects. This tool includes two subtools. A decision-support subtool that prompts users to consider which relevant practices to include and provides as output a customizable project proposal or tool. The second subtool assists in evaluating the extent to which existing projects are utilizing recommended practices.

The need for standards of practice for landscape restoration

To be successful, FLR must be planned and implemented in a way that recognizes landscapes as socioecological systems. These systems comprise multiple interacting ecosystems situated within a shared biophysical, cultural and institutional context.^{14, 508} A critical distinction for understanding this definition of a landscape involves differentiating between landscape *scale* and landscape *level*.¹⁴

Scale refers to the spatial or temporal dimensions at which management actions occur. In contrast, *level* refers to the position of landscapes with respect to the structure of living systems – from cells and organisms to populations, ecosystems, landscapes and the biosphere. From a landscape ecology perspective, landscapes should not be defined solely by their spatial extent; rather, they should be defined by the spatial arrangement of their components, the ecological processes that link them and the temporal dynamics that emerge from these interactions.⁵⁰⁹ Consequently, implementing management actions over large spatial areas does not necessarily constitute management at the landscape level.¹⁴

To balance improving the ecological integrity of landscapes with the social and economic outcomes of FLR, there is an urgent need to shift FLR from implementing site-level restoration projects across large geographic areas to applying a landscape-level approach that accounts for the spatial distribution, structure and interactions of ecosystems and their components across a landscape. Innovations in spatial planning and prioritization tools allow for landscape-level decision-making. However, there is limited guidance on best practices for implementing FLR activities in a manner that: i) facilitates the

application of the FLR principles;²⁶¹ ii) recovers landscape integrity, including exchanges and interaction among ecosystems within the landscape, transboundary effects, and ecological and hydrological connectivity,⁵¹⁰ among other attributes; and iii) addresses trade-offs among ecological, cultural and socioeconomic objectives.^{8, 511} Recognizing this need, the Sixth Global Forum on Ecological Restoration was held in conjunction with SER's Eleventh World Conference on Ecological Restoration, to develop standards of practice for landscape and seascape restoration (anticipated to be launched in 2027).

Certification and verification frameworks for restoration projects

Restoration projects undergo certification either voluntarily (e.g. to be better positioned to attract funding), or to meet specific requirements. There are several frameworks available to certify restoration projects. For example, the Ecosystem Restoration Standard, developed in 2020 by Preferred by Nature, is a social and environmental standard for field verification used for self-assessment and third-party performance evaluation. The standard includes an optional climate change module that allows project owners to assess positive climate impacts and thereby suitability for the carbon credit market. Likewise, The Global Biodiversity Standard (TGBS), launched at the Sixteenth Conference of the Parties to the Convention on Biological Diversity in 2024, is a site-based assessment and certification scheme that recognizes project outcomes that have a positive impact on biodiversity, protect and restore natural ecosystems and balance biodiversity recovery, carbon absorption and socioeconomic benefits to local communities.⁵¹² TGBS has been used to assess over 200 projects in 11 countries. To increase its use, TGBS sponsors a mentoring programme that provides capacity development to practitioners, institutions and government agencies to help align their work with the TGBS certification framework.

Moving from voluntary adoption to systematic integration

Ensuring a broad application of standards and certification programmes is fundamental to improving consistency and quality across projects, supporting accountability to funders,

regulators and communities, and reducing the risk of actions that may cause unintended ecological or socioeconomic harm. While considerable progress has been made in promoting their use, transformative change will only occur if governments and funders integrate standards and certification and verification systematically into their programmes. For example, this could be achieved by linking funding eligibility to compliance with standards and embedding certification and verification requirements into procurement and grant criteria. As long as adoption remains voluntary, the uptake of best practice guidelines and frameworks will stay limited, and the overall quality of restoration efforts is unlikely to improve substantially.

5.3.2 Education, capacity development and the restoration workforce

Limited technical capacity is one of the key barriers to achieving the mission of the UN Decade⁵⁷ and, therefore, to achieving global restoration targets. Given the pace of restoration activity, there is an urgent need to increase the technical and professional restoration workforce and strengthen its capacity to do effective, standards-based restoration. Towards this end, comprehensive capacity development programmes are needed to improve both the quantity and quality of FLR and foster innovation.^{398, 513}

Key capacity development needs include increasing educational opportunities^{514, 515} that incorporate multidimensional (i.e. ecological, cultural and socioeconomic) restoration approaches^{292, 516} and quantitative methods for assessing restoration outcomes (section 5.4.2). In addition to formal academic programmes, there is a need to increase the skills and knowledge level of the restoration workforce through access to other learning opportunities, including those that provide micro-credentials or certificates to newly trained workers.

There are many examples of education and capacity-development innovations for restoration that are helping address the gaps mentioned above. For example, the courses developed by the G20 Global Land Initiative and the United Nations Convention to Combat Desertification (G20 GLI/ UNCCD), in collaboration with universities and

experts from around the world, titled *Trigger Change! Innovative Sustainable Agriculture Solutions for Land Restoration*^{as} (launched in 2024) and *Trigger Change! Innovations in Sustainable Urban Land Restoration*^{at} (launched in 2025). Both courses are intended for upper-level bachelor's or master's students and include 48 hours of instruction. They can be adapted for vocational education and training or other forms of professional education. The courses are entirely open source and available to all types of educators. Teaching materials can be used as provided or modified to incorporate local and regional examples or to meet specific learning objectives.

Another example is the Ecological Restoration Toolbox (DERTO),^{au} an open-access, digital learning and knowledge hub designed to address critical capacity gaps limiting the scale and quality of ecological restoration, with content relevant for FLR. By offering free, modular training resources – ranging from vocational education and training modules and massive online open courses (MOOCs) to business models, case studies and virtual demonstration sites – DERTO aims to enable rapid, cost-effective upskilling across the restoration workforce. DERTO resources can be integrated into vocational curricula, continuing professional development and project onboarding, strengthening links between education, practice and investment readiness. By reaching practitioners, educators, employers and citizen-scientists at scale, DERTO has the potential to help overcome skills shortages and knowledge fragmentation that constrain restoration outcomes. DERTO is currently being developed by the TEAM#UP Consortium and is co-funded by the European Union.

Educational video games offer a high-impact opportunity to raise awareness of the importance of FLR among youth. For example, in 2023, FAO developed the *Forest Kids* game^{av} to encourage children to explore forest biomes, thereby raising awareness about their critical importance. In 2025,

as See <https://g20land.org/trigger-change/>

at See <https://g20land.org/active-campaigns/urban-land-restoration-course/>

au See <https://derto.teamup2restore.eu/>

av See <https://www.fao.org/forest-resources-assessment/ForestKids/>

a new module on forest restoration was launched, in which each restoration decision teaches lessons about biodiversity, climate and the importance of forests. The design encourages teamwork and problem-solving, reinforcing the idea that successful restoration is a shared effort. Through this new module, the game aims to facilitate the integration of forest restoration education from an early age and create pathways for youth leadership in this field.

Furthermore, the Global Landscapes Forum and the Center for International Forestry Research and World Agroforestry (CIFOR–ICRAF) host The Landscape Academy,^{aw} a portal that facilitates access to online and offline courses from over 20 world-class institutions on several topics including business, finance and economics, food and livelihoods, governance and policy, and restoration. These organizations also co-lead the Restoration Education^{ax} initiative to build capacity for landscape restoration. The initiative works in Africa and Asia, fostering collaboration among professors, educational centres and international institutions to deliver a modular, adaptable curriculum that combines knowledge and skills from environmental and social sciences.

In addition, the *Capacity, knowledge and learning action plan for the United Nations Decade on Ecosystem Restoration*, developed by the UN Decade Task Force on Best Practices in 2023, proposes eight capacity- and knowledge-development initiatives to address the capacity gaps of different stakeholder groups, based on the results of a global capacity needs assessment, a stocktaking of knowledge products and capacity-development initiatives, and targeted consultations. Initiatives 1 and 2 focus on enhancing the access and development of educational resources and programmes targeting university students, restoration practitioners, professors, and primary and secondary schoolchildren. Initiative 3 targets capacity development for communities while Initiative 4 focuses on the contribution of Indigenous Peoples' food, knowledge and territorial management systems to ecosystem conservation and restoration. Initiative 5 raises

capacity to mainstream ecosystem restoration through extension services for smallholder farmers and landowners. Initiative 6 targets policymakers, while Initiatives 7 and 8 enhance capacity within the finance and private sectors. These eight initiatives are at the initial phase of implementation through coordinated activities and collaborations with UN Decade partners to maximize synergies. They aim to stimulate the systemic capacity development needed to accomplish the vision of the UN Decade.

Certification programmes for restoration practitioners are one of the key innovations for strengthening restoration as a profession. These programmes signal to employers, clients, funders and the public that individuals have the knowledge, practical skills and on-the-ground experience for effective restoration. SER hosts a globally applied certification programme for ecological restoration practitioners called the Certified Ecological Restoration Practitioner (CERP) programme,^{ay} which evaluates practitioners based on their restoration and ecological knowledge, on-the-ground practical experience, understanding of restoration principles and standards, and adherence to a code of ethics.⁵¹⁷ Expanding the number of certified professionals for FLR is critical to advancing the field, as certification helps deliver more consistent, credible and effective outcomes. It also supports professional development and enhances accountability and ethics.

While many capacity-development efforts are underway in addition to the examples previously mentioned, significant opportunities remain to drive transformative change. For instance, to further expand academic opportunities in restoration, more focus is needed on supporting educators and institutions in integrating restoration knowledge into natural resource management programmes. This can be achieved by facilitating access to adaptable teaching materials, with innovative examples such as the G20 GLI/UNCCD courses, the DERTO platform and the Restoration Education Initiative. In addition, educator networks could play a key role in facilitating collaboration and sharing of experiences to enable the development of new

^{aw} See <https://academy.globallandscapesforum.org/>

^{ax} See <https://academy.globallandscapesforum.org/restoration-education/>

^{ay} See <https://www.ser.org/page/CERPPProgram>

academic programmes. To increase the number of certified restoration professionals, certification programmes could increase partnerships with educational institutions to introduce certification opportunities early in students' careers (SER's programme offers such academic alignments), encourage employers to offer incentives to obtain professional certification, and advocate for governments and donors to incorporate professional certification in policies and funding opportunities.

Finally, to improve the capacities of the technical and professional restoration workforce, better coordination among providers is needed to enhance the reach, collaboration and comprehensiveness of capacity-development programmes, as well as a long-term commitment from institutions to ensure their sustainability over time. Likewise, funders should recognize capacity development as integral to their return on investment and dedicate funding to this work. ■

5.4 THE MONITORING AND ADAPTIVE LEARNING PILLAR

5.4.1 Measuring progress, sharing insights and improving practice

Forest and landscape restoration is a long-term process with uncertainties about how to best achieve restoration goals. A major challenge in implementing effective restoration is the lack of reliable assessments of restoration outcomes, as mentioned in previous chapters. Often assessments focus exclusively or primarily on area of implementation (e.g. the headline indicator for Target 2 of the Kunming–Montreal Global Biodiversity Framework [KMGBF] is area under restoration),⁵⁶ rather than the degree to which restoration goals and objectives are achieved (effectiveness monitoring) or the ecological and socioeconomic effects of restoration activities, whether positive or negative (effects or impact monitoring). Despite this, assessing the effectiveness and effects of restoration,

and sharing lessons learned, are essential for successful actions to be adopted and expanded, ineffective approaches to be discontinued and promising new methods to be added. Recent guidance and tools have improved the capacity for the rigorous monitoring and evaluation of lessons learned, and for systematic reporting of restoration outcomes. Here we provide an overview of these recent innovations, as well as challenges and opportunities for measuring restoration impact and sharing lessons learned.

5.4.2 Assessing restoration outcomes

Despite considerable investment in restoration monitoring and evaluation, efforts to assess restoration outcomes often fail to produce reliable or useful information,⁵⁰⁹ due to limitations in or lack of inclusion of critical elements of monitoring. Recognizing the need for additional guidance on assessing restoration outcomes at the project or site level, the UN Decade Task Force on Best Practices implemented a systematic review of global guidance for monitoring restoration activities and developed best practices for improving capacity for and reliability of monitoring, published as the "Monitoring and Evaluation" component within the UN Decade Standards of Practice.⁶ Because FLR deploys multiple restorative approaches at multiple sites within a landscape, it requires both site-level and landscape-level monitoring.

The Monitoring and Evaluation component of the UN Decade Standards of Practice provides specific recommended practices for 11 key elements for effective monitoring of restoration projects, including stakeholder engagement, early development of monitoring plans, clear aims and objectives, appropriate indicators, monitoring and sampling designs, reliable and repeatable data collection, sound data management and analysis, evaluation of monitoring effectiveness, reporting and communication, and adaptive management. Utilizing this guidance can help restoration implementers avoid key pitfalls that limit the utility of monitoring results. For instance, the UN Decade Standards of Practice emphasize the importance of planning for monitoring at the inception of restoration planning: if monitoring questions and methods are not established before baseline data are collected, it may be impossible

to measure restoration effects; and if monitoring resources are not directly incorporated into project budgets, they will not be available. The UN Decade Standards of Practice also provide guidance on matching monitoring approaches to specific monitoring aims. For instance, they differentiate best practices for assessing the degree of recovery from best practices for assessing the effects of management actions. Assessing the degree of recovery involves using response ratios to compare restoration sites after restoration has been implemented to performance standards defined by restoration goals (e.g. Moreno-Mateos *et al.*, 2012⁵¹⁸). In production landscapes, these performance standards may be related to soil properties, overall vegetation cover, or pollinator diversity or abundance. Where ecological restoration is the goal, performance standards are based on reference models describing conditions in the absence of degradation.^{519, 520}

In contrast, assessing whether the restoration activities actually caused observed changes at the project sites requires approaches that avoid confounding background variation (temporal and spatial variation unrelated to restoration) in socioecological systems with restoration effects. Determining the causal effects of restoration activities requires comparing changes (from before to after implementation of activities) at restoration sites to background changes at comparable untreated control sites.^{519, 520} This approach does not test the achievement of restoration goals or rely on reference models, but does require pre-treatment data.

Together, the Monitoring and Evaluation component of the UN Decade Standards of Practice includes 80 recommended practices that can improve capacity for maximizing learning about the outcomes of restoration actions, sharing lessons learned and harmonizing across projects and initiatives. But investment in development of the standards of practice will only be transformational if it is actually applied at scale (section 5.3.1).

Because the UN Decade Standards of Practice focus primarily on monitoring and evaluation of one or more sites within a project, they do not address monitoring the degree of recovery

of an ecosystem type. Assessing the degree of recovery for an ecosystem type requires compiling assessments at landscape, regional or global scales, using a standardized framework, such as the IUCN Green Status of Ecosystems.⁵²¹ This framework should prove highly useful for understanding the achievement of ambitious global targets that are based on a percentage of recovery for each type of ecosystem.

The challenge for FLR is moving beyond assessing restoration outcomes of activities at individual sites for specific types of ecosystems to assessing outcomes across the landscapes in which FLR has been implemented. This includes determining impacts on ecological integrity (overall composition and diversity of ecosystems within landscapes, the size and shape and structural connectivity among ecosystem patches, and functions including gene flow and propagule dispersal across ecosystem patches) and human well-being at the landscape level.

Currently, there is too little emphasis on true landscape-level assessments. For instance, a recent systematic review⁵²² of FLR projects in Malaysia found that explicit assessments of landscape connectivity were entirely absent. Future efforts should focus on guidance for assessing restoration outcomes at the landscape level, including ecological, cultural and socioeconomic indicators that span terrestrial and inland waters, and, where relevant, coastal ecosystems. Interdisciplinary collaborations among restoration ecologists, landscape ecologists, conservation biologists, social scientists and economists, among other experts, can facilitate the application of a broader set of tools for assessing the outcomes of FLR.

5.4.3 Reporting and sharing lessons learned

Systematic reporting and transparent sharing of lessons learned are essential for ensuring that restoration efforts evolve from fragmented, project level interventions towards coordinated, scalable pathways capable of delivering long-term ecological and social gains. As highlighted throughout this report, restoration initiatives frequently operate with heterogeneous definitions, monitoring approaches and data

BOX 5.1 SUPPORT TOWARDS RESTORATION MONITORING AND REPORTING: THE TARGET 2 ROAD MAP

To support countries in implementing, monitoring and reporting on ecosystem restoration, the Target 2 Road Map, established in 2023, builds on the United Nations Decade on Ecosystem Restoration (2021–2030) Task Force on Monitoring as a coordinated global partnership to monitor progress towards the target for 30 percent of degraded ecosystems to be under effective restoration by 2030, in line with global and national restoration targets such as those in the Kunming–Montreal Global Biodiversity Framework (KMGBF), land degradation neutrality (LDN) and nationally determined contributions (NDCs). The Road Map strengthens the alignment between global monitoring frameworks and national reporting needs by engaging the Rio Conventions, other multilateral environmental agreements (MEAs) and key institutions through its working groups, which focus on: (1) indicators and monitoring guidance covering freshwater, marine and coastal, and terrestrial

ecosystems; (2) data and the Framework for Ecosystem Restoration Monitoring (FERM) platform, which supports data integration, interoperability and reporting; (3) national and regional capacity development to strengthen country-level implementation and reporting; and (4) Indigenous Peoples' restoration monitoring, to support inclusive and culturally appropriate monitoring approaches. As part of the Road Map, efforts to harmonize reporting on ecosystem restoration are ongoing by linking FERM to national reporting through the Convention on Biological Diversity's (CBD) Online Reporting Tool, the United Nations Convention to Combat Desertification's (UNCCD) Performance Review and Assessment of Implementation System (PRAIS), the Ramsar Sites Information Service, the Global Forest Resources Assessments (FRA) platform and other frameworks. These linkages aim to support greater coherence, consistency and alignment in restoration monitoring and reporting across global frameworks.

structures, limiting comparability across countries and frameworks. This constrains the ability to assess effectiveness or effects, understand drivers of success or failure, and adapt implementation strategies accordingly. Reporting systems could be substantially improved by the early integration of monitoring with project design, as described above (section 5.4.2). Recent innovations such as the UN Decade Standards of Practice,⁶ the Framework for Ecosystem Restoration Monitoring (FERM; **Box 2.1**), the Restoration Project Information Sharing Framework⁵²³ and the emerging Target 2 Road Map (**Box 5.1**) offer robust foundations for harmonizing approaches, supporting geospatially explicit reporting and expanding monitoring beyond biophysical metrics to include cultural and socioeconomic outcomes. These tools reflect a growing recognition that restoration success cannot be inferred from area-based indicators alone, and that credible reporting must capture dimensions such as ecosystem integrity, connectivity, livelihood benefits, governance quality and equity. Improving the consistency, transparency and methodological rigour of reporting will enable countries to better evaluate

progress against commitments, reduce risks for investors and support alignment across climate, biodiversity and land-degradation frameworks.

The exchange of experiences, innovations and lessons learned across regions, sectors and scales is key for successful restoration. Restoration interventions are context specific, yet they share common technical, institutional and financial challenges. For that reason, sharing lessons across projects, countries and regions enables collective learning. Platforms such as FERM's good practice search engine (**Box 5.2**), the UN Decade Task Force on Best Practices, regional FLR networks (e.g. Initiative 20x20 in Latin America and the Caribbean,^{az} the African Forest Landscape Restoration Initiative^{ba} [AFR100]) and institutional knowledge sharing mechanisms (e.g. Mansourian *et al.*, 2021²⁰⁶), including those for specific countries, ecoregions, ecosystems or restoration approaches, help consolidate diverse experiences and assist the restoration community to avoid repeating mistakes. Increasingly, interoperable

az See <https://initiative20x20.org/>

ba See <http://afr100.org/>

BOX 5.2 AN INNOVATIVE FRAMEWORK FOR DISSEMINATING GOOD PRACTICES UNDER THE UNITED NATIONS DECADÉ ON ECOSYSTEM RESTORATION 2021–2030

The United Nations Decade on Ecosystem Restoration (2021–2030) (the UN Decade) Task Force on Best Practices designed the Framework for Collecting and Disseminating Good Restoration Practices to facilitate knowledge exchange, build capacity and foster mutual learning among restoration practitioners throughout the UN Decade and beyond. By improving access to knowledge and promoting the replication and adaptation of good practices in contexts with similar goals, it helps prevent repeated mistakes, accelerate learning and strengthen capacities to implement and scale up effective restoration efforts across sectors, ecosystems and regions.

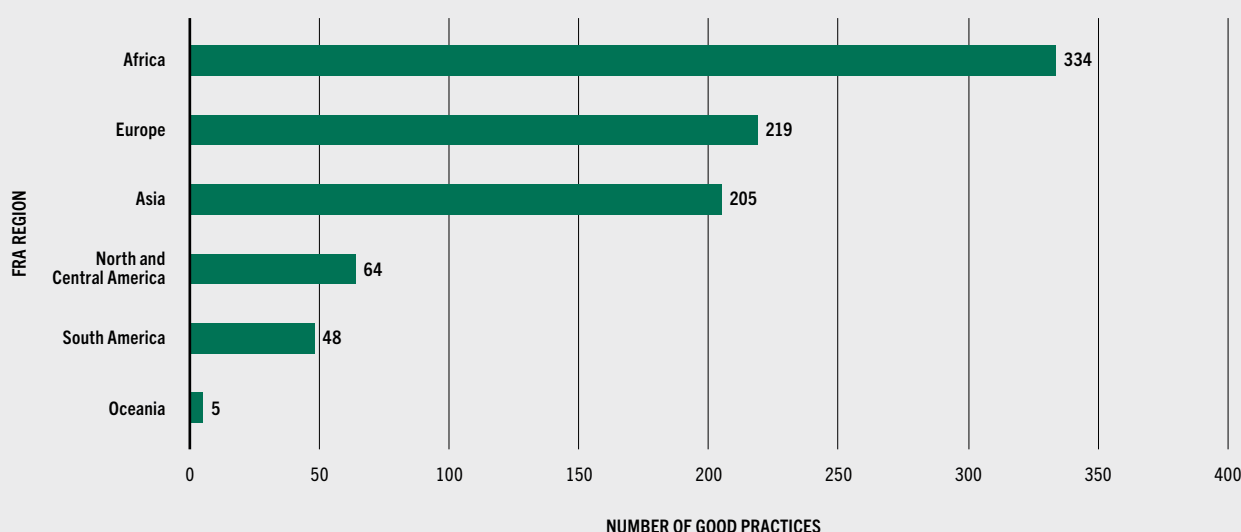
To ensure a consistent and reliable process for gathering knowledge, a comprehensive protocol was developed for the systematic collection and dissemination of good practices. It includes a clear definition of what qualifies as a good restoration practice and a standardized submission form aligned with the UN Decade's ten principles for ecosystem restoration,⁸ which has been integrated into the Framework for Ecosystem Restoration Monitoring Framework (FERM) platform in collaboration with the UN Decade Task Force on Monitoring. A structured review process validates each practice submitted through FERM to ensure alignment with the principles and confirm that practices can be replicated or adapted in comparable contexts.

A key innovation is the development of a common search engine⁹ also integrated into FERM, designed to disseminate good practices by bringing together multiple existing platforms already collecting restoration good practices. Currently, it connects five databases: FERM, World Overview of Conservation Approaches and Technologies (WOCAT) Global Database on Sustainable Land Management, PANORAMA – Solutions for a Healthy Planet, GoProFor and the Forest Knowledge Gateway. Together, these platforms provide access to 2 279 good practices as of April 2026: 1 868 in English, 319 in French and 92 in Spanish.

The tool allows users to filter practices by degradation driver, ecosystem, region, source, language and country, as well as conduct keyword searches (see Figures A and B). Search results can be downloaded for analysis or research, making knowledge accessible and actionable. This innovation exemplifies collaboration among organizations, leveraging data interoperability technologies such as application programming interfaces (APIs) to ensure sustainability, automated updates and integration with additional platforms. The framework continues to evolve based on user feedback, enhancing its value and utility for restoration practitioners worldwide.

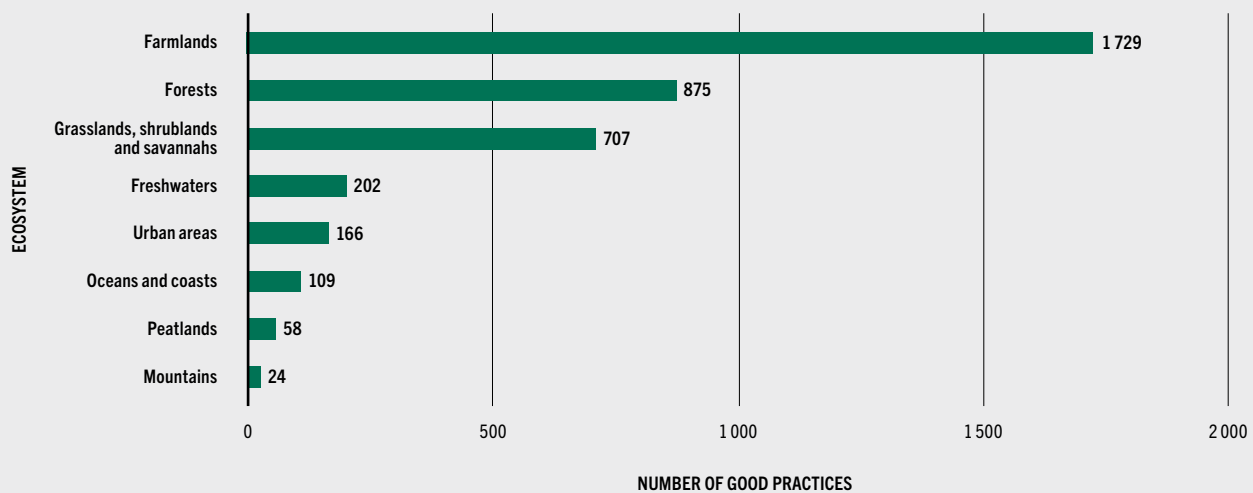
NOTE: ⁹See <https://ferm.fao.org/en/search/good-practices>

FIGURE A GOOD PRACTICES IN FOREST ECOSYSTEMS AVAILABLE THROUGH THE FRAMEWORK FOR ECOSYSTEM RESTORATION MONITORING, BY GLOBAL FOREST RESOURCES ASSESSMENT REGION



NOTE: FRA = Global Forest Resources Assessment

SOURCE: FERM. 2026. FERM search tool. In: FAO. Rome. [Cited 29 April 2026]. <https://ferm.fao.org/>

BOX 5.2 (Continued)**FIGURE B** GOOD RESTORATION PRACTICES AVAILABLE THROUGH THE FRAMEWORK FOR ECOSYSTEM RESTORATION MONITORING, BY ECOSYSTEM

SOURCE: FERM. 2026. FERM search tool. In: FAO. Rome. [Cited 29 April 2026]. <https://ferm.fao.org/>

databases and open-access learning tools allow practitioners, policymakers and communities to access a growing body of evidence on what works, for whom and under which conditions. Ensuring that reporting systems include locally generated knowledge – from Indigenous Peoples as well as from local communities, and farmer led monitoring – strengthens both the legitimacy and the utility of lessons learned, while reinforcing participatory governance. Embedding structured learning within restoration programmes can accelerate innovation, improve cost-effectiveness, and support the transition from short-term project cycles to sustained, landscape level change.

As countries work towards achieving Target 2 of the KMGBF and other global restoration commitments, fostering a culture of transparent reporting and shared learning will be essential for scaling restoration ambitions into impactful, equitable and long-lasting outcomes. ■

5.5 DELIVERING TRANSFORMATIVE FOREST AND LANDSCAPE RESTORATION FOR 2030 AND BEYOND

The final years of the UN Decade present a narrow but critical window to close the gap between global restoration commitments and on-the-ground restoration actions, including FLR. Achieving this will require a decisive shift – from fragmented efforts to coordinated, high-quality restoration programmes. The three pillars discussed above – knowledge systems, standards and capacity, and monitoring and adaptive learning – provide a critical foundation to enhance the quality, effectiveness and impact of FLR. These pillars also underpin all four FLR

pathways – people, land, finance and business, and policy coherence and law – to support the innovations and investments needed to increase the pace and scale of FLR. When considered collectively, the three pillars and the four pathways can help set priorities for advancing FLR. The interconnected nature of the three pillars creates a positive feedback loop, helping support not only all four pathways, but also the transformative change that is needed to take FLR to the next level strategically, politically and financially.

First, all forms of knowledge must be mobilized and integrated into practice. Scientific, Indigenous, practitioner and locally generated knowledge already exist in abundance, yet barriers to access, translation and trust prevent their collective and inclusive use. Forest and landscape restoration must move beyond producing knowledge to embedding inclusive knowledge-integration processes within planning, implementation and evaluation.

Second, standards and certification must become the norm in FLR, not the exception. Voluntary uptake has proven insufficient to ensure quality and consistency. Governments, funders and institutions should require adherence to standards of practice and support the expansion of a trained, certified FLR workforce capable of delivering effective outcomes at scale.

Third, monitoring and adaptive learning must be prioritized and funded as core components of FLR, not optional add-ons. Without rigorous assessment and transparent reporting of outcomes – ecological, social and economic – restoration efforts cannot improve, scale or attract sustained investment.

Knowledge, capacity and monitoring-based learning must be continually integrated to reinforce each other and provide opportunities for continuous improvement across all aspects of FLR. Across all three pillars, governments must take a leading role – legally, institutionally and financially – in enabling effective FLR. International, private sector, Indigenous Peoples, civil society and different local communities initiatives are critical to advancing restoration but do not replace the need for government-led

and funded programmes. Effective FLR must be embedded within national systems and long-term policy frameworks.

Finally, scaling FLR must mean more than expanding the area under restoration. It must also translate into scaling quality, durability, inclusivity and impact over time. By aligning knowledge systems, standards-based practice and adaptive learning with the four pathways of people, land, finance and business, and policy coherence and law, the global community can transition from ambition to measurable, lasting outcomes. As we pass the midpoint of the UN Decade on Ecosystem Restoration, guidance documents (principles and standards of practice) and lessons learned can be applied to forthcoming initiatives, such as the United Nations Decade for Afforestation and Reforestation in line with Sustainable Forest Management 2027–2036, which provides an opportunity to continue the work on scaling up effective FLR. The opportunity for effective FLR remains, but only if action is accelerated, coordinated and grounded on proven approaches. ■

5.6 CONCLUSIONS: FROM AMBITION TO IMPACT THROUGH HIGH-QUALITY FOREST AND LANDSCAPE RESTORATION

Forest and landscape restoration has emerged as a powerful and unifying response to the triple crisis of climate change, biodiversity loss and land degradation. As documented throughout this edition of *The State of the World's Forests* approximately 460 million ha of forests and tree-covered lands are degraded. At the same time, global demand for food, fibre, energy and ecosystem services continues to grow, intensifying pressure on already stressed landscapes. Restoration is no longer a niche intervention or an optional environmental action. It is a strategic investment in resilient agrifood systems, climate stability, biodiversity recovery and sustainable development.

Building on the momentum created by the United Nations Decade on Ecosystem Restoration 2021–2030 and the Kunming–Montreal Global Biodiversity Framework, countries have pledged unprecedented restoration ambitions. Yet, as this report shows, progress remains uneven. While millions of hectares are reported as under restoration, the gap between commitments and long-term outcomes persists. Data limitations, fragmented governance, insufficient financing, weak monitoring of impacts and persistent trade-offs between short-term land uses and long-term sustainability continue to pressure effectiveness. Above all, restoration too often prioritizes scale over quality, risking ecological integrity, social fairness and durability of results.

This edition of *The State of the World's Forests* demonstrates that high-quality FLR – grounded in science, Indigenous and local knowledge, inclusive governance and enabling policies – can deliver multiple and reinforcing benefits: strengthening food security, generating employment, enhancing climate change mitigation and adaptation, restoring biodiversity and reducing long-term risks and costs associated with land degradation. The challenge for the future is not whether to restore, but how to restore better, faster and at scale, while ensuring equity and long-term impact. This underscores the importance of the legal dimensions of restoration, in shaping how forest and landscape restoration is defined, implemented and sustained over time. As explored in this edition of the report, moving from ambition to lasting impact requires not only enabling policies, but legal and institutional frameworks that are adaptive, rights-informed and capable of supporting context-specific, inclusive and long-term restoration processes.

5.6.1 The way forward: four enabling pathways for scaling high-quality restoration

Evidence presented across chapters of this report points consistently to four mutually reinforcing pathways that underpin successful forest and landscape restoration at scale.

First, people and rights must be at the centre of FLR. Forest and landscape restoration is more legitimate, effective and durable when rights

holders are recognized, rights are secured and the people who live in, manage and depend on landscapes are meaningfully engaged across the full restoration cycle. This includes Indigenous Peoples, who are distinct collective rights holders, as well as local communities and other groups whose rights, knowledge, livelihoods and responsibilities shape restoration outcomes. Secure tenure, free, prior and informed consent, where applicable, equitable benefit-sharing and inclusive governance are essential to sustain restoration gains over time. When power asymmetries, social costs and barriers to participation are overlooked, restoration can disadvantage those already facing exclusion, weakening legitimacy, trust and long-term outcomes.

Second, FLR must be planned and implemented at the landscape level. Forest and landscape restoration operates across mosaics of ecosystems and land uses. Spatial prioritization, integrated land-use planning and context-specific combinations of interventions are necessary to manage trade-offs and maximize synergies between biodiversity, production, climate and livelihoods. Under appropriate conditions, restoration and productive land use can be mutually reinforcing, for example through agroforestry, agroecological practices and multifunctional landscapes that simultaneously support production, ecosystem functions and livelihoods.

Third, FLR must be designed for the realities of restoration. While the economic case for restoration is strong, current financing remains fragmented, short term and insufficient. Public finance, climate and biodiversity funds, blended finance, payments for ecosystem services and private investment must be better aligned with restoration quality and long-term outcomes. Financing mechanisms need to explicitly address transaction costs, opportunity costs and early-stage risks, especially for smallholders and community-led initiatives, while rewarding verified ecological and social impact rather than number of hectares alone.

Fourth, policy coherence and law are critical enabling conditions. Restoration commitments achieve scale and durability when anchored in coherent legal and policy frameworks that

cut across forestry, agriculture, land use, biodiversity and climate sectors. Clear definitions, aligned incentives, robust safeguards that can be effectively enforced, and integration of restoration objectives into nationally determined contributions (NDCs), national biodiversity strategies and action plans (NBSAPs), land degradation neutrality (LDN) targets and development plans are essential to move from project-based action to systemic transformation. At the same time, the effectiveness of such frameworks depends not only on their formal coherence, but also on how they are understood, interpreted and mobilized in practice. This includes the capacity of institutions and stakeholders to navigate legal arrangements and apply them effectively in specific contexts, as well as the accessibility, clarity and practical applicability of legal frameworks. More broadly, achieving high-quality restoration may require moving beyond a narrow view of law as only a set of rules to be enforced, towards legal approaches that better reflect the relational, context-specific and evolving nature of forest and landscape restoration.

5.6.2 From measuring hectares to measuring success

A central message of this report is that area-based indicators alone are insufficient. While hectares under restoration remain a necessary system of measurement, they do not capture whether ecosystems are recovering, livelihoods are improving or resilience is increasing. Strengthening monitoring systems and capacities to include ecological integrity, biodiversity outcomes, socioeconomic benefits and governance quality is a priority.

The inclusion of forest restoration data in FAO's Global Forest Resources Assessment (FRA) 2025 and the development of the Framework for Ecosystem Restoration Monitoring (FERM) mark important steps forward. However, harmonization across reporting frameworks, improved spatial data, and greater interoperability between national and global systems are urgently needed. Monitoring and adaptive learning must be treated not as an optional element, but as core investments that enable accountability, learning and continuous improvement.

5.6.3 Looking beyond 2030: consolidating gains and preparing the ground for the future

As the United Nations Decade on Ecosystem Restoration 2021–2030 advances, attention is increasingly turning to how its achievements, lessons and approaches can be sustained beyond its timeframe. The adoption of the United Nations Decade for Afforestation and Reforestation in line with Sustainable Forest Management in the post-2030 period, responds to rising global demand for wood, fibre and ecosystem services and the need to strengthen long-term climate and biodiversity outcomes. While no decisions have yet been taken, it is clear that any future decade would need to build directly on the results, standards, monitoring frameworks and partnerships established under the current UN Decade. Looking ahead offers an important opportunity to consolidate a coherent long-term transition—from halting and reversing degradation to sustainably managing forest resources. Afforestation and reforestation can contribute to climate change mitigation, sustainable wood supply and bioeconomy development, but only if they are embedded in integrated landscape approaches and fully aligned with restoration principles. Experience from the current UN Decade clearly shows that fragmented targets, ecologically inappropriate tree planting and poorly governed forest expansion risk undermining biodiversity, water resources and local livelihoods. Continuity, quality and coherence, therefore, will be essential guiding principles for any future global effort. Crucially, the next UN Decade should be understood as a strategic extension of a longer-term forest and landscape transition, building on the accumulated evidence, partnerships and institutional infrastructure of the current UN Decade. Ensuring such continuity would help reduce fragmentation, safeguard ecological integrity and social legitimacy, and translate restoration momentum into durable forest stewardship capable of meeting future environmental and socioeconomic demands.

5.6.4 Actionable priorities and recommendations

This report highlights the following priority actions for scaling high-quality FLR:

1. Prioritize restoration quality over quantity, ensuring alignment with internationally agreed principles and standards of practice.
2. Embed forest and landscape restoration as a national development priority, integrating it into climate, biodiversity, land-use and agrifood system strategies, budgets and legal frameworks.
3. Strengthen tenure security and inclusive governance, recognizing Indigenous Peoples as distinct collective rights holders. This includes respecting the rights, knowledge and decision-making roles of local communities and other rights holders as foundations of effective FLR.
4. Scale financing that matches FLR timelines, combining public and private instruments and linking finance to verified outcomes.
5. Invest in monitoring, data and learning systems, including spatially explicit reporting and impact-oriented indicators.
6. Promote capacity development supported by standards, certification and sustained institutional investment.
7. Align FLR with sustainable production and demand, positioning restored landscapes as engines of resilient livelihoods and deforestation-free value chains.

Forest and landscape restoration offers a rare opportunity to address multiple global challenges simultaneously. It can repair past damage, build resilience to future threats and strengthen a transition towards more sustainable, inclusive and regenerative agrifood systems. However, the time for action is limited. Delayed or poorly designed restoration increases long-term costs, exacerbates inequalities and locks landscapes into trajectories that are increasingly difficult to reverse. The remainder of the 2020–2030 decade must be one of high-quality implementation, while laying the foundations for sustained action beyond 2030. By grounding FLR in people, landscapes, science and coherent policy, countries and partners can transform ambition into lasting impact, ensuring that forest landscapes remain central to a resilient and equitable future for people, nature and the climate. ■



PARAGUAY

The PROEZA project combines traditional knowledge with agroforestry practices to provide food, income and environmental protection.

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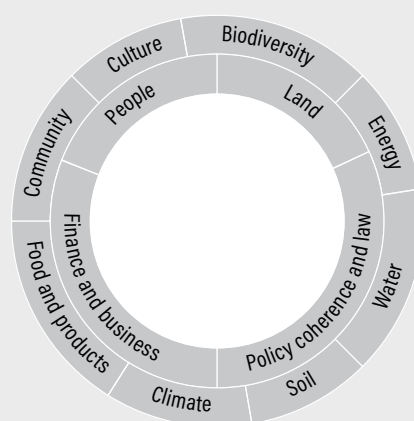
CASE STUDIES ON FOREST AND LANDSCAPE RESTORATION FOR A SUSTAINABLE AND RESILIENT FUTURE

1 INTRODUCTION

There are 18 case studies demonstrating the potential of forest and landscape restoration (FLR) to help build a sustainable and resilient future.^{bb} The case studies showcase inspirational FLR initiatives across various regions and ecosystems that generate replicable lessons at different scales and contexts worldwide. A map is also included to show the geographic distribution of the case studies. The chapter illustrates the four FLR pathways presented in Chapter 4, namely, people, land, finance and business, and policy coherence and law, by highlighting the benefits of restoration through concrete real-world experiences. It focuses on successful applications of the approaches discussed throughout the publication, rather than analysing challenges or failures. The case studies reinforce key insights and recommendations provided in other chapters. Some of the case studies presented are part of initiatives recognized as World Restoration Flagships under the United Nations Decade on Ecosystem Restoration 2021–2030 (UN Decade). **Figure CS1** illustrates the alignment of each case study with the four pathways, showing its restoration benefits and it being either a World Restoration Flagship, a Food and Agriculture Organization of the United Nations (FAO) 80th anniversary nominee, registered in the Framework for Ecosystem Restoration Monitoring (FERM) platform or a European Union initiative.

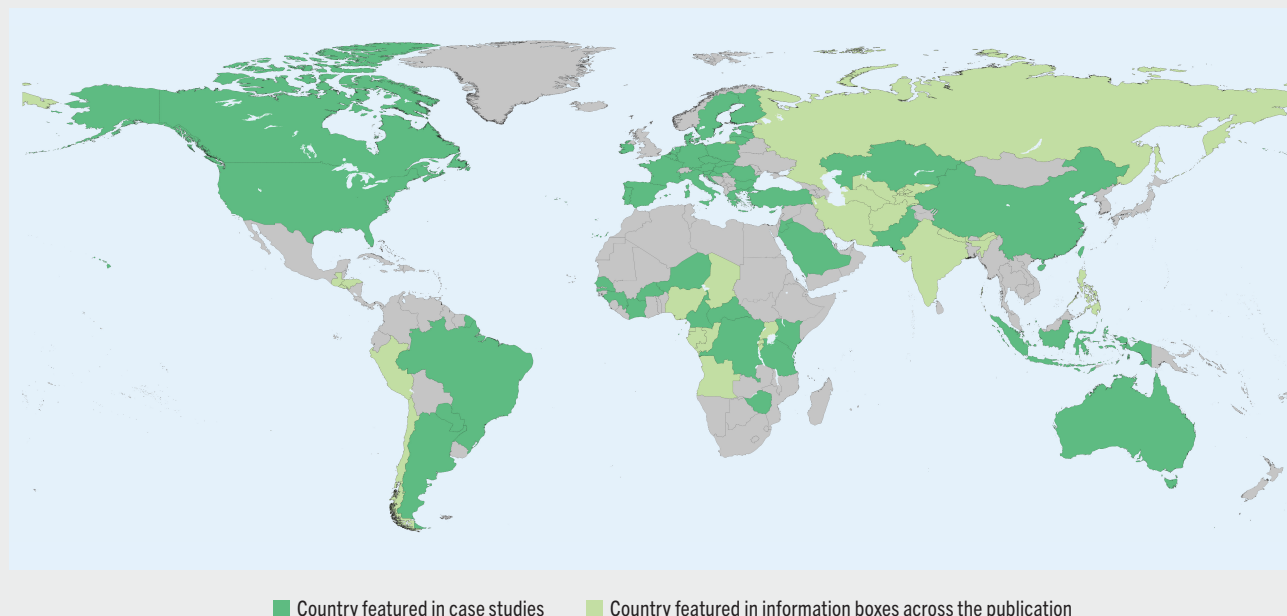
^{bb} The definitions in these case studies are those of individual authors and do not necessarily concord with those in other chapters of *The State of the World's Forests 2026*.

FIGURE CS1 RESTORATION BENEFITS AND RELEVANT RECOGNITIONS OF THE 18 CASE STUDIES PRESENTED IN THIS PUBLICATION, AND THE FOREST AND LANDSCAPE RESTORATION PATHWAYS TO WHICH THEY CONTRIBUTE



NOTE: The different elements of the figure are highlighted to provide a clear visual identity for each case study. This representation is based on an internal review of pathways and benefits; however, it remains indicative and does not imply a fully objective or quantitative assessment.

FIGURE CS2 GEOGRAPHIC COVERAGE OF THE 18 CASE STUDIES PRESENTED IN *THE STATE OF THE WORLD'S FORESTS 2026* AND OF THE INFORMATION BOXES ACROSS THE PUBLICATION



Refer to the disclaimer on the copyright page for the names and boundaries used in this map. Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties. Final boundary between the Republic of Sudan and the Republic of South Sudan has not yet been determined. Final status of the Abyei area is not yet determined.

SOURCE: Authors' own elaboration.

2 SELECTION PROCESS

Successful initiatives registered in the FERM^{bc} were first pre-identified, focusing on projects implemented by FAO and key partners and recognized as World Restoration Flagships under the UN Decade or that were FAO 80th anniversary nominees. A targeted call for proposals, restricted to these pre-identified initiatives, was then launched to invite expressions of interest to contribute as a case study for this report. In total, 53 submissions were received, which were screened to identify the final 18 case studies selected based on robustness of content and data, replicability, scalability, relevance to the four FLR pathways, and strength and clarity of the message conveyed.

The final selection was further guided by the following criteria: scientific rigour, credibility, clarity, coherence, innovation^{bd} and demonstrated evidence of benefit-sharing and equity among different stakeholders. Case studies were also selected to jointly represent a balanced and diverse range of ecosystems, FLR objectives, socioeconomic contexts and scales. While efforts were made to ensure broad geographic coverage and balance, this chapter is not intended to be fully representative of all regions; countries not included among the case studies are, where relevant, reflected in boxes and examples presented in other chapters. The text of the case studies, initially prepared and submitted by the proponents, was subject to technical validation by the writing team of this report and revised in response to reviewers' feedback. It was then rephrased and underwent final language editing to ensure consistency, clarity and alignment with the overall report.

^{bc} Data as of June 2026. Differences with FERM may arise due to its dynamic and regularly updated platform.

^{bd} Innovation was defined, in line with the FAO Science and Innovation Strategy, as doing something new and different, whether solving an old problem in a new way, addressing a new problem with a proven solution or bringing a new solution to a new problem. Innovation is also used as a noun to refer to the changes generated by this process. Innovation includes changes in practices, norms, markets and institutional arrangements, which may foster new networks of food production, processing, distribution and consumption that may challenge the status quo.⁵⁸

AFRICA

CASE STUDY 1

THE GREAT GREEN WALL FOR ECOSYSTEM RESTORATION AND PEACE IN BURKINA FASO AND THE NIGER

Emphasising local planning, ownership and decentralized governance models



- Community-led planning restores land and reduces conflict. In Burkina Faso and the Niger, local planning across several communes has integrated 100 000 ha into development plans: turning restoration into stability and jobs.
- Local ownership makes restoration sustainable. Training more than 100 entrepreneurs and funding local businesses through small grants shows that restoration works when it generates income and strengthens social cohesion.

**CASE STUDY LOCATION**

Burkina Faso and the Niger

**IMPLEMENTATION PERIOD**

2024–2027

**AREA UNDER RESTORATION**

Burkina Faso: 5 000 ha
Niger: 5 000 ha

**TOTAL TARGET AREA TO RESTORE**

100 000 ha of land with restoration potential integrated in local development plans in the ten selected communes

**RESTORATION APPROACH**

Regeneration-focused practices, water harvesting, soil and water conservation, tree-based systems and agroforestry, sand dune stabilization and wind erosion control (arid fringe), restoration of rangelands and pastoral systems, participatory and integrated planning and monitoring of forest and landscape restoration, and fostering entrepreneurship.

**TOTAL NUMBER OF BENEFICIARIES**

30 000

**BUDGET**

USD 5 million

**SOURCES OF FUNDING**

Multi-Partner Trust Fund of the United Nations Decade on Ecosystem Restoration 2021–2030 (funded by Germany and Denmark) and national contributions

**ECOSYSTEM TYPE***

Forests
Grasslands, shrublands and savannahs
Farmlands

NOTE: *The types of ecosystems referenced are based on the classification provided by the United Nations Decade on Ecosystem Restoration 2021–2030.

Key takeaways and highlights

- ▶ Local planning is anchored in communal development frameworks: Integrating forest and landscape restoration (FLR) into municipal development plans aligns restoration with local priorities, legal frameworks and budgets, strengthening coherence between national strategies and local needs, making scaling-up practical and appropriate for diverse landscapes.
- ▶ Strong local ownership through participatory design drives sustainability: When communities co-create restoration plans and select actions to implement, adoption and maintenance improves, which ensures sustainability and empowers local actors to act as stewards of landscapes.
- ▶ Decentralized governance with multilevel coordination: Multilevel governance connects autonomous local councils to national and regional platforms for coordination, funding and monitoring, ensuring that decisions are made close to the field while maintaining policy alignment and resource mobilization.

Introduction and context

Launched in 2007 by the African Union, the Great Green Wall for the Sahara and the Sahel Initiative is an ambitious effort to restore 100 million ha of degraded savannahs, grasslands and farmlands across Africa's Sahel region. Initially conceived as a linear tree planting campaign, it has evolved into a mosaic of rural development activities designed to help communities and ecosystems adapt to climate change, halt the accelerated and ongoing degradation of ecosystems, and improve the livelihoods of local communities. It spans 11 countries (Burkina Faso, Chad, Djibouti, Eritrea, Ethiopia, Mali, Mauritania, the Niger, Nigeria, Senegal and the Sudan), and a coordinating body, the Pan-African Agency for the Great Green Wall, has been established. Each member country also has a Great Green Wall body.

While the Great Green Wall for the Sahara and the Sahel Initiative targets degraded land stretching across the continent, the activities described in this case study focus on Burkina Faso and the Niger, and the interventions implemented in the context of the World Restoration Flagship,

which is called the Great Green Wall for Ecosystem Restoration and Peace (GGW flagship). Recognized as a World Restoration Flagship, the GGW flagship supports restoration and livelihoods protection where environmental degradation and acute food insecurity are interlinked dynamics exacerbated by the ongoing insecurity crisis in the central Sahel. Finding ways to keep restoration and protection happening in conflict areas is key for the resilience of affected populations and peacebuilding.

Restoration efforts under the GGW flagship concentrate on strengthening decentralized systems, which are already supported in the target countries, receiving appropriate capacity building and means to support local communities in the most difficult times. The initiative aligns restoration and political, security, and development objectives and mobilizes a wide range of technical and financial partners. It emphasizes local ownership and decentralized governance. Restoration activities are integrated into municipal development plans, ensuring that they reflect local realities and improve ecosystem health. Rejecting one-size-fits-all solutions, this approach favours tailored interventions, such as assisted natural regeneration (ANR) and soil and water conservation measures, including mechanized options where relevant, using Delfino ploughs technology.

Best practices and innovation to scale up and replicate restoration efforts

Placing municipalities and communal councils at the centre of the restoration action in line with the decentralization process underway in many sub-Saharan countries: By strengthening their capacities as owners and managers of natural resources, from planning and implementation, to monitoring and evaluation, and by entrusting them with fiduciary management, the GGW flagship has clearly demonstrated the relevance of this decentralized approach in pilot communities, where it has created the conditions for successful scaling-up of FLR and sustainable forest management.

Supporting the development of integrated and participatory land-use plans that promote the integration of ecological activities into local development plans and annual investment

plans at the municipal level: The GGW flagship supports the development and updating of these plans, finances green investments within them, and uses and strengthens existing structures at the municipal level to provide communal councils with the financial means to achieve their green objectives. Community-based land-use monitoring and geospatial tracking are used to monitor restoration activities, ensuring accountability and adaptive management.

Training decentralized agents from national institutions responsible for supporting municipalities and local communities on agricultural and forestry issues: This training empowers them to work with communities on implementing sustainable agricultural intensification and restoration activities. Local Ministry of Agriculture staff also receive support to monitor the commitments of associations and non-governmental organizations regarding restoration and sustainable livelihoods. This strengthens the capacity of decentralized agents to assist land-use planning and the development of land-use plans by local communities, who often bear the brunt of the consequences of conflict, generating an enabling environment for long-term restoration activities.

Strengthening decentralized governance: Local authorities and municipal councils play a central

role in planning and implementing restoration. The approach emphasized participatory landscape management plans and exchanges between municipalities.

Using conflict-sensitive approaches in fragile areas to ensure restoration is linked to peacebuilding and social cohesion: The GGW flagship integrates the means for mitigating and managing nature-resource conflicts, such as benefit-sharing mechanisms and participatory processes (with a focus on gender-sensitive and youth engagement processes).

Implementing site-specific interventions: The GGW flagship promotes various modes of restoration, allowing flexibility for site-specific interventions. Beyond tree planting, it promotes integrated ecosystem management, combining ANR, soil and water management, water harvesting and rangeland restoration.

Using blended approaches for financing restoration: Scaling-up requires more consistent, blended financing models combining public funds, climate finance and private investment. The GGW flagship enables eco-entrepreneurship and green value chains that further contribute to sustainable restoration and diversified livelihoods, providing incentives for the continuous sustainable management of areas under restoration. ■

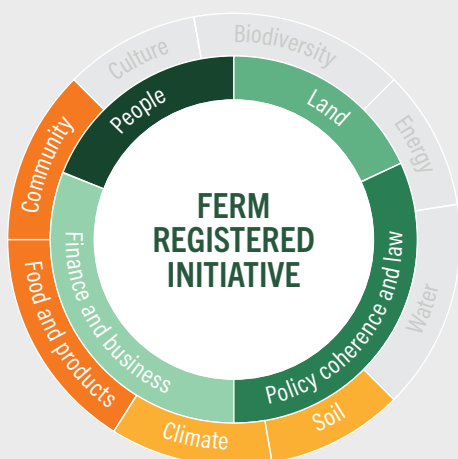
Farmers in the Niger
with a regenerating
shrub in a dry
Sahelian landscape.
© FAO



CASE STUDY 2

PROMOTING ZERO-DEFORESTATION COCOA PRODUCTION FOR REDUCING EMISSIONS IN CÔTE D'IVOIRE

Scaling climate-resilient cocoa agroforestry through inclusive governance and landscape restoration



- ▶ Agroforestry systems have restored more than 4 600 ha and supported 5 499 farmers, improving incomes while aligning with zero-deforestation standards.
- ▶ Secure land rights and inclusive governance enable lasting impact. With 23 local development plans and formal agreements, restoration has improved productivity, protected trees and strengthened resilience.



CASE STUDY LOCATION

Agnéby-Tiassa, La Mé and Sud-Comoé regions of Côte d'Ivoire



IMPLEMENTATION PERIOD

2021–2027



AREA UNDER RESTORATION

4 725 ha



TOTAL TARGET AREA TO RESTORE

5 150 ha



RESTORATION APPROACH

Land-use planning to integrate environmental considerations into local development, agroforestry, strengthening food security and land tenure



TOTAL NUMBER OF BENEFICIARIES

5 644 people
(25 percent women)



BUDGET

USD 3 million



SOURCES OF FUNDING

Green Climate Fund, Government of Côte d'Ivoire, FAO



ECOSYSTEM TYPE*

Farmlands
Forests

NOTE: The types of ecosystems referenced are based on the classification provided by the United Nations Decade on Ecosystem Restoration 2021–2030.

Key takeaways and highlights

- Communities and local institutions are at the heart of restoration: This project focuses on forest restoration through sustainable agroforestry and strengthening climate resistance. Agroforestry prioritizes the taungya system, where farmers cultivate food crops alongside tree seedlings on cleared forest land during the early years of plantation establishment. Strengthening climate resilience is achieved through income diversification, social inclusion, gender-responsive local governance and land tenure security.
- Designing and managing multifunctional landscapes: Multifunctional landscape management is promoted through cocoa agroforestry and balancing production, forest restoration, biodiversity conservation, climate resilience and rural incomes, including the development of 23 inclusive and gender-responsive local development plans.
- Policies and a paradigm shift from scale to impact: Agreements between the government and beneficiaries ensure tree protection and post-project monitoring. Local policies promote effective inclusion of women across activities and actively address child labour.

Introduction and context

The Promoting Zero-Deforestation Cocoa Production for Reducing Emissions in Côte d'Ivoire Project (PROMIRE) is implemented in areas facing challenges from climate change and heavy pressure on forest resources due to agricultural expansion, particularly cocoa farming, which is the main source of income for rural households. Traditional production systems, which are mostly extensive and poorly diversified, have contributed to deforestation, soil degradation, biodiversity loss, and increased community vulnerability to climate change impacts.

From a socioeconomic perspective, local populations rely heavily on agricultural and forestlands for their livelihoods. Many are smallholder cocoa producers, who often face land tenure insecurity, declining productivity and unstable incomes. Women and youth, despite being highly involved in agricultural activities, have historically had limited access to productive resources, decision-making processes and economic opportunities.

In this context, project interventions are needed to simultaneously address climate change, forest landscape restoration, food and livelihood

Landry Ekissi on his agroforestry plot in Agnéby-Tiassa, Côte d'Ivoire, where cocoa cultivation is integrated with forest trees and food crops.
© FAO/Dominique Kei Cocoa



security, and social inclusion. The PROMIRE project targets the main drivers of deforestation and land degradation – unsustainable agricultural practices, weak land governance and the lack of economic alternatives – by promoting sustainable agroforestry systems and restoring degraded forests and mangroves. It also aims to help Côte d'Ivoire align cocoa production with the new European Union Deforestation Regulation, which seeks to prevent the trade of goods that contribute to deforestation and forest degradation worldwide.

The institutional and policy environment is favourable to achieving the goals of the project, which aligns with Côte d'Ivoire's national priorities on combating deforestation, promoting cocoa agroforestry and implementing climate commitments. Its governance is based on a participatory approach involving government technical services, local authorities, community organizations, producers and the private sector. This partnership-driven dynamic has strengthened the local ownership of interventions, improved land governance and supported the development of gender-responsive local development plans.

Best practices and innovation to scale up and replicate restoration efforts

Combining agroforestry with forest restoration: By converting cocoa plantations into agroforestry systems and restoring forests and mangroves, PROMIRE is strengthening climate resilience and enhancing the socioeconomic security of rural communities. Under PROMIRE, two agroforestry systems are being promoted, in accordance with the African Regional Standard for Sustainable Cocoa. PROMIRE has introduced 30–40 trees per hectare while maintaining a cocoa density of 1 320 plants per hectare. The introduced species are compatible with cocoa and meet the needs of beneficiaries.

Adopting agroforestry such as the taungya system: This system integrates food crops with forest plantations, improves vegetation cover and soil fertility, and generates diversified household incomes, reducing sole dependence on cocoa production.

Strengthening formal agreements and participatory governance: To ensure sustainable results, agreements were established between the government, through the ministry responsible for the environment and project beneficiaries.

These agreements commit producers to protecting the introduced trees, while public authorities ensure post-project monitoring. Besides government institutions, PROMIRE is involving civil society organizations (e.g. national and international non-governmental organizations, associations of municipalities) and private-sector actors (e.g. agro-industrial companies, forestry enterprises and microfinance institutions).

This engagement has been guided by strategic frameworks, including the Joint Action Plan between PROMIRE and the Project for Improving the Implementation of Rural Land Policy in Côte d'Ivoire on land tenure security, as well as the sustainability plan on agreements concluded with private-sector actors in the cocoa and forestry sectors and with microfinance institutions. These efforts are facilitating participatory governance.

Integrating digital tools: Integrating tools such as the Open Foris ground application, a digital tool co-developed by FAO and Google to support monitoring through participatory, field-based data collection, has strengthened the enabling environment for implementation. The use of these tools is facilitating monitoring, evaluation and adaptive management, while also enhancing transparency and evidence-based decision-making.

Aligning with national priorities on combating deforestation, promoting cocoa agroforestry and implementing climate commitments: Memoranda of understanding between the project and government agencies and departments (e.g. National Agency for Rural Development Support, *Société de Développement des Forêts* and regional councils) are strengthening national capacities and ownership, ensuring institutional memory of PROMIRE interventions and helping consolidate results during the post-project phase.

CASE STUDY 3**COMMUNITY-LED RESTORATION OF DEGRADED RANGELANDS IN THE AMBOSELI ECOSYSTEM IN KENYA**

Scaling inclusive landscape restoration using the low-cost half-moon method



- Low-cost restoration methods can deliver rapid results. The half-moon technique has restored more than 2 500 ha, improving soil moisture vegetation recovery and the return of wildlife.
- Inclusive participation accelerates restoration and livelihoods. More than 700 women and youth were actively engaged, generating income and strengthening community ownership.

**CASE STUDY LOCATION**

Amboseli-Chyulu ecosystem, Kenya

**IMPLEMENTATION PERIOD**

2023–2025

**AREA UNDER RESTORATION**

2 584 ha

**TOTAL TARGET AREA TO RESTORE**

2 500 ha

RESTORATION APPROACH

Community-driven rangeland restoration through half-moons (“earth smiles”), natural regeneration, sustainable grazing practices and participation of women and youth

**TOTAL NUMBER OF BENEFICIARIES**

1 500 individuals (300 households)

**BUDGET**

USD 3.4 million (total AREECA budget in Kenya) + USD 200 000 for half-moon interventions

**SOURCES OF FUNDING**

International Climate Initiative of the German Federal Ministry for the Environment, Climate Action, Nature Conservation and Nuclear Safety

**ECOSYSTEM TYPE***

Grasslands, shrublands and savannahs

NOTE: *The types of ecosystems referenced are based on the classification provided by the United Nations Decade on Ecosystem Restoration 2021–2030.

Key takeaways and highlights

- The half-moon method produces significant improvements: The half-moon method is a soil and water conservation practice that involves constructing low earth embankments along contours to reduce runoff, control erosion and enhance soil moisture for improved land productivity. Restoring over 2 500 ha using this method has significantly improved soil moisture, rainwater infiltration, regrowth of native perennial grasses and the return of wildlife in areas previously considered lost.
- Women and youth emerging as leaders in land restoration: These groups have helped to create new income sources and foster a stronger sense of community ownership and environmental stewardship.
- A strong partnership model, transparent funding systems and a community-centred approach: This combination makes this initiative a practical and scalable blueprint for restoring degraded drylands in Kenya and across Africa.

Introduction and context

The Amboseli ecosystem in southern Kenya is one of the country's most iconic dryland landscapes, known for its wildlife, open grasslands and strong cultural ties to Maasai pastoralist communities. It plays a vital role in sustaining both biodiversity and local livelihoods. However, in recent decades, the rangelands of the Amboseli Landowners Conservancies Association have experienced significant degradation due to land fragmentation, climate variability, prolonged droughts, unsustainable grazing and rapid land-use changes. These pressures have led to declining vegetation cover, reduced soil fertility and increased vulnerability to erosion and desertification. For pastoralist communities that depend heavily on healthy rangelands, the impacts have been severe. Declining pasture availability has increased household vulnerability, intensified competition and conflict over grazing areas, and heightened food insecurity. At the same time, wildlife – particularly migratory species within the Amboseli-Chyulu landscape – face shrinking habitats and increased competition with livestock.

In response to these challenges, a community-centred rangeland restoration initiative was launched in 2023 to rehabilitate degraded land while empowering local communities and Indigenous Peoples, as long-term natural resource custodians. The project combines traditional knowledge with low-cost restoration techniques, including half-moons ("earth smiles"), which slow runoff, improve water infiltration and support natural vegetation regrowth in previously bare areas.

The early impacts have been transformative, with communities observing improved grass cover, better soil structure and increased pasture availability during dry periods. The project has also created employment, strengthened community cohesion, and enhanced resilience to climate change. In addition, grass seed banks managed by local Maasai women now produce 1 000 kg/seed bank of fodder seeds per successful rainy season and hay for both sale and livestock use, generating income while supporting rangeland recovery.

Today, the initiative stands as a promising model of how dryland restoration and livelihood improvement can be achieved when these groups are empowered with the right tools, knowledge and support.

Best practices and innovation to scale up and replicate restoration efforts

Using low-cost restoration methods: The adoption of the half-moon method used in this project demonstrates how low-cost techniques can achieve large-scale regenerative impact. By constructing semicircular bunds that trap and retain rainwater, communities have been able to significantly improve soil moisture and create microhabitats that support the natural regeneration of grasses and other native vegetation. This approach is effective, easy to teach and readily replicable in other dryland settings.

Intentional inclusion of women and youth: Traditionally, grazing and land-use decisions were made by men, but the active participation of women and young people has accelerated restoration, strengthened community cohesion and generated income opportunities. More than

700 women and youth have directly engaged in constructing bunds, monitoring regrowth and leading community mobilization efforts.

Community-led grazing management plan: The project supported the development of a community-led grazing management plan for the conservancy. A grazing committee was established to implement the plan, under which only designated grazing blocks were opened at a time while others remained closed to allow pasture recovery. Although this required short-term restrictions on access to certain grazing areas, the approach resulted in long-term benefits, including improved pasture condition, increased livestock productivity and reduced grazing pressure on degraded rangelands.

Capacity building: Community members received training in soil conservation, seed identification, basic monitoring techniques and sustainable grazing management. These skills enable communities to expand restoration through in-kind contributions, increasing the area under restoration beyond what would have been possible with available funding alone.

Formally recognizing community roles in land stewardship: When community members are acknowledged as key co-managers of natural resources, their motivation to protect and restore landscapes increases significantly. Policy frameworks at the county and national levels should embed participatory land management approaches and ensure that community voices guide planning processes. The project introduced and operationalized community-led grazing management, including rotational grazing and the protection of restoration areas. However, to sustain and scale these gains, such practices must be mainstreamed through county legislation and land-use planning frameworks.

Financial policy frameworks need attention: While international funding has been crucial, long-term restoration success requires more predictable and diverse funding sources such as payment for ecosystem services and blended finance to create incentives for communities and conservancies to continue restoration independently. Reducing bureaucratic barriers to climate finance access would encourage more community groups and conservancies to apply for such funding.

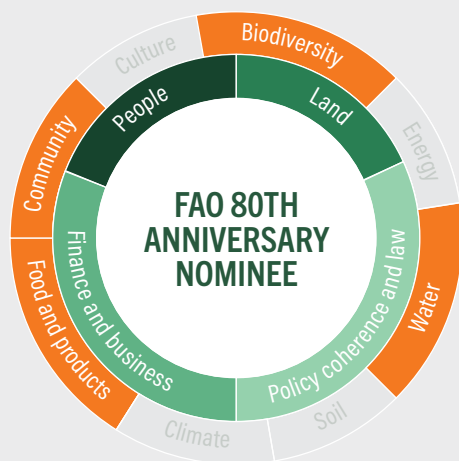
Scaling restoration from the ground: against the backdrop of Mount Kilimanjaro, half-moons capture water and restore rangelands at the ALOCA restoration site.
© Faith Tanui



CASE STUDY 4

RIGHTS-RESPONSIVE RESTORATION: WOMEN-LED LANDSCAPE RESTORATION THROUGH SOCIAL SAFEGUARDS IN SENEGAL

Experiences from the Sustainable Wildlife Management Programme



- Rights-based approaches ensure sustainable restoration. Ensuring free, prior and informed consent, gender equality and grievance mechanisms build trust, reduce conflicts and empower communities to sustain restored wetlands.
- Linking restoration to value chains improves livelihoods and women's economic leadership. Women-led production, processing and marketing of water lily products strengthened women's roles as economic actors and created income opportunities while restoring wetland ecosystems.

**CASE STUDY LOCATION**

Senegal River Delta

**IMPLEMENTATION PERIOD**

2023–2028

**AREA UNDER RESTORATION**

Pilot plot under restoration: 12 ha

**TOTAL TARGET AREA TO RESTORE**

No quantitative target but aims to demonstrate that it is feasible on an experimental plot

RESTORATION APPROACH

Invasive species control, hydrological rehabilitation and sustainable harvesting, anchored in free, prior and informed consent, gender-responsive planning, local stewardship and rights

**TOTAL NUMBER OF BENEFICIARIES**

48 women

**BUDGET**

USD 190 000

**SOURCES OF FUNDING**

European Union and French Global Environment Facility

**ECOSYSTEM TYPE***

Wetlands

NOTE: *The types of ecosystems referenced are based on the classification provided by the United Nations Decade on Ecosystem Restoration 2021–2030.

Key takeaways and highlights

- ▶ When rights come first, restoration lasts: Embedding free, prior and informed consent (FPIC), gender equality and grievance mechanisms from the outset reduces conflict, strengthens trust and creates the social conditions for durable, scalable restoration outcomes.
- ▶ People drive landscapes: Community-led wetland restoration that aligns biodiversity recovery with food security, women-led livelihoods and inclusive governance deliver multifunctional landscapes that work for nature and people.
- ▶ Draw on existing market opportunities: Supporting women to connect to existing value chains and local markets allows for diversified and increased incomes.

Introduction and context

Wetland degradation is a major driver of biodiversity loss, declining ecosystem services and food insecurity in the Senegal River Delta. Over past decades, hydrological alterations, agricultural intensification and the spread of invasive species, particularly *Typha*, have degraded wetlands, reduced habitat for waterbirds and fish, and undermined traditional livelihood systems. Abandoned rice fields and poorly managed water infrastructure have further contributed to ecosystem fragmentation and declining productivity, directly affecting communities that depend on wetlands for food, income and cultural practices.

This case study is situated in a rural Sahelian wetland context where livelihoods are closely tied to natural resources. Local populations, especially women, depend on fishing, small-scale agriculture and the harvesting of aquatic plants for access to food and income. Women are also central actors in local governance systems, natural resource management and such small-scale trade linked to wetland products. Land and water are largely governed through a mix of statutory arrangements and customary use rights, with high dependency on restored lands for subsistence and local markets.

To address these challenges, the Sustainable Wildlife Management Programme applies a community rights-based approach, embedding restoration within inclusive governance and accountable social safeguards. Implemented across 16 countries and 81 local communities, the programme operationalizes FPIC, gender-responsive planning and grievance redress mechanisms to ensure that the sustainable management of natural resources strengthens rights while delivering ecological outcomes.

In the Senegal River Delta, restoration focuses on converting abandoned rice fields into functional wetlands through invasive *Typha* control, gravity-fed water and dyke management, and sustainable harvest protocols for white water lily (*Nymphaea alba*). The approach links ecosystem recovery with women-led value chains and

White water lily (*Nymphaea alba*) cultivation contributes towards improving the food security and economic conditions of local populations while helping to restore natural ecosystems favourable to biodiversity.

© Bruno Portier



local governance: women and youth account for 59 percent of decision-making participants, while women are active as producers and community actors in the development of restoration-linked value chains. Women also represent 47 percent of direct beneficiaries. By combining restoration with inclusive governance, enabling policies (including frameworks related to the Ramsar Convention) and multistakeholder engagement, the case demonstrates how rights-responsive approaches can restore degraded wetlands while strengthening livelihoods and long-term stewardship.

Best practices and innovation to scale up and replicate restoration efforts

Implementing a community rights-based approach: This approach is a social innovation for wetland restoration, embedding FPIC, accessible and culturally appropriate grievance redress mechanisms and gender mainstreaming from design to implementation, with continuous feedback and co-learning.

Linking to the value chain of the white water lily: Women's groups are organized and supported not only through targeted training, access to inputs and improved processing techniques, but also as economic actors managing and strengthening restoration-linked value chains, alongside the development of attractive and market-oriented packaging. Marketing efforts focus on two main outlets: (i) local and regional restaurants, including those in the city of Saint-Louis and nearby tourism facilities; and (ii) direct sales at the entrance of Djoudj National Bird Park, positioning the white water lily as a typical local product for visitors. To further expand market reach, the initiative is also exploring packaging that includes simple recipes on the label, addressing knowledge gaps among consumers unfamiliar with traditional preparation methods, and enhancing product appeal.

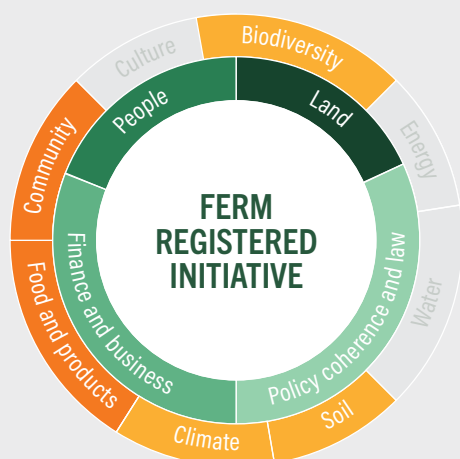
Women from villages near the Djoudj National Bird Sanctuary harvesting water lily seeds in an experimental plot designed to restore abandoned rice fields.
© Bruno Portier



CASE STUDY 5

RESTORING DRYLAND FORESTS AND LIVELIHOODS THROUGH INTEGRATED LANDSCAPE APPROACHES IN ZIMBABWE

Community-led restoration in miombo and mopane drylands under the Global Environment Facility-7 Dryland Sustainable Landscapes Impact Program



- ▶ Integrated land-use planning enables large-scale restoration. More than 180 000 ha have been restored, improving ecosystem connectivity, productivity and resilience.
- ▶ Linking restoration to livelihoods sustains long-term impact. Engaging more than 11 000 beneficiaries in forest and farm enterprises, created incentives for continued stewardship.

**CASE STUDY LOCATION**

Save and Runde catchments, Manicaland, Masvingo and Midlands Provinces, Zimbabwe

**IMPLEMENTATION PERIOD**

2021–2027

**AREA UNDER RESTORATION**

188 490 ha

**TOTAL TARGET AREA TO RESTORE**

274 650 ha

RESTORATION APPROACH

Community woodlots, assisted natural regeneration, riparian and buffer zone restoration, fire management, agroforestry and sustainable forest management, guided by integrated land-use plans and a land degradation neutrality framework

**TOTAL NUMBER OF BENEFICIARIES**

11 996, including smallholder farmers, forest-dependent households and community institutions

**BUDGET**

USD 10.4 million

**SOURCES OF FUNDING**

Global Environment Facility-7, Government of Zimbabwe

**ECOSYSTEM TYPE***

Farmlands
Forests
Grasslands, shrublands and savannahs

NOTE: *The types of ecosystems referenced are based on the classification provided by the United Nations Decade on Ecosystem Restoration 2021–2030.

Key takeaways and highlights

- ▶ Integrated land-use plans guiding restoration: Assisted natural regeneration, community woodlots, riparian and buffer zone restoration, fire management, agroforestry and sustainable forest management were used to improve ecological connectivity and land productivity.
- ▶ Restoration led by community-based institutions: Over 11 000 beneficiaries, including smallholders and community institutions, are being trained through Farmer Field Schools to lead assisted natural regeneration (ANR), fire management and sustainable forest management, reinforcing livelihoods and ecological restoration.
- ▶ Restoration linked to diversified forest and farm enterprises: This approach strengthens incentives for long-term stewardship in miombo and mopane ecosystems by applying the Sustainable Landscape Production Framework (SLPF) green value chain development.

Introduction and context

Zimbabwe's miombo and mopane drylands support rural livelihoods, biodiversity conservation and water regulation; yet they are experiencing severe land degradation caused by deforestation, uncontrolled fires, unsustainable harvesting and climate variability.⁵²⁴ In the Save and Runde catchments, increasing pressure from agricultural expansion, fuelwood demand and limited livelihood alternatives has accelerated

woodland degradation, undermining ecosystem services and community resilience.⁵²⁵ The GEF-7 Dryland Sustainable Landscapes Impact Program (DSL-IP) was designed to address these challenges by applying SLPF, an integrated pathway for achieving land degradation neutrality (LDN) at scale. Aligned with LDN principles and programmatically rolled out in six Southern African countries (Angola, Botswana, Malawi, Namibia, the United Republic of Tanzania and Zimbabwe) the framework ensures evidence and context from targeted landscapes are the foundation for the design of integrated and scalable land and forest management options.

Implemented across eight districts in Manicaland, Masvingo and Midlands Provinces, the programme operates within complex socioeconomic settings characterized by smallholder farming, communal land tenure and high dependence on forest resources for energy, construction materials and income.

The GEF programme strengthens the enabling environment for restoration by supporting participatory governance structures, cross-sector coordination and integrated land-use planning at the landscape and catchment levels. Community-based forest management committees and forest and farm producer organizations (FFPOs) play a central role in planning, implementation and benefit-sharing, ensuring restoration responds to local priorities and



Indigenous tree truncheons used in assisted natural regeneration by the Zamazama Community Woodland Management Group, Zimbabwe.
© GEF PMU/Ntandoyenkosi Ngwenya

knowledge systems through the SLPF's tailored technical support. By combining ecological restoration with livelihood diversification and institutional strengthening, the programme seeks to reverse degradation trends while improving food security, income generation and climate resilience.

The project has demonstrated strong spillover effects, with farmers in non-project areas independently adopting DSL-IP practices and local authorities in Chivi and Buhera districts allocating devolution funds to LDN activities. Community-led restoration is also accelerating, from village savings and lending group initiatives to the rehabilitation of degraded mining land in Shurugwi, demonstrating that the project's impact is scaling beyond its original boundaries.

Best practices and innovation to scale up and replicate restoration efforts

Implementing integrated land-use planning at the basin scale: This approach aligns forestry, agriculture and rangeland management under a unified land degradation neutrality framework. It addresses fragmentation in governance and enables coordinated action across sectors and administrative boundaries.

Integrating community seed banks and community-based forest governance with livelihood-oriented producer organizations: By linking community-based forest management committees with FFPOs, restoration activities are embedded within viable business models that generate incentives for long-term stewardship. This model, utilizing the SLPF crop diversification pillar, has supported diversified income streams from forest, crop and rangeland products while reinforcing equitable benefit-sharing mechanisms.

Applying climate-resilient ANR techniques: Such techniques included Indigenous truncheon planting – a traditional vegetative propagation method in which a large hardwood cutting (called a “truncheon”) from a native tree species is planted directly into the ground to grow into a new tree – combined with targeted seedling establishment. These low-cost restoration methods have proven effective in harsh dryland conditions, achieving higher survival rates than conventional planting methods. Together, these

practices provide a replicable model for restoring multifunctional dryland landscapes at scale.

Embedding restoration priorities within land-use planning processes: Doing so strengthens the coherence between forestry, agriculture and environmental policies, which reduces trade-offs and enhances impact. It also reinforces the legal recognition of community forest management institutions, which is important for accountability and long-term stewardship. Furthermore, aligning restoration programmes with national climate, biodiversity and land degradation commitments can unlock blended financing opportunities and improve monitoring and reporting.

Integrating adaptive monitoring systems and knowledge-sharing platforms: The programme also underscores the need for a paradigm shift from measuring restoration success solely by hectares restored towards assessing long-term ecological and socioeconomic outcomes through the SLPF's Integrated Landscape Assessment Methodology (ILAM). Integrating adaptive monitoring systems and knowledge-sharing platforms can support evidence-based policy adjustments and the scaling of successful forest landscape restoration models across similar dryland contexts.

Programme staff and stakeholders inspect gabion check dam structures installed for gully stabilization and catchment restoration.
© GEF-7 DSLIP Programme

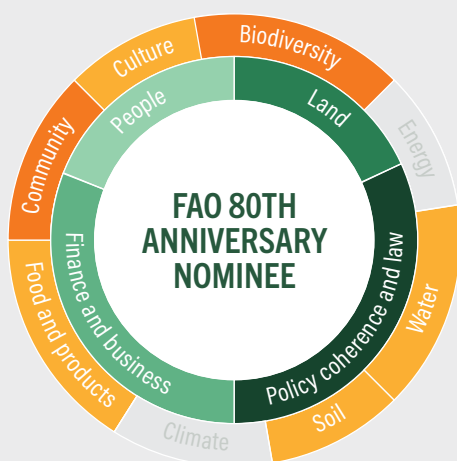


ASIA

CASE STUDY 6

CHINA'S GREEN GREAT WALL: A GREAT ENDEAVOUR FOR THE HARMONIOUS COEXISTENCE OF HUMANITY AND NATURE

How long-term government commitment can enable restoration at scale



- ▶ Long-term government commitment enables restoration at scale. Several million ha under restoration and 15 million people lifted from poverty show how sustained investment can transform degraded landscapes.
- ▶ Restoration delivers economic and food security benefits. Shelterbelt forests increased crop yields and generated 423 million tonnes of additional food production, linking restoration to livelihoods.

CASE STUDY LOCATION



Xinjiang, Gansu, Ningxia, Qinghai, Shaanxi, Shanxi, Hebei, Beijing, Tianjin, Inner Mongolia, Liaoning, Jilin and Heilongjiang, China



IMPLEMENTATION PERIOD

1978–2050

AREA UNDER RESTORATION



Since 1978, 31.74 million ha of afforestation area has been preserved, 33.33 million ha of desertified lands have been rehabilitated, 44.67 million ha of soil erosion have been controlled and 1.656 million ha of regional farmland shelterbelt forests have been planted, effectively protecting 30 million ha of farmland



TOTAL TARGET AREA TO RESTORE

49.333 million ha for Phase VI (2021–2030)



RESTORATION APPROACH

Afforestation, forest and grassland regeneration through mountain area closures, aerial seeding, sand fixation and control, forest stand and quality improvement



TOTAL NUMBER OF BENEFICIARIES

15 million people



BUDGET

USD 31.8 billion



SOURCES OF FUNDING

Government of China, international organizations and governments, including FAO, the Governments of Germany and Belgium, donations from enterprises



ECOSYSTEM TYPE*

Farmlands
Forests
Freshwater ecosystems
Grasslands, shrublands and savannahs
Mountain ecosystems

NOTE: *The types of ecosystems referenced are based on the classification provided by the United Nations Decade on Ecosystem Restoration 2021–2030.

Key takeaways and highlights

- Centennial ecological programme: The Overall Plan of the Three-North Program, spanning from 1978–2050, covers nearly half of China's total territory.
- Systematic restoration programme: Expanding from a sand control initiative, the Three-North Program has begun to put into practice key theories in environmental economics, ecosystem restoration and sustainable development.
- People-centred development programme: The Three-North Program has helped lift 15 million people out of poverty and has created 313 million jobs so far for rural residents.⁵²⁶

Introduction and context

In the late 1970s, in response to severe environmental challenges, such as sandstorms and soil erosion in the Three-North region, which includes northeastern, northern and northwestern China, the Chinese Government launched the Three-North Program to combat desertification and land degradation. Over the past 40 years, the Chinese Government has steadily advanced the programme. While in the early phases (1978–2000s), like many other long-term investment approaches, the focus was on monocultures of fast-growing trees, such as poplar, for rapid establishment, the current strategy (Phase 6, started in 2021) explicitly prioritizes ecological restoration and emphasizes mixed forests and native vegetation to ensure biodiversity, illustrating how the approach has evolved over time. The Three-North Program covers a total area of 49.333 million ha and has, since 1978, put 31.74 million ha of preserved afforested area, 33.33 million ha of rehabilitated desertified lands and 44.67 million ha of controlled soil erosion under restoration, and has planted 1.656 million ha of regional farmland shelterbelt forests, effectively protecting 30 million ha of farmland,^{527–529} and is one of the world's largest ecosystem afforestation and restoration initiatives. It benefits nearly 300 million people and reflects a strong commitment to environmental improvement.⁵²⁶

China's approach to desertification control can be summarized as a strategy that encourages broad participation from all relevant stakeholders and promotes nature-based solutions tailored to the country's specific conditions. This approach is supported by government leadership, policy guidance, scientific and technological innovation, legal frameworks, economic incentives and long-term commitment.⁵³⁰

Best practices and innovation to scale up and replicate restoration efforts

Combining mechanical and biological approaches: The programme employs mechanical approaches combined with biological approaches, such as using straw checkerboard barriers for sand fixation, planting drought-resistant native shrubs (e.g. *Caragana arborescens*) and promoting natural regeneration through fencing to restore the degraded land while minimizing negative hydrological impact.²⁴⁷ Economic innovations, such as the "Solar Panels + Planting" model and sand-based industries (e.g. *Cistanche* cultivation, a parasitic plant that thrives in arid conditions) have further integrated ecological governance with local poverty alleviation.

Sharing knowledge across borders: Heads of state, ambassadors and experts from over 100 countries have visited the Three-North Program to learn more about desertification control, and more than 100 desertification-control technologies from China have been successfully applied in over 40 countries and regions. Among them, the "fungus-grass technology", in which edible and medicinal fungi are cultivated on grass-based substrates (replacing wood-based materials such as logs or sawdust, thereby reducing pressure on forests), has been introduced in six African countries.

The "straw checkerboard technique", in which straw is laid in a checkerboard grid with parts buried and parts exposed to increase surface roughness, reducing near-surface wind speed and helping to retain moisture to support vegetation recovery, has been widely adopted in desertification-prone areas worldwide, thereby contributing to the Green Great Wall in China.⁵³¹

Government leadership and long-term commitment: The Chinese Government has consistently prioritized combating desertification by allocating dedicated funds and developing master plans and phase plans, and established policies supporting the socioeconomic and environmental components of the Three-North Program. For example, the national policy instrument Grain for Green compensates farmers across the country for converting steep or environmentally sensitive cropland into forest and grassland, with the goal of reducing soil erosion and improving ecosystem health. It serves as one of the key funding mechanisms to achieve the restoration targets established by the Three-North Program.

Policies that encourage broad participation: Innovative policies implemented by relevant local authorities, such as “whoever plants owns” (one of the core principles of China’s forestry property rights system), “family-run forestry” (a forestry management principle designating farmer households as the basic producing and operating unit) and “contracted afforestation” (a forestry management system where contractors enjoy the ownership and right to benefits from forests they have planted) have encouraged broad participation.

Scientific and technological advancement: The programme has pioneered several innovative desertification and sand control methods, such as scientific desertification control,²³³ targeted sand stabilization, photovoltaic sand control, road-based sand management and industry-driven desertification prevention. The programme continues to explore and apply new materials and methods to combat desertification.

Economic gains and food security through restoration: The programme’s “Farmland Shelterbed Networks” have planted 1.656 million ha of farmland shelterbelt forests, effectively protecting 30 million ha of farmland. This has resulted in food crop yield increases of 4.68 percent, 4.28 percent and 9.45 percent in high-, medium- and low-yield areas, respectively. According to statistics on food yields in project areas over different periods, over the past 40 years, areas benefiting from farmland

shelterbelts have achieved a cumulative increase in food production of 423 million tonnes, with an average annual increase of 10 million tonnes. The programme area produces 48 million tonnes of dried or fresh fruits and nuts annually, and approximately 15 million people have been lifted out of poverty through specialized fruit and forestry industries.

Economic incentives: The success of desertification-control efforts is closely linked to economic benefits for local communities. By aligning ecosystem restoration with local livelihoods, the Three-North Program has effectively mobilized stakeholders and increased participation in combating desertification. Fiscal regulations also incentivize enterprise donations to public-good programmes such as the Three-North Program, as these donations are tax-deductible up to a proportion of annual profits.

Yanwang Bizi Juncao Ecological Management Demonstration Base, Alxa League, Inner Mongolia showing results of the fungus-grass sand-control projects.
© Fu Chao



CASE STUDY 7

BUILDING WITH NATURE IN INDONESIA: RESTORING AN ERODING COASTLINE

Restoring coastal resilience through nature-based solutions and community-led mangrove recovery



- Nature-based solutions provide more effective coastal protection. Natural mangrove regeneration achieves up to 70 percent seedling survival, compared to 15–20 percent for planted seedlings, reducing costs and increasing resilience.
- Linking restoration to livelihoods ensures long-term impact. Through bio-rights and sustainable aquaculture, communities restore mangroves while improving incomes and reducing pressure on ecosystems.

**CASE STUDY LOCATION**

Demak, Central Java, Indonesia

**IMPLEMENTATION PERIOD**

2015–2021

**AREA UNDER RESTORATION**

120 ha

**TOTAL TARGET AREA TO RESTORE**

120 ha

RESTORATION APPROACH

Permeable sediment-trapping structures along the severely eroded parts of the coastline; conversion of degraded and unproductive aquaculture ponds along the shoreline; revitalization of aquaculture ponds through sustainable aquaculture practices

**TOTAL NUMBER OF BENEFICIARIES**

272 community group members (14 percent women) and 277 farmers

**BUDGET**

USD 9.44 million

**SOURCES OF FUNDING**

Government of Indonesia, EcoShape Foundation

**ECOSYSTEM TYPE***

Forests
Oceans and coasts

NOTE: *The types of ecosystems referenced are based on the classification provided by the United Nations Decade on Ecosystem Restoration 2021–2030.

Key takeaways and highlights

- Innovative, nature-led and cost-effective coastal protection: Hard infrastructure was replaced with permeable structures that trap sediment, reduce wave energy and promote mangrove recovery, creating a more sustainable, adaptive, lower-risk and largely self-maintaining coastal protection system.
- High survival rates and substantial co-benefits of natural regeneration: Natural mangrove regeneration results in approximately 70 percent survival, compared to 15–20 percent for outplanting. This restores diversity and strengthens ecosystem resilience while providing co-benefits, including coastal protection, improved fisheries, better water quality and increased carbon storage.
- Integrated socioeconomic incentives and strong institutional buy-in: Community-based mangrove restoration provides financial and technical support to help develop more sustainable livelihoods, in exchange for active engagement in conservation and restoration through a mechanism called bio-rights.

Introduction and context

Northern Java's coastlines are sinking and eroding rapidly due to decades of mangrove clearing for aquaculture, unsustainable pond expansion and excessive groundwater extraction. In the worst-affected areas, more than 3 km of land have already been lost to the sea, engulfing entire villages and reducing local incomes by 60–80 percent. The crisis goes far beyond flooding: it signifies a rapidly accelerating loss of the coastline itself, threatening 30 million people across 3 000 villages in northern Java.⁵³² Seawalls are ineffective on muddy coasts, leaving the villages of Demak increasingly exposed to chronic flooding. Communities rely heavily on aquaculture and small-scale fisheries, making them highly vulnerable to coastal degradation.

Wetlands International, the EcoShape consortium,^{be} government agencies and local partners implemented a Building with Nature

approach that tackles the root causes of mangrove loss while enabling natural recovery. Recognized as a World Restoration Flagship, the project implemented measures along 20 km of severely eroded shoreline, including the construction of 3.4 km of permeable barriers offshore to reduce wave energy and trap sediment, restoring the calm, muddy conditions required for natural mangrove regeneration. In mildly eroded areas, communities reopened abandoned ponds to seed-rich water and sediment, enabling spontaneous mangrove recovery. Households also received livelihood support to reduce dependence on eroding shorelines.^{533, 534}

Since unsustainable aquaculture is a major driver of mangrove loss, the project promoted sustainable production systems. Through the associated mangrove aquaculture (AMA) model, an integrated coastal management approach that combines mangrove conservation or restoration with sustainable aquaculture to support livelihoods while preserving ecosystem functions, shrimp farmers were trained to set back dykes, modify sluices to enhance natural sedimentation and allocate 20 percent of their pond area to mangroves. A total of 464 ha of ponds are now managed using best practices, including AMA, and farmers report increased shrimp yields. Mangroves under restoration now buffer 10 000 people in Demak from erosion, storm surges and saline intrusion.⁵³² They also store carbon, improve water quality and support fisheries that diversify livelihoods. The approach is scalable across Indonesia's muddy coasts.⁵³⁵

All measures were anchored in village development plans and aligned with coastal policies, enabling access to funding for maintenance and rehabilitation. However, there is ongoing pressure to rezone eroded land for industry. The project, therefore, facilitated dialogues between coastal and urban communities about subsidence, advocating for reduced groundwater extraction and considering sustainable surface-water alternatives.

Without stopping subsidence, permeable structures can only slow land loss, providing communities with more time to adapt.^{533, 534}

^{be} EcoShape – Building with Nature is a network of organizations and individuals, working together to use building with nature to resolve water-related societal issues. Building with nature is a philosophy about designing and constructing water-related infrastructure that harnesses the forces of nature for the benefit of both nature and humans, thereby strengthening nature, economy and society.

Best practices and innovation to scale up and replicate restoration efforts

Ecological mangrove restoration: Nearly 80 percent of mass-planting efforts fail, especially where coastlines have been extensively altered. Wetlands International applies community-based ecological mangrove restoration, a participatory restoration approach that empowers local communities to restore mangroves by first addressing the ecological causes of degradation and facilitating natural regeneration processes. The approach builds on principles of assisted natural regeneration (ANR), while going further by restoring the hydrological and sediment conditions required for mangrove recovery. It restores the abiotic conditions that enable natural mangrove regrowth and tackles the root causes of mangrove loss. Moreover, long-term restoration success depends on local communities actively participating and stewarding restored ecosystems.⁵³⁶

Associated mangrove aquaculture model: Pairing mangroves as coastal defences with improved aquaculture delivers lasting protection and more self-resilient communities, scalable across Indonesia's coasts. The model establishes mangrove belts outside aquaculture ponds and along boundaries, creating greenbelts that filter water, curb disease and boost yields. A controlled portion of each pond (typically around 20 percent) is restored to natural mangroves as part of an integrated system design.

Smaller ponds ringed by healthy mangroves can match or exceed yields, especially when paired with sustainable techniques, such as wet compost from fruit and vegetable waste. In contrast, mangrove restoration within ponds or on embankments without suitable design and ecological conditions is unlikely to succeed.

Bio-rights mechanism: Communities and local institutions are at the heart of restoration. The Building with Nature Indonesia consortium used a bio-rights financing mechanism linking community engagement with conservation outcomes. Households receive small loans for sustainable aquaculture and other income-generating activities; once restoration targets are met, loans convert into grants. For example, the project supported 277 shrimp farmers to restore 20 percent of their aquaculture ponds to mangroves, boosting yields, while community by-laws and government policies supported long-term funding, making the model scalable across Indonesia and Asia.^{537, 538}

Long-term enabling frameworks: Restoring mangrove coasts is a long-term process and

requires continuous adaptation; legal, political and financial systems must therefore support sustained, integrated planning.

Multilevel governance: Combining community empowerment with engagement from national ministries proved effective. Nine villages integrated nature-based solutions into development plans and land-use regulations, securing local government recognition and funding for mangrove rehabilitation and improved aquaculture. Co-design with two national ministries created an enabling environment for nationwide mainstreaming. Indonesia's Ministry of Marine Affairs and Fisheries mainstreamed 23.5 km of permeable structures nationwide, while the Ministry of Public Works tested designs and financed monitoring.⁵³³

Cross-sector coordination: Industrial rezoning pressures prompted dialogues advocating reduced groundwater extraction and expanded surface-water use, informing the 2021 Roadmap for Adapting and Mitigating Land Subsidence in Central Java. Implementation is urgently needed to reduce groundwater use, enhance aquifer recharge and improve surface-water supply by 2030.⁵³⁶

Innovative finance: Development and philanthropic capital helped de-risk early community engagement and pilot hybrid structures. A blended finance approach with long-term maintenance funds, procurement integration and public-private partnerships is essential for durable scaling.

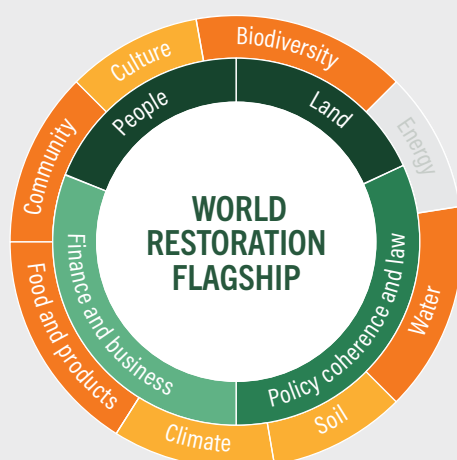
Community groups construct permeable structures along the eroded coastline in North Java to trap sediment, enabling mangroves to regrow naturally, increasing coastal resilience.
© Nanang Sujana



CASE STUDY 8

COMMUNITY ENGAGEMENT AND NATIONAL AMBITION IN RANGELANDS: COMPLEMENTARY MODELS FOR RESTORING ARID AND SEMI-ARID LANDSCAPES IN JORDAN AND SAUDI ARABIA

Two World Restoration Flagships showing how sustainable grazing management and large-scale, multi-ecosystem restoration can advance the recovery of drylands



- Participatory and sustainable grazing management restores both land and livelihoods. In Jordan, traditional herder knowledge combined with scientific protocols, increased vegetation biomass in rangelands (from 30 tonnes in 2008 to 250 tonnes in 2024), lifted native plant species, expanded managed grazing days, increasing the number of participating herding families.
- Sustained, long-term national commitment can take restoration to scale. In Saudi Arabia, over 43.9 million trees have been planted, and 94 000 ha have been restored through the National Greening Program, advancing towards 4 million ha and 400 million trees by 2030 while building a model for restoration in hyper-arid conditions.

**CASE STUDY LOCATION**

Jordan: Tal Al-Rumman
Saudi Arabia: All regions

**IMPLEMENTATION PERIOD**

Jordan: 2008–present
Saudi Arabia: 2021–present

**AREA UNDER RESTORATION**

Jordan: 190 ha
Saudi Arabia: 94 000 ha

**TOTAL TARGET AREA TO RESTORE**

Jordan: 190 ha
Saudi Arabia: 4 million ha by 2030 and 40 million ha by 2100

RESTORATION APPROACH

Jordan: Community-based rangeland rehabilitation: participatory managed grazing, paired with flock-management and animal-health support, native seed banking and income diversification.



Saudi Arabia: Natural regeneration and ecological succession across action zones, supported by science-based geospatial planning, native-species seeding and planting, rewilding in protected areas, agroforestry, mangrove restoration, urban greening and sustainable water management.

TOTAL NUMBER OF BENEFICIARIES

Jordan: 54 herding families in the wider Tal Al-Rumman community, including the Tal Al-Rumman women's cooperative
Saudi Arabia: an estimated 156 000 to 187 000 jobs (average annual) projected nationwide

**BUDGET**

N/A

SOURCES OF FUNDING

Jordan: International donors, non-governmental organizations, local communities, development agencies, in-kind support from the Government of Jordan (access to public lands and administrative support)
Saudi Arabia: Government of Saudi Arabia

ECOSYSTEM TYPE*

Jordan: Grasslands, shrublands and savannahs; Forests
Saudi Arabia: Grasslands, shrublands and savannahs; Forests; Farmlands; Oceans and coasts; Urban areas

NOTE: *The types of ecosystems referenced are based on the classification provided by the United Nations Decade on Ecosystem Restoration 2021–2030.

Key takeaways and highlights

- ▶ Turning conflict into partnership: Rather than excluding herders, the Jordanian flagship engaged them as co-managers, developing grazing protocols from shared scientific and traditional knowledge; what could have become a resource conflict became a durable restoration partnership.
- ▶ Two scales, one principle: Whether on 190 ha in Jordan or across millions of hectares in Saudi Arabia, both initiatives prioritize natural processes over intensive intervention, demonstrating that the same restoration approach applies at very different scales.
- ▶ Rigorous evidence and monitoring underpin adaptive management: Annual biomass, stocking-rate and species surveys in Jordan, and large-scale geospatial suitability analysis in Saudi Arabia, demonstrate how evidence-based monitoring guides decisions.

Introduction and context

Across the drylands of Western Asia, rangelands sustain both pastoral communities and biodiversity, yet face mounting pressure from overgrazing, recurrent drought, weak governance and land-use change. Restoring these arid and semi-arid landscapes calls for approaches that reconcile the needs of livestock-dependent communities with the recovery of vegetation, soils and native species. Yet rangelands are only one of several degraded ecosystems competing for attention: mountain forests, mangroves, agricultural lands and rapidly growing cities also require restoration if drylands are to become more resilient. The two initiatives – a community-based initiative in Jordan and a nationwide programme in Saudi Arabia, both recognized as World Restoration Flagships under the UN Decade on Ecosystem Restoration – illustrate complementary pathways to that goal.

In Jordan, the degraded open mountain forest of Tal Al-Rumman, north of Amman, came under the management of the Royal Botanic Garden (RBG) in 2008. The site was subject to year-round illegal grazing by 3 500 sheep and goats, which obstructed ecological recovery. Instead of fencing herders out, the RBG launched the Community-Based Rangeland Rehabilitation programme,

designing sustainable, habitat-specific grazing protocols together with local pastoralists and gathering tribal elders' knowledge of past range practices, livestock diseases and medicinal plants. In 2014, the RBG and the Ministry of Environment designated the site a Special Conservation Area.

In Saudi Arabia, the National Greening Program (NGP) is the delivery arm of the Saudi Green Initiative, which has committed to growing 10 billion trees and restoring 40 million ha of land by 2100. Guided by a National Greening Masterplan launched in 2023, the NGP works across diverse action zones – rangelands, which make up roughly 70 percent of the territory, alongside mountain forests, mangroves, national parks, abandoned fodder farms, greenbelts and cities. It places strong emphasis on natural regeneration, ecological succession and sustainable water use, aiming to set a benchmark for restoration under some of the most challenging arid conditions.

KSA National Greening Program,
UN World Restoration Flagship.
© UNEP/Todd Brown



Best practices and innovation to scale up and replicate restoration efforts

Sustainable, habitat-specific managed grazing: In Jordan, annual biomass and stocking-rate studies, using transect-quadrat methods across sectors defined by soil, elevation and aspect, determine how much forage can be sustainably used. Herders graze designated sectors for limited periods – typically 2.5 hours per day – under ranger supervision, while the RBG provides supplementary feed equivalent to roughly 25 percent of expected forage to allow the range to recover. Controlled grazing raised biomass by about 30 percent in the first three years, and vegetation production rose from 30 tonnes in 2008 to 250 tonnes in 2024.

A participatory approach that changes societal attitudes: In Jordan, herders are treated not as a problem to be excluded but as co-managers who help plan, implement and monitor interventions through elected representatives, building transparency and shared responsibility. Listening to the community and valuing its knowledge has gradually shifted attitudes towards restoration, moving pastoralists away from unsustainable practices on public land and fostering a sense of ownership that sustains the programme. Awareness campaigns, school engagement, summer schools and community gatherings reinforce a culture of environmental stewardship.

Linking restoration to herder livelihoods: In Jordan, simple flock-management techniques – such as isolating rams before the breeding season – raised pregnancy rates sharply, while two trained para-veterinarians and a vaccination programme reduced losses. Participating herders' incomes more than doubled, feed-cost savings grew from USD 8 500 in 2008 to USD 40 000 by 2023, and income diversification through dairy, handicrafts and beekeeping further strengthened resilience.

Large-scale forest and landscape restoration across multiple ecosystems: Forest restoration is one of the central pillars of the NGP in Saudi Arabia. Many of the country's mountain forests are degraded and are a clear priority for the programme, which aims to restore them by increasing tree density where vegetation cover is low and by introducing agroforestry on

abandoned mountain terraces. The programme works in parallel across a range of other ecosystems – conserving and expanding mangroves and coastal ecosystems (with 6 million mangrove seedlings planted along the Red Sea and Arabian Gulf), rewilding national parks and protected areas, rehabilitating abandoned fodder farms away from groundwater-intensive practices, establishing greenbelts to curb sandstorms and greening cities so that all urban residents live within 800 metres of a quality green space.

Natural regeneration, ecological succession and rewilding: Saudi Arabia prioritizes creating conditions for natural vegetation recovery, rather than mass tree planting – designating areas with limited human activity, strategically seeding and planting, and favouring genetically appropriate native species while avoiding potentially invasive ones. This approach is particularly important for rangelands where the programme combines designated restoration areas where human activity is restricted to allow nature to rejuvenate, modern livestock-management practices taught to farmers and local communities, and the reintroduction of native wildlife to rebuild balanced ecosystems. Rewilding is central in

Herders and scientists collaborate in Jordan's Royal Botanic Garden, combining traditional knowledge and scientific methods to restore degraded rangelands and build sustainable livelihoods.
© UNEP



protected areas, including wildlife reintroduction or relocation into the NEOM Nature Reserve. Water-efficient approaches – such as wastewater reuse and rainwater harvesting – support these efforts by enhancing soil moisture. Carbon sequestration potential is estimated at 1.15–1.18 Mt CO₂ (Verra standards), with a national baseline under development to track long-term climate benefits.

Technology and science-based planning: A geospatial suitability analysis covering the whole Kingdom of Saudi Arabia examined soil, water, temperature, wind, topography and elevation for each action zone, validated by more than 1 150 field surveys for ground-truthing. Advanced tools, including satellite multispectral and hyperspectral imagery, LiDAR and drones, support the assessment of vegetation, terrain, biomass and canopy structure. A GIS-based portal and national Soil Information System enable decision-making and monitoring, while a comprehensive degradation assessment produced 246 maps that serve as a baseline for adaptive management.

Inclusive engagement of women, youth and local and Indigenous knowledge: In Jordan, participatory assessments deliberately included different tribes, women and youth. Women took a significant role in herd-management training and, through the Tal Al-Rumman women's cooperative established in 2016 – the area's first community-based organization – gained a recognized space for income generation and decision-making. In Saudi Arabia, women and youth were embedded as core members of the leadership and implementation team, and traditional knowledge – such as the Bedouin water-harvesting practices – was integrated alongside science from the universities.

Strong governance frameworks: In Jordan, the 2023 management plan designating the site a Special Conservation Area guarantees community and stakeholder representation on the management committee, while the flagship advocates for supportive legal frameworks, including updates to the National Rangeland Strategy and the national biodiversity strategies and action plan. In Saudi Arabia, a clear governance structure defined through the

National Greening Masterplan assigns roles across government departments and agencies and is led at the highest level by the Saudi Green Initiative Supreme Committee, ensuring coordinated decision-making and accountability.

Designing for long-term sustainability: Both flagships embed durability into their design. Jordan diversifies funding across donors and government grants, generates continuous revenue for communities through eco-friendly grazing, invests in local capacity building and leadership, and is pursuing Global Biodiversity Standard certification. Saudi Arabia applies ecological succession principles, tailors site-specific approaches, minimizes invasive interventions, monitors successional trajectories and implements long-term adaptive management supported by multidisciplinary expertise and continuous capacity building.

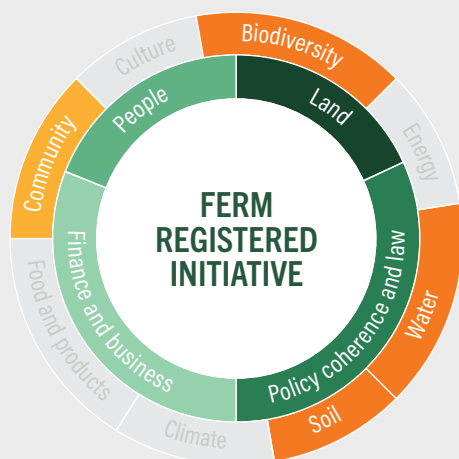
KSA National Greening Program,
UN World Restoration Flagship.
© UNEP/Todd Brown



CASE STUDY 9

CONSERVATION AND RESTORATION OF RELICT TURANGA POPLAR POPULATIONS AND RIPARIAN FORESTS USING BIOTECHNOLOGY IN KAZAKHSTAN

Methods for *ex situ* conservation of genetic material and propagation of near threatened native tree species



- Biotechnology can help restore threatened ecosystems. Cryobanking 100 000 seeds and applying micropropagation techniques to the relict turanga poplar population enabled the recovery of a near-threatened species at scale.
- Combining science and community action strengthens restoration outcomes. Local engagement and advanced propagation methods ensure genetic diversity and long-term ecosystem resilience.

**CASE STUDY LOCATION**

Ili River Delta and South Lake Balkhash Ramsar site, Almaty region, Kazakhstan

**IMPLEMENTATION PERIOD**

2018–2048

**AREA UNDER RESTORATION**

25 500 ha

**TOTAL TARGET AREA TO RESTORE**

200 000 ha

**RESTORATION APPROACH**

Collection of *Populus pruinosus* (turanga) seeds and cuttings in the field, combination of seed propagation and clonal micropropagation of *Populus pruinosus* and *Populus euphratica*, adaptation of seedlings in greenhouses and nurseries

**TOTAL NUMBER OF BENEFICIARIES**

200 000

**BUDGET**

USD 6 million (invested to date)

**SOURCES OF FUNDING**

National project of the Ministry of Ecology and Natural Resources of the Republic of Kazakhstan, Ministry of Science and Higher Education, United Nations Development Programme (UNDP), World Wide Fund for Nature (WWF) Central Asia internal financing, International Climate Initiative (IKI) grants, and United Nations Environment Programme (UNEP) grants

**ECOSYSTEM TYPE***

Forests
Freshwaters
Grasslands, shrublands and savannahs

NOTE: *The types of ecosystems referenced are based on the classification provided by the United Nations Decade on Ecosystem Restoration 2021–2030.

Key takeaways and highlights

- Developing *ex situ* conservation methods: Conservation methods for genetic material, seed and clonal propagation were developed for a near threatened desert poplar native to a Central Asian mountain biodiversity hotspot.
- Establishing plant material collections: Efforts included the cryobanking of 100 000 turanga seeds, creating DNA and *in vitro* collections, and establishing three tree collections in botanical gardens to conserve the species.
- Illustrating the land pathway of forest and landscape restoration (FLR). This case study illustrates how biotechnological approaches for restoring vulnerable riparian forests can contribute to the land pathway of FLR (Chapter 4).

In the Almaty region, Kazakhstan, communities fence turanga seedlings after planting to protect them from livestock and rabbits, supporting the recovery of fragile riparian forests.
© WWF Central Asia/Aibek Baibulov



Introduction and context

Tugai riparian forests – forests dominated by *Populus* species – are ecosystems found along rivers in Central Asia and western China. These forests and adjacent grasslands form oases within desert landscapes, attracting wild ungulates (e.g. *Cervus hanglu bactrianus*, the Bukhara deer) and supporting highly productive agricultural areas. Today, tugai ecosystems cover less than 10 percent of the area they did in the 1960s due to degradation drivers such as river regulation, climate change and livestock grazing.⁵³⁹ The blue-leaved turanga (*Populus pruinosa*), a key species making up tugai forests, is listed as near threatened by the International Union for Conservation of Nature (IUCN). Seed formation and natural regeneration in remaining populations of turanga are complicated, as there are not always enough male or female trees for pollination. Moreover, turanga seeds lose germination energy within several days in the wild, or within 3–6 months under traditional storage conditions. Due to the lack of planting material, there was a need to develop techniques for efficient seed storage and clonal micropropagation.

This initiative aims to restore turanga poplar populations (*Populus pruinosa* and *Populus euphratica* species) and riparian forests in the Ili River Delta and South Lake Balkhash Ramsar site in Kazakhstan, two of the remaining places in Central Asia where turanga populations and tugai forests still exist. The location consists of protected areas, plots of tugai forests and restoration sites, as well as villages and pastures. Field restoration activities are implemented by the World Wide Fund for Nature (WWF) Central Asia programme on state forestlands, within the national project on Caspian tiger reintroduction in collaboration with the Ministry of Ecology.^{540, 541}

Local communities are engaged in various ways, including decision-making through regular meetings with the official village administrations, or “akimats”. The akimats also contribute to mitigating and managing land-use conflicts. Turanga plots serve as a source of seeds and cuttings for propagation, and school children^{bf} and youth^{bg} are involved in collecting turanga seeds as part of extracurricular activities. Meanwhile, the Institute of Plant Biology and Biotechnology produces seedlings for restoration and conserves seeds, cuttings and DNA *ex situ*. Women from local communities also contribute to caring for seedlings in greenhouses to generate additional income.

Best practices and innovation to scale up and replicate restoration efforts

Using various micropropagation methods: Methods for the *ex situ* conservation of genetic material and seed, as well as clonal propagation techniques for desert poplar native to the Central Asian mountains’ biodiversity hotspot were developed.

A cryobank of 100 000 turanga seeds along with DNA samples, an *in vitro* collection and three field collections in botanical gardens have been established.⁵⁴²

Combining seed propagation and clonal micropropagation: The team found that restoration of turanga poplar populations in the drylands of Central Asia is efficient when a combination of seed propagation and clonal micropropagation is used to produce planting material (90 percent and 10 percent, accordingly). Seed propagation ensures the maintenance of genetic diversity in turanga populations, while clonal micropropagation allows the production of healthy, pest-free and high-quality planting material to fill the gap in male trees at the restoration sites and facilitate pollination and formation of natural seed banks in the river delta. This combined approach reduces the risk

of degradation of restored turanga populations, increases their long-term sustainability and minimizes genetic drift (the random loss of genetic traits over time). Separate propagation of male and female forms allows for planning of the optimal sex ratio among trees at restoration sites. Female trees produced through seed propagation increase the reproductive function of turanga populations in the wild. Male trees produced through clonal micropropagation facilitate pollination. Moreover, male clones may also be suitable for urban greening in nearby towns, as they do not produce seed fluff, providing an additional practical application of the approach.

Tugai forest landscape in the Ili River Delta and South Lake Balkhash Ramsar Site, Kazakhstan.
© FAO/Christophe Besacier



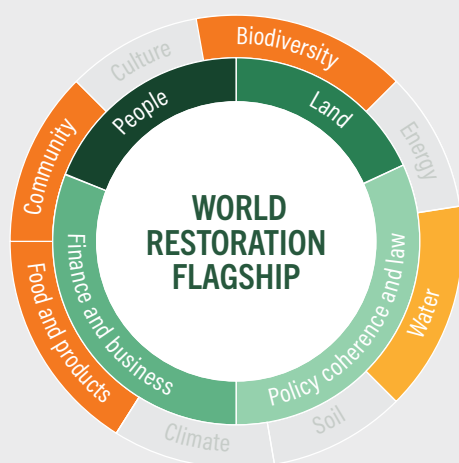
^{bf} A child means every human being below the age of 18 years unless under the law applicable to the child, majority is attained earlier. United Nations. 1989. Convention on the Rights of the Child. Article 1. New York, NY, USA.

^{bg} Youth, as defined by the United Nations, are persons between the ages of 15 and 24 years. United Nations. n.d. Youth. In: *United Nations Youth*. New York, NY, USA.

CASE STUDY 10

RESTORING HIGH-CONSERVATION-VALUE CHILGOZA PINE FORESTS IN PAKISTAN

From degradation to creating value: restoring chilgoza forests through community action and market innovation



- Community-led restoration strengthens both ecosystems and incomes. More than 30 000 households benefited from sustainable forest management and restoration good practices promoting the sustainable harvesting and processing of Chilgoza pine nuts.
- Market incentives drive conservation. Registering Chilgoza pine as a Geographical Indication product increased its value, creating incentives to protect forests.

CASE STUDY LOCATION



Provinces of Balochistan and Khyber Pakhtunkhwa, and the administrative territory of Gilgit-Baltistan, Pakistan



IMPLEMENTATION PERIOD

2018–2025



AREA UNDER RESTORATION

74 756 ha (69 477 ha under management plans, 3 789 ha under ANR and 1 490 ha under agroforestry)



TOTAL TARGET AREA TO RESTORE

34 400 ha



RESTORATION APPROACH

Sustainable forest management, assisted natural regeneration and agroforestry



TOTAL NUMBER OF BENEFICIARIES

30 388 households (32 percent women)
6 244 participants trained (52 percent women)



BUDGET

USD 3 978 440



SOURCES OF FUNDING

Global Environment Facility and cofinancing from provincial budgets



ECOSYSTEM TYPE*

Farmlands
Forests
Grasslands, shrublands and savannahs

NOTE: *The types of ecosystems referenced are based on the classification provided by the United Nations Decade on Ecosystem Restoration 2021–2030.

Key takeaways and highlights

- ▶ Empowering communities to ensure the long-term success of restoration efforts: Communities were empowered to lead restoration efforts by applying new knowledge and skills, supported by the establishment of forest protection and conservation committees that promote effective local governance mechanisms.
- ▶ Linking conservation efforts and production outcomes: Developing biodiversity-friendly value chains and market linkages through targeted interventions was essential, including by operationalizing value-adding pine nut processing and providing tools and planting material such as seedlings.

Introduction and context

The Restoration Initiative was designed to tackle key common barriers to expanding and scaling up restoration efforts. It brought together nine countries (Cameroon, Central African Republic, China, Democratic Republic of the Congo, Guinea, Kenya, Pakistan, Sao Tome and Principe, and the United Republic of Tanzania) and three Global Environment Facility (GEF) agencies – the International Union for Conservation of Nature (IUCN), the Food and Agriculture Organization of the United Nations (FAO) and the United Nations Environment Programme (UNEP) – as well as governments and strategic partners, to overcome barriers to restoring degraded landscapes, in support of the Bonn Challenge. Recognized as a World Restoration Flagship in 2025, the Restoration Initiative has put more than 480 000 ha under restoration and benefited more than 280 000 people. In Pakistan, the project was implemented over 2018–2025 through a close partnership between the Provincial Forest and Wildlife Departments and FAO, with funding provided by GEF. It focused on conserving and sustainably managing the unique chilgoza pine forests found in the Provinces of Balochistan and Khyber Pakhtunkhwa, as well as the administrative territory of Gilgit-Baltistan. It integrated ecological restoration with socioeconomic development through four interconnected components: strengthening policy frameworks, promoting sustainable forest management, enabling community-based conservation and sharing knowledge across platforms. The project supported the development

of sustainable forest management plans covering 69 477 ha across the target area, planted more than 1 million seedlings to support diversified land use and created the foundation for a USD 2.15 million government-funded upscaling project in Khyber Pakhtunkhwa, with similar initiatives underway in Balochistan and Gilgit-Baltistan.

The project successfully demonstrated sustainable, community-led restoration practices that increase local incomes while enhancing biodiversity for a lasting impact. Recognizing its innovative participatory approach to restoration, the government plans to scale it with new funding windows, and expand it to other vulnerable and underserved ecosystems in order to benefit both people and the environment.

Best practices and innovation to scale up and replicate restoration efforts

Geographical Indication: The project registered chilgoza pine nuts as a product with a Geographical Indication to enhance their market recognition, value and competitiveness. This decision was intended to substantially increase the pine nut prices in both national and international markets. Four types of chilgoza pine nuts are now in the final stages of Geographical Indication registration, with the book of specifications finalized and the registration procedures currently underway. This process represents a strategic intervention to promote value addition, protect regional identity and improve access to premium markets. The Geographical Indication is expected to significantly enhance the market and economic value of chilgoza pine nuts while creating new opportunities for branding, marketing and developing local enterprise. Meanwhile, the project supported the sustainable harvest of pine nuts worth approximately USD 25 million per year, boosting local incomes and conservation incentives.

Assisted natural regeneration: The project introduced assisted natural regeneration (ANR), which involved protecting degraded areas of forestland and establishing locally managed rules that prohibit the extraction of fuelwood, poles or timber and the grazing of livestock. By June 2024, participating communities had established a total of 3 789 ha of ANR across 60 sites with project support.

More importantly, the project's introduction of ANR was used as a central strategy in the government's Ten Billion Tree Tsunami project across much of the country. Recognizing that the ambitious targets of the project were unlikely to be reached through tree planting alone, ANR provided a more reliable and cost-effective way to restore degraded forestland.

Forest protection and conservation committees: Fourteen forest protection and conservation committees were supported to strengthen the community-level management of chilgoza

pine forests. In many communities, there was already an existing committee of village elders responsible for managing and protecting the forest, and these groups were given additional support through training, introducing ANR sites, providing assistance for community-level forest guards for each ANR site and providing harvesting toolkits to promote the sustainable and safe collection of chilgoza seeds. The project's support strengthened and reinforced these rules as well as the community structures responsible for overseeing their implementation.

Address drivers of deforestation: The project identified key drivers of deforestation and provided alternative, more sustainable options, to local communities. It distributed 15 600 fuel-efficient stoves, 23 solar dryers, 12 biobriquette machines and four pellet-making machines in support of local livelihoods and more sustainable forest management, as well it awarded 275 grants, including 75 medicinal plant toolkits and 200 fodder demonstration plots.



A woman practices traditional sewing in the Hindu Kush mountain valley in Pakistan.
© FAO/Christophe Besacier

CASE STUDY 11

EMPOWERING COMMUNITIES THROUGH INTEGRATED WATERSHED RESTORATION IN TÜRKİYE

Insights from the Murat River Watershed Rehabilitation Project



- Integrated watershed management delivers large-scale impacts. Restoration across 446 000 ha reduced erosion and sequestered 13 million tonnes of CO₂, strengthening climate resilience.
- Addressing socioeconomic drivers sustains restoration. Reducing wood use by 50 percent and increasing incomes by up to 58 percent link restoration directly to improved livelihoods.



CASE STUDY LOCATION

Provinces of Elazığ, Bingöl and Muş, Türkiye



IMPLEMENTATION PERIOD

2013–2022



AREA UNDER RESTORATION

446 000 ha



TOTAL TARGET AREA TO RESTORE

446 000 ha

RESTORATION APPROACH



Afforestation and sapling planting, erosion control, oak rehabilitation, climate-smart agriculture, pasture rehabilitation, establishing beehives, solar-powered heating systems, introduction of new irrigation systems, community engagement and gender-inclusive development



TOTAL NUMBER OF BENEFICIARIES

131 052 individuals



BUDGET

USD 50 544 822



SOURCES OF FUNDING

Türkiye, International Fund for Agricultural Development (IFAD)

ECOSYSTEM TYPE*



Farmlands
Forests
Freshwaters
Grasslands, shrublands and savannahs
Mountains

NOTE: *The types of ecosystems referenced are based on the classification provided by the United Nations Decade on Ecosystem Restoration 2021–2030.

Key takeaways and highlights

- ▶ Integrating forest restoration and watershed management can improve the outcomes of forest and landscape restoration (FLR). This case study implemented FLR across 36 microcatchments, linking forests, pastures and water across 446 000 ha, resulting in the sequestration of an estimated 13 million tonnes of carbon dioxide (tCO₂).
- ▶ Addressing socioeconomic drivers secures FLR sustainability for people. Introducing efficient stoves, solar heaters and home insulation cut household wood consumption by 50 percent, protecting 282 000 ha of forest. Concurrent livelihood investments raised incomes by 27–58 percent, while new irrigation boosted land productivity.
- ▶ Participatory and inclusive design drives scale and social acceptance. The project reached 292 villages and earned an International Fund for Agricultural Development (IFAD) Gender Equality Award because of the strong participation of women. A 95 percent satisfaction rate in impact surveys underscores that enabling institutions and equity are critical for FLR adoption and long-term impact.

Introduction and context

The Murat River Watershed Rehabilitation Project was designed to address severe environmental degradation and socioeconomic challenges in eastern Türkiye, specifically in the Provinces of Elazığ, Bingöl and Muş. This region, characterized by mountainous terrain and fragile ecosystems, faces high erosion risks, declining water resources and rural poverty, all exacerbated by climate change and unsustainable land-use practices.

The Murat River supports thousands of households reliant on agriculture and livestock. However, soil erosion, deforestation and inefficient water use threatened both livelihoods and biodiversity. Migration from rural to urban areas was accelerating due to declining productivity and income.

To reverse these trends, the project adopted an integrated river watershed management approach, combining ecological restoration with socioeconomic development. Supported by a loan agreement between IFAD and Türkiye and implemented under the coordination of



A clear river winds through a forested Mediterranean landscape in Türkiye, bordered by dense trees and rocky terrain.
© FAO/Carolina Gallo Granizo

the General Directorate of Forestry, the project targeted 36 microcatchments covering 446 000 ha and 292 villages.

Key interventions included afforestation (4 239 ha, 16.4 million saplings), erosion control (21 845 ha), oak and pasture rehabilitation and the introduction of climate-smart agriculture. Social components focused on income diversification through fruit orchards, greenhouses and livestock infrastructure, alongside renewable energy solutions such as solar water heating and energy-efficient stoves.

The project benefited 131 052 individuals, soil erosion decreased by 23.7 percent and 13 million tCO₂ will be sequestered over 20 years. Gender equality was prioritized, earning the project an IFAD Gender Equality Award for empowering women through training and economic opportunities.^{543–546}

This case study demonstrates how integrated watershed management can simultaneously restore ecosystems, enhance resilience to climate change and improve rural livelihoods, offering a scalable model for similar contexts globally.

Best practices and innovation to scale up and replicate restoration efforts

Addressing degradation drivers: Innovative renewable energy solutions, such as solar water heating systems, energy-efficient stoves, and a 187.5 kilowatt solar power plant reduced wood consumption by 50 percent, protecting 282 000 ha of forest. These measures also lowered household energy costs and improved living standards.

Community engagement and income-generating activities: The project trained 2 446 farmers and actively promoted women's participation through vocational courses and income-generating activities. Inclusive approaches that enhance rural incomes and well-being, such as fruit orchards, greenhouses and livestock infrastructure, ensured that restoration efforts translated into tangible economic gains for local communities.

Adaptive management and accountability: Monitoring systems for carbon cycles, soil erosion, vegetation cover and socioeconomic indicators provided data-driven insights, enabling adaptive management and accountability.

Prioritizing intersectoral coordination among forestry, agriculture, water management and energy institutions to ensure integrated planning and implementation: Establishing legal provisions for community participation and benefit-sharing is essential to fostering ownership and sustainability, as demonstrated by the project's success in engaging 292 villages and over 131 000 individuals.

Aiming for blended financing models, combining government resources with international development funds, as seen in the IFAD partnership: The project's achievement of 13 million tCO₂ sequestered highlights the potential of integrating carbon accounting into policy frameworks, enabling access to climate finance and carbon markets.

Providing incentives for renewable energy adoption and climate-smart agriculture reduced pressure on forests and enhanced productivity, aligning with national greenhouse gas reduction targets.

OGM Murat Basin Project, Honey Production.
© OGM (Afforestation Department-Archive)

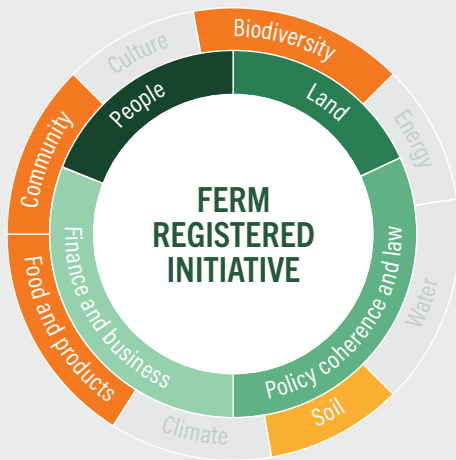


EUROPE

CASE STUDY 12

BALANCING NATURE AND PRODUCTION THROUGH MULTIFUNCTIONAL RESTORATION IN DENMARK, FRANCE AND SPAIN

How to build acceptance for restoration initiatives among multiple stakeholders



- Restoration succeeds when it aligns with local needs. In France, engaging 87 forest owners and in Spain benefiting over 100 000 people showed that combining economic and environmental benefits increases acceptance.
- Multifunctional restoration benefits biodiversity, climate resilience and productive land use. In Denmark, local stakeholders helped guide restoration across 34 582 ha, including over 900 ha of coastal wetlands and peatlands, cutting more than 3 000 tonnes of CO₂ each year.

CASE STUDY LOCATION



Denmark: All regions
France: Landes de Gascogne forest, Aquitaine region
Spain: El Bierzo, León Province, Castilla y León region

IMPLEMENTATION PERIOD



Denmark: 2021–present
France: 2021–2026
Spain: 2021–2025

AREA UNDER RESTORATION



Denmark: 34 582 ha
France: 416 ha
Spain: 138 ha

TOTAL TARGET AREA TO RESTORE



Denmark: 64 900 ha
France: 80 ha
Spain: 5 000 ha

RESTORATION APPROACH



Denmark: Designated forest set aside from forestry with plans to introduce grazing, restore natural hydrology and vegetation structure, and plant native woody plant species. Policy and legal adjustments to promote biodiversity.
France: Diversification of pure stands of productive maritime pine by establishing broadleaved hedgerows around them.
Spain: Restore brown bear habitats, mitigate wildfire risks, support rural economies.
All: Multistakeholder planning and implementation.

TOTAL NUMBER OF BENEFICIARIES



Denmark: Entire population (forests are accessible to the public)
France: 87 forest owners
Spain: More than 100 000 people

BUDGET



Denmark: USD 24 million
France: USD 1 145 093
Spain: USD 433 747

SOURCES OF FUNDING



Denmark: Government of Denmark
France and Spain: European SUPERB research project Horizon 20*20

ECOSYSTEM TYPE*



Denmark and Spain: Forests
Grasslands, shrublands and savannahs
France: Forests

NOTE: *The types of ecosystems referenced are based on the classification provided by the United Nations Decade on Ecosystem Restoration 2021–2030.

Key takeaways and highlights

- Focusing on stakeholder consultations: Timely, structured and continuous engagement across stakeholder groups allows for identifying and designing project components that can strengthen legitimacy and acceptance among communities, landowners and businesses, even in large-scale restoration initiatives.
- Balancing environmental and financial benefits supports long-term commitment: Integrating socioeconomic benefits into restoration strategies results in context-specific solutions that align restoration objectives with local values and stakeholder priorities, enhancing sustained engagement.
- Importance of using rigorous scientific protocols: Measuring the effects of restoration actions using robust scientific approaches is important to demonstrate impacts, guide adaptive management and convince landowners, stakeholders and funders of the project's value for biodiversity, resilience, people and society.

Introduction and context

Across Europe, land-use intensification, pollution and climate change continue to place significant pressure on ecosystems, negatively impacting 81 percent of protected habitats, 39 percent of protected bird species and 63 percent of other protected species. Although protected areas make up 26 percent of the land in the region, they alone have not been sufficient to reverse degradation.

More active and improved management of forests and other landscapes is needed to restore ecological functionality, improve human health, well-being and quality of life, and increase the availability of green spaces and forests, which support ecosystem services, soil quality and biodiversity.⁵⁴⁷

In this context, forest and landscape restoration (FLR) increasingly takes place within multifunctional landscapes where ecological, social and economic objectives must be reconciled. A key challenge is that restoration initiatives often require changes in land use or management practices, which can generate resistance if local benefits are unclear. As a result, the long-term success of restoration depends not only on ecological effectiveness,

but also on societal acceptance and the ability to balance nature conservation with financial and socioeconomic considerations.

This case study presents three European examples demonstrating how aligning biodiversity goals with locally relevant economic and social benefits through multistakeholder planning contributes to sustainable and locally accepted restoration. In Denmark, restoration goals on state-owned land aim to promote biodiversity through rewilding and the development of self-regulating ecosystems while also creating opportunities for outdoor and nature-based activities. This is being achieved by designating 64 900 ha of forest set aside from forestry, with detailed restoration planning currently underway.⁵⁴⁸ In France, the balance between intensive wood production and biodiversity conservation was improved by introducing 50 km of broadleaved hedgerows along pure conifer plantations.⁵⁴⁹ In Spain, 138 ha were placed under restoration using a multifunctional approach that combined biodiversity goals, such as creating wildlife corridors to restore the habitat of the Cantabrian brown bear *Ursus arctos*, with socioeconomic revitalization based on establishing productive chestnut (*Castanea sativa*) plantations to support rural economic development, and implementing silviculture treatments to reduce forest fuel loads and wildfire risk.⁵⁵⁰

Best practices and innovation to scale up and replicate restoration efforts

A trophic rewilding approach is used in Denmark to allow for natural dynamics with species of local historical significance. This approach promotes ecological processes and dynamics instead of deciding on species composition, leading to a shift in how goals are set and success is measured. Forestry activities like harvesting native wood species have ceased and are replaced with efforts to restore structural heterogeneity, tree microhabitats and dead wood.

Traditional agricultural bocage landscapes inspired the restoration interventions in France. These landscapes were historically shaped by a dense network of mixed hedgerows comprising species such as *Pinus pinea*, *Arbutus unedo*, *Betula pendula*, *Sorbus domestica*, *Sorbus torminalis* and *Sambucus nigra* that bordered fields and

pastures. These hedgerow systems supported local livelihoods by providing a wide range of ecosystem functions and services. Applying this concept to the forestry sector, the forest bocage represents an innovative nature-based solution that improves the balance between intensive wood production and biodiversity conservation, maximizing both socioeconomic and environmental benefits. Introducing broadleaved hedgerows along pure conifer plantations enables continuous forest management for timber production while creating new, complementary habitats that support biodiversity. These habitats can help regulate pine pests and may also enhance resilience to abiotic risks such as storms and fires.⁵⁵¹

Participatory process and multistakeholder consultations: In each country, the restoration approach focused on multistakeholder consultations at all stages of the initiatives to ensure an accepted and sustainable balance between conservation and production goals. In Spain, for example, activities systematically integrated perspectives from diverse key stakeholders – including forest owners, farmers and public authorities – through structured co-creation and participatory processes. These processes confirmed that promoting chestnut cultivation is a key opportunity for rural communities and a way to increase local acceptance of restoration efforts. However, they also identified significant tensions, such as “stakeholder fatigue” among landowners and farmers due to the long time required to get tangible results, highlighting the need for better communication regarding benefits, and suitable compensation mechanisms for different types of stakeholders. Public support is clearly influenced by sociodemographic factors and perceptions of forest benefits, and respondents who perceived forests primarily as a source of material resources were statistically less likely to support restoration.⁵⁵² This supports the strategic inclusion of profitable components in restoration initiatives, for example combining chestnut plantations with wildlife restoration or introducing broadleaved hedgerows along pure conifer plantations, ensuring that restoration initiatives also reflect economic values to achieve long-term legitimacy and commitment. The participatory process ensured that restoration

initiatives were tailored to local socioeconomic and ecological values, thereby supporting sustained commitment and adaptive management for long-term resilience. Local stakeholders also played a key role in France, specifically in selecting the most suitable tree species for restoration through the forest bocage concept, identifying potential constraints and risks for its deployment, designing a land planning strategy and contributing to outreach efforts. In Denmark, interventions also benefited from inputs from the scientific community and stakeholders through advisory reports, in addition to local consultations and public hearings on the plans.

Clear and well-defined policy implications. The Danish Government has invested in rewilding and restoring forest ecosystems on both public and private land. In 2021, changes to national legislation were made to enable the establishment of national nature parks. In other

Plantation of a new broadleaved hedgerow by AFB in the Landes de Gascogne region, south-west France.
© AFB



areas, biodiversity is supported within the existing legal framework by designating set-aside forests, where natural processes and biodiversity are the primary goals.⁵⁵³ Other important considerations include providing opportunities for outdoor and nature-based experiences. In total, nearly 33 percent of government owned land now consists of forests set aside from forestry, representing more than 70 000 ha.⁵⁵⁴

The effort aims to develop biodiverse ecosystems while also providing spaces for people to experience and explore nature through outdoor recreational activities. The change in the law has allowed the cessation of commercial forestry activities on government owned land and the detailed planning of restoration efforts. Other changes in the legal framework include laws on nature conservation, animal welfare, car traffic regulations and forestry. A specific chapter of the nature conservation law governs how larger areas can be prioritized and set aside to create national nature parks.

A detailed restoration plan guides the management of each state-owned area. The plans are made available online to ensure public

access and accountability⁵⁴⁸ and aim to restore natural disturbances, dispersal processes and trophic interactions. Planned activities include introducing large herbivores to maintain mosaic grazing landscapes and restoring natural hydrology by covering and closing ditches, removing drainpipes, and restoring both permanent and temporary water bodies and streams. Furthermore, the vegetation structure is being restored in some forest stands. This is especially true for conifer stands composed of species that are not native to the region. These non-native species tend to leave little room for structural heterogeneity and other species. In other places, little or no effort is made to actively modify vegetation structures. Increasing dead wood and trees with a variety of habitats is also part of the restoration activities. In some cases, the introduction of woody species, such as shrubs and trees that produce fruits and flowers for pollinators, will include *Prunus spinosa*, *Crataegus monogyna*, *Viburnum opulus*, *Frangula alnus*, *Euonymus europaeus*, *Corylus avellana*, *Ilex aquifolium*, *Rosa* spp., *Juniperus communis*, *Taxus baccata*, *Quercus* spp., *Tilia* spp., *Salix* spp., *Ulmus* spp., *Carpinus betulus*, *Acer campestre*, *Acer platanoides*, *Prunus avium* and *Populus tremula*.

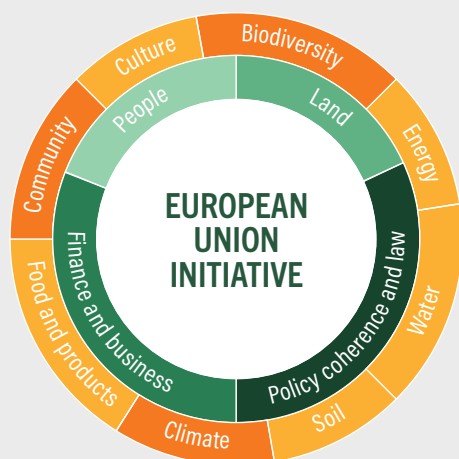
Chestnut plantation in León, Spain. Enrichment plantations help restore landscapes and create habitat for wildlife.
© Cesefor



CASE STUDY 13

THE EUROPEAN UNION'S NATURE RESTORATION REGULATION: FROM AMBITION TO BINDING ACTION

A landmark regional framework with legally binding forest and landscape restoration targets



- Legally binding targets accelerate restoration. The European Union committed to restoring 20 percent of land by 2030 and planting 3 billion additional trees, addressing widespread ecosystem degradation.
- National planning frameworks enable implementation at scale. National Restoration Plans in European Union Member States are expected to combine targets, monitoring and stakeholder engagement to deliver measurable results.



CASE STUDY LOCATION

European Union



IMPLEMENTATION PERIOD

Entered into force in 2024



AREA UNDER RESTORATION

To be determined in National Restoration Plans



TOTAL TARGET AREA TO RESTORE

20 percent of European Union land by 2030

RESTORATION APPROACH



Country specific approaches to restore degraded terrestrial, freshwater, marine and urban ecosystems, including agricultural and forest ecosystems; halt and reverse the decline of pollinators

TOTAL NUMBER OF BENEFICIARIES



European Union population (approximately 450 million people), with more direct benefits for rural and coastal communities, farmers, foresters and urban residents



BUDGET

No targeted or dedicated budget allocated as of June 2026



SOURCES OF FUNDING

Member States may promote private or public support schemes to stakeholders implementing restoration

ECOSYSTEM TYPE*



Farmlands
Forests
Freshwaters
Grasslands, shrublands and savannahs
Mountains
Oceans and coasts
Peatlands
Urban areas

NOTE: *The types of ecosystems referenced are based on the classification provided by the United Nations Decade on Ecosystem Restoration 2021–2030.

Key takeaways and highlights

- ▶ The Nature Restoration Regulation addresses the severe degradation of forests across Europe: Eighty-four percent of forest habitats are in unfavourable condition, and previous European Union restoration efforts have not been successful. This highlights the need for legally binding, long-term measures across contexts and landscapes at the European Union level.
- ▶ Establishing clear, measured and time-bound responsibilities to restore ecosystems: The Nature Restoration Regulation commits Member States to restoring 20 percent of ecosystems by 2030, including planting 3 billion additional trees, and to restoring all ecosystems in need across terrestrial and marine environments within the European Union by 2050.
- ▶ Relying on National Restoration Plans for implementation: The plans combine common templates, stakeholder engagement, and monitoring and reporting based on established indicators, while allowing for national discretion, and for context-specific measures to be applied within a binding legal framework.⁵⁵⁵

Introduction and context

Forests cover about 40 percent of the European Union's land area. They play a vital role in supporting biodiversity, regulating the climate and providing ecosystem services.⁵⁵⁶ Despite their importance, the ecological condition of European forests has deteriorated markedly over recent decades. Eighty-four percent of European forest habitats have an unfavourable conservation status, with 58 percent classified as poor, 26 percent as bad and only 16 percent in good condition.⁵⁵⁷ The main pressures affecting European Union forests, as reported by Member States, include inadequate habitat management, particularly the removal of old and dead trees, clear-cutting and the loss of old-growth forest structures.⁵⁵⁶ Conversion and land-use change (e.g. for urban and industrial development) contribute to degradation, alongside natural processes, pests, pathogens and invasive species.

These combined pressures have accelerated the decline of forest ecosystems, reducing their resilience and ability to provide ecosystem services – especially carbon sequestration, water regulation and soil conservation – as well as

other services that indirectly support agriculture, biodiversity and human well-being. Growing evidence of persistent European ecosystems degradation, alongside global commitments under the Kunming–Montreal Global Biodiversity Framework (KMGBF), has prompted renewed European Union action through the European Green Deal and the European Union Biodiversity Strategy for 2030.^{558, 559} Earlier targets to restore at least 15 percent of degraded ecosystems by 2020, set under the European Union Biodiversity Strategy to 2020, were not achieved, in part due to their non-binding nature.^{560, 561}

These shortcomings reinforced the case for a legally enforceable restoration instrument.⁵⁶⁰ Following an impact assessment and stakeholder consultations, the European Union Regulation 2024/1991 on Nature Restoration entered into force on 18 August 2024.

Best practices and innovation to scale up and replicate restoration efforts

National Restoration Plans (NRPs) and indicator-based obligations: European Union Member States have been preparing their NRPs, which were due for submission by 1 September 2026. At the time of writing, on-the-ground restoration actions under the Nature Restoration Regulation remained limited, pending the adoption and implementation of these plans.⁵⁶² Under the regulation, Member States are required to establish and implement appropriate restoration measures to restore degraded forest ecosystems, going beyond the pre-existing obligations. In addition to restoration obligations for terrestrial, coastal, freshwater and urban ecosystems, the regulation also includes indicator-based obligations, with short- and long-term measures extending to 2050. NRPs are subject to European Union-level reporting obligations and forest restoration is tracked using the Common Forest Bird Index, an indicator that tracks population trends of widespread forest bird species to assess the ecological condition and biodiversity health of forest ecosystems over time, and at least six of seven common forest ecosystem indicators (standing deadwood, lying deadwood, uneven-aged forest structure, forest connectivity, soil organic carbon stock, dominance of native tree species and tree species diversity). By 2030, Member States must set a satisfactory level for

each indicator and progressively implement the restoration measures identified in their NRPs until these satisfactory levels are reached.⁵⁶³

National Restoration Plans as coordination mechanisms that allow for contextual flexibility: A central implication for scaling up is the use of the NRP process as a coordination mechanism to align institutional mandates, sectoral policies and funding instruments.⁵⁶² To enable replication across diverse ecological and socioeconomic contexts, legal clarity and administrative consistency will need to be strengthened within the discretion left by the Nature Restoration Regulation. Although NRPs must follow a uniform format per the Commission Implementing Regulation (European Union) 2025/912, 2025, Member States retain flexibility to determine restoration measures tailored to local conditions and priorities.

Guiding the operationalization of restoration targets and indicators in national plans: For

forest ecosystem restoration, defining satisfactory levels for each indicator that align with climate, biodiversity and nature protection objectives may prove challenging for member states.⁵⁶⁴ This reflects both diverse ecological conditions and the need to reconcile multiple and sometimes competing interests within forest governance systems.^{565, 566} This underscores the need for guidance on operationalizing restoration targets and indicators within NRPs, standardized methodologies and clear procedures for integrating restoration obligations into permitting and land management decisions. In parallel, investments in interagency coordination and institutional capacity building will be essential to support consistent application.

By using the binding Nature Restoration Regulation framework to harmonize rules, procedures and monitoring, national legal systems can support the large-scale replication of forest and landscape restoration while reducing the risk of divergent implementation.

Across Europe, landscapes like Monti Ceriti highlight the essential role of trees in supporting biodiversity and ecosystem health.
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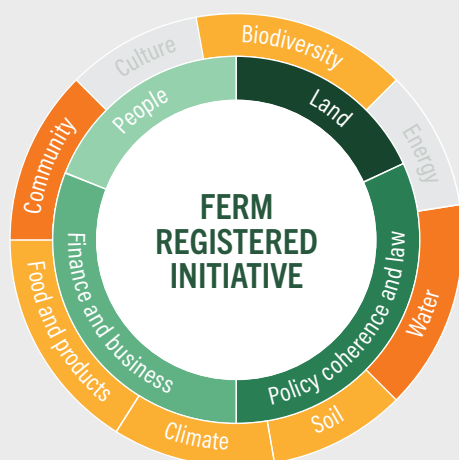


NORTH AND CENTRAL AMERICA

CASE STUDY 14

KEEPING THE GREEN IN THE ONTARIO GREENBELT: FORESTS CANADA'S PROGRAMME TO PLANT TREES

Large-scale restoration on private lands for resilient ecosystems and communities



- Restoration on private land was achieved at scale. More than 1 100 landowners were engaged, and 7 million trees planted, restoring 3 847 ha and strengthening landscape resilience.
- A restoration economy enabled long-term impact. Partnerships across nurseries, seed collectors and landowners created a stable supply chain, supporting continuous restoration across an 800 000 ha landscape.



CASE STUDY LOCATION

Ontario's Greenbelt in Ontario, Canada



IMPLEMENTATION PERIOD

2008–2025



AREA UNDER RESTORATION

3 847 ha



TOTAL TARGET AREA TO RESTORE

3 847 ha



RESTORATION APPROACH

Afforestation, riparian, windbreak and shelterbelt plantings and restoration of forests impacted by extreme climate events



TOTAL NUMBER OF BENEFICIARIES

13 conservation authorities
10 nurseries
Approximately 1 100 private landowners
13 municipalities
68 townships
19 private consultants
3 stewardship groups



BUDGET

USD 7.3–10.9 million



SOURCES OF FUNDING

Government of Canada, Province of Ontario, municipal funding, corporate funders, foundations and individual donors



ECOSYSTEM TYPE*

Forests
Farmlands

NOTE: *The types of ecosystems referenced are based on the classification provided by the United Nations Decade on Ecosystem Restoration 2021–2030.

Key takeaways and highlights

- ▶ **Private lands:** Large-scale forest restoration on predominantly private land is achievable by investing in long-term technical support, subsidized restoration services, landowner communication, nursery partnerships and capacity development, and monitoring and adaptive management throughout the restoration supply chain to ensure long-term success.
- ▶ **Partnerships:** A multilevel restoration network of seed collectors, nurseries, private consultants, conservation authorities and landowners was built, enabling consistent annual planting volumes and forming a durable “restoration economy” that strengthens capacity across the region.
- ▶ **Scope and scale:** A long-term, landscape-level programme restoring forest cover across 800 000 ha of the Ontario Greenbelt, addressing the loss of more than 5 000 ha of woodland since 2000 and contributing to the 30 percent forest-cover climate resilience target.

Introduction and context

The Ontario Greenbelt is an 800 000 ha mosaic of forests, farmlands, wetlands, grasslands, rivers and urban areas situated within the most densely populated region of Canada. Established through provincial legislation in 2005, the Ontario Greenbelt was formed to curb urban sprawl and protect ecologically sensitive landscapes, including the Niagara Escarpment, Oak Ridges Moraine, Urban River Valleys, Protected Countryside and Specialty Crop Areas. These landscapes support diverse rural economies, high-quality agricultural soils and vital ecological functions that benefit over 9 million residents nearby.⁵⁶⁷

Despite its protected status, the Ontario Greenbelt faces ongoing development pressures. More than 5 000 ha of woodland have been lost since 2000, reducing habitat connectivity and undermining the climate resilience of the region.⁵⁶⁸ Reversing this trend is essential to meeting the Government of Canada's target of 30 percent healthy forest cover, a goal associated with increasing biodiversity, improving water quality, and reducing climate-related risks such as flooding and extreme heat.⁵⁶⁹

Most of the land on the Ontario Greenbelt is privately owned, so most restoration opportunities are on land not controlled by government or private agencies. This means that private landowners, such as farmers, rural residential owners and conservation authorities, are central to any restoration effort because their day-to-day decisions shape the health of the landscape. Social, cultural and economic connections to the land shape how restoration occurs; therefore, the long-term restoration and stewardship of forests in the region depend on the sustained engagement of local private landowners.

Over the past two decades, Forests Canada has worked with this diverse network of actors to rebuild the region's forest cover by planting over 7 million trees, including *Pinus strobus*, *Pinus resinosa*, *Picea glauca* and *Thuja occidentalis*. Through collaborations with over 1 000 landowners, ten nurseries, 13 conservation authorities, 13 private consultants, several foundations and stewardship groups and a current network of approximately 14 seed collectors, the programme has established partnerships, technical infrastructure, practical guidance, monitoring protocols and the adaptive management required for successful restoration at the landscape scale.⁵⁷⁰ By reducing barriers to participation and co-designing projects with landowners, Forests Canada has helped to restore ecological integrity, support rural economies and strengthen climate resilience across the Ontario Greenbelt.⁵⁷¹

Best practices and innovation to scale up and replicate restoration efforts

Private lands: A core innovation of this case study is its ability to restore forest cover on predominantly private lands. Forests Canada addresses the social, cultural and economic realities of landowners and removes traditional barriers to participation by providing site assessments, planting prescriptions, technical guidance, subsidized tree planting and multiyear monitoring (in the second and fifth years).

Monitoring offers a chance to guide landowners as they develop into effective restoration leaders, and to determine survival and establishment of planted trees. This model enables private

landowners to actively participate and lead restoration efforts in ways that are shaped by their social, cultural and economic realities, while being ecologically informed and genetically supported through the collection and use of appropriate, locally adapted tree seed.

Restoration economy: Forests Canada's programme relies on a coordinated network of nurseries, seed collectors, planting delivery agents and funders. By guaranteeing demand through long-term agreements and predictable annual planting volumes, the programme strengthens nursery capacity and provides stable employment in restoration delivery.

This localized "restoration economy" increases the availability of seeds and seedlings, maintains regional genetic diversity, and ensures scalability even when work occurs across many small, privately owned parcels. Partnerships with municipalities and conservation authorities help align projects with watershed and biodiversity goals, creating a landscape-level approach from site-specific actions.

Together, these practices of sustained partnerships across the breadth of the restoration supply chain can help form a replicable model where ecological restoration is paired with rural economic development. This model can be used to enable forest and landscape restoration (FLR) to be expanded across diverse jurisdictions and ownership structures.

Long-term nursery and seed supply: Forests Canada works closely with contracted seed collectors, who gather approximately 12 million viable seeds each year. Close partnerships with nurseries allow for securing and growing of appropriate stock two to three years prior to planting projects. This supports the restoration economies and ensures adequate availability of regionally adapted planting stock.

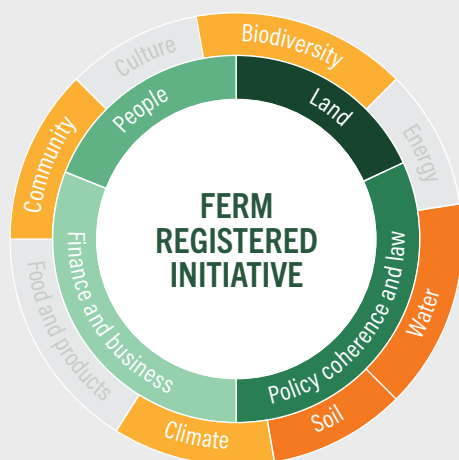
Toronto and Region
Conservation Authority
staff at a planting site
supported by the
Greenbelt Foundation in
Caledon, Ontario.
© Forests Canada



CASE STUDY 15

PHYTOREMEDIATION OF DEGRADED SOILS USING POPLARS AND OTHER FAST-GROWING TREES IN THE UNITED STATES OF AMERICA

Innovative phytotechnologies for restoring polluted landscapes through science-based solutions



- Nature-based technologies restored polluted landscapes. More than 20 000 trees were planted across 16 sites, reducing pollution and improving water quality.
- Science-driven approaches improved restoration effectiveness. Innovations such as pollutant prioritization and phytoecurrent selection enabled targeted remediation and scalable restoration solutions.

**CASE STUDY LOCATION**

Great Lakes Basin, United States of America

**IMPLEMENTATION PERIOD**

2016–2031

**AREA UNDER RESTORATION**

453 ha

**TOTAL TARGET AREA TO RESTORE**

453 ha

**RESTORATION APPROACH**

Phytoremediation, phytotechnologies, forest and landscape restoration, ecological restoration, land rehabilitation and afforestation

**TOTAL NUMBER OF BENEFICIARIES**

13 landfill managers
24 scholars from eight countries
139 500 community members potentially benefiting from the phytoremediation buffers

**BUDGET**

USD 1 995 212

**SOURCES OF FUNDING**

Great Lakes Restoration Initiative

**ECOSYSTEM TYPE***

Farmlands
Forests
Urban areas
Freshwaters

NOTE: *The types of ecosystems referenced are based on the classification provided by the United Nations Decade on Ecosystem Restoration 2021–2030.

Key takeaways and highlights

- Pollutant prioritization approach: This approach supports the systematic identification of priority pollutants to be targeted by remediation systems and can be adapted to reflect community concerns and local priorities.
- Phytorecurrent selection: This approach allows practitioners to select the most suitable plant species to meet the ecological objectives of a project, for example providing effective remediation of degraded lands and waters.
- Innovations in tree establishment: The novel DeValix willow mat restoration technique is a nature-based bioengineering method that uses living willow material to stabilize riverbanks, prevent erosion, and restore riparian ecosystems. Phytoremediation vegetation systems established using this technique can contribute to carbon sequestration and improve water management and freshwater availability and contributes to soil stabilization and health.

Introduction and context

In Northern America, the Great Lakes are a significant source of freshwater for the United States of America and Canada, and provide substantial other provisioning, regulating, supporting and cultural ecosystem services to the region. In recent decades, these ecosystem services have been increasingly impacted by point and non-point source pollution from human activities (e.g. conventional agriculture, mining operations, manufacturing, industry and land-use change).

Phytotechnologies are a suite of strategies that hold promise for the sustainable restoration of degraded lands and waters. The most common phytotechnology, phytoremediation, involves the strategic use of vegetation in the landscape to intercept and remediate contaminated soil, sludge, sediment or groundwater. Phytoremediation systems harness the natural physiological processes of plants, including photosynthesis and transpiration, to degrade, uptake, sequester, immobilize, stabilize or volatilize contaminants. To restore degraded lands in the Great Lakes Basin, an interdisciplinary team of scientists, practitioners and engineers has developed and implemented a network of 16 phytoremediation buffer systems at landfills and similarly contaminated sites within the Lake Michigan and

Lake Superior watersheds.⁵⁷² The buffers consist of hybrid poplars and willows, fast-growing trees whose productivity, rapid growth, extensive rooting and elevated water use make them ideally suited for phytoremediation applications. To date, over 20 000 trees have been planted within these systems, and they serve to reduce runoff, enhance stormwater management and mitigate pollution.⁵⁷³ Currently, ongoing monitoring efforts are assessing the long-term efficacy of these buffer systems, with studies focusing on genotype, water use, growth and productivity, and phytoremediation potential. Findings from these and similar studies will be essential for developing phytoremediation best management practices that can guide restoration practitioners' management actions and inform policy decisions.

Best practices and innovation to scale up and replicate restoration efforts

Selecting priority pollutants: The first step in designing a successful phytoremediation system is to select the priority pollutants to target with remediation and monitoring activities. The project developed a novel approach for comprehensive pollutant prioritization,⁵⁷⁴ which incorporates freely available toxicity data to enable standardized, quantitative prioritization and can be tailored to reflect local human health or ecosystem well-being priorities. The approach has been applied to identify priority pollutants in landfill leachate and contaminated groundwater at degraded sites.

Selecting genotypes: Once priority contaminants are identified, genotypes that maximize phytoremediation effectiveness are selected. The project developed an approach called phytorecurrent selection for choosing genotypes for the phytoremediation of degraded lands around the world.^{572, 575} Phytorecurrent selection maximizes remediation potential through repeated cycles of germplasm selection and performance monitoring across the tree life cycle, including after outplanting in landscape-scale forest and landscape restoration initiatives.

Designing and implementing multifunctional phytoremediation buffer systems: Once priority contaminants have been identified and superior genotypes selected, multifunctional phytoremediation buffer systems can be

designed and implemented. The project developed and tested innovative approaches for tree establishment in phytotechnology systems, including the novel DeValix willow mat restoration technique.⁵⁷⁶ The DeValix technique involves horizontal planting designed to be easily done by hand and thus serve as an alternative to traditional vertical planting methods.

Technology transfer through outreach and education initiatives: The project established the International Phytoremediation Training Academy, which applies a train-the-trainer approach to educate natural resource professionals on principles and implementation of phytoremediation projects.⁵⁷³ Programme participants participate in phytoremediation site field tours, engage in hands-on data-collection methods and develop phytoremediation action plans for implementing phytoremediation projects in their own communities.

A total of 24 scholars from eight countries (Bangladesh, Democratic Republic of the Congo, Ethiopia, Ghana, India, Malawi, Lebanon, United States of America) received training in 2023 and 2024.

The International Commission on Poplars and Other Fast-Growing Trees Sustaining People and the Environment, a statutory body hosted by the Food and Agriculture Organization of the United Nations (FAO) that serves as a platform for knowledge sharing and capacity development,¹⁶¹ is an existing network that is particularly well positioned to enhance phytoremediation knowledge exchange. Its Working Party on Environmental and Ecosystem Services facilitates technical exchange on the environmental and ecosystem services provided by fast growing trees, including phytoremediation for soil and water restoration.¹⁶¹



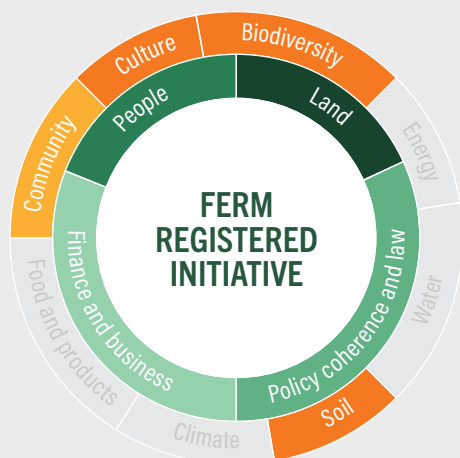
Aerial view of three phytoremediation buffer systems (two in foreground, one in back right of photo) in Bellevue, WI.
© USDA/Ryan Vinhal

OCEANIA

CASE STUDY 16

RESTORING BANKSIA WOODLANDS: WORLD-CLASS POST-MINING REHABILITATION IN WESTERN AUSTRALIA

A 30-year science–industry partnership delivering measurable biodiversity gains



- Ecological restoration in post-mining Banksia woodlands has boosted biodiversity, with innovative methods increasing seedling survival 5 to 8 times and speeding ecosystem recovery.
- Long-term partnerships accelerated restoration success. Collaboration between science, industry and Indigenous knowledge systems delivered sustained restoration over 30 years.



CASE STUDY LOCATION

Swan Coastal Plain, Perth Metropolitan Region, Western Australia, Australia



IMPLEMENTATION PERIOD

1995–2025



AREA UNDER RESTORATION

225 ha



TOTAL TARGET AREA TO RESTORE

571 ha

RESTORATION APPROACH



Integrated restoration science, adaptive management (drought tolerance), precision topsoil handling (landplaning) and moving, seed dormancy alleviation (smoke, coating, raking), soil ripping and impedance reduction, weed exclusion engineering, reference site benchmarking, participatory approaches with communities (including Indigenous Peoples) and research for adaptive management

TOTAL NUMBER OF BENEFICIARIES



- > 1 100 people (Indigenous Peoples, students, other residents and volunteers)
- > 20 government departments
- > 50 industry organizations
- > 70 scientists

BUDGET



USD 15 682 725 (including costs for clearing, pick-up top-soils, moving of the top-soils up to 10 km or more, seed propagation, tubstock production, weed management and site management, research elements and engagement of Indigenous Peoples)

SOURCES OF FUNDING



Heidelberg Materials Australia, Kings Park Science – Botanic Gardens and Parks Authority (BGPA), Commonwealth Government, via Australian Research Council (ARC) and Co-operative Research Council (CRC)



ECOSYSTEM TYPE*

Forests

NOTE: *The types of ecosystems referenced are based on the classification provided by the United Nations Decade on Ecosystem Restoration 2021–2030.

Key takeaways and highlights

- Science-driven restoration breakthroughs demonstrate 5- to 8-fold increases in seedling abundance through first-year topsoil optimization, 3- to 10-fold improvements in germination using smoke technology and seed coatings, and significant biodiversity recovery, with restored plots reaching almost 100 plants for every 5 m².
- Collaborative innovation delivering real-world impact: Knowledge exchange and the cross-fertilization of Western science, Indigenous knowledge systems and industry expertise have the potential to accelerate innovation and support transformative on-the-ground restoration solutions.
- Engagement of Indigenous Peoples: Activities and strategies are in place to create meaningful, long-term relationships with Aboriginal communities grounded in respect, collaboration and a genuine desire to support self-determination while strengthening the cultural, social and environmental outcomes of restoration.

Introduction and context

Perth, in southwest Western Australia, is located in the Swan Coastal Plain, a globally recognized biodiversity hotspot that was once dominated by banksia woodland. Today, due to significant urban sprawl, and agricultural and mining activity, less than 10 percent of these woodlands remain.⁵⁷⁷ Heidelberg Materials Australia (HMA) is a mining company that extracts sand from the deep, nutrient-poor silica sand layers that support the biodiverse ecosystems of banksia woodlands. Sand extraction involves clearing banksia woodland vegetation, stripping topsoil and removing the underlying white and yellow quartz sand horizons down to a depth of 18–40 m in the sand profile. Recognizing the ecological vulnerability of the sand extraction site, HMA formed a long-term, science-led partnership with Kings Park Science (BGPA) in 1995, setting the company on its science-led restoration initiative with the academic sector.

This collaboration aimed to pioneer integrated restoration practices capable of returning mined areas to species compositions closely reflecting natural banksia woodland. Early efforts across the region often resulted in low species richness

and poor plant recruitment. In response, the partnership initiated large-scale research into seed biology, topsoil conservation, soil impedance, seed enhancement technologies and weed suppression engineering. Through precision topsoil handling (less than 10 cm stripping and less than 5 cm spreading), smoke-induced germination, seed coating treatments, deep soil ripping and strict weed exclusion, the programme delivered 5- to 8-fold improvements in seedling recruitment and restored species compositions approaching natural benchmarks (e.g. *Anigozanthos manglesii*, *Burchardia congesta*, *Corymbia calophylla*, *Jacksonia furcellata*, *Macrozamia riedlei*, *Scholtzia involucrate*, *Xanthorrhoea preissii* and various *Banksia* species). In some areas, by the second and third years, native species richness per 5 m² was almost double that recorded in undisturbed banksia woodland ecosystems.⁵⁷⁸

This model is now considered world-leading for restoring biodiverse ecosystems within resource extraction landscapes. The collaboration benefits regional communities, research partners, students and environmental practitioners, while driving positive and lasting biodiversity outcomes. Ongoing research and on-the-ground restoration support local employment and training opportunities, strengthen cultural and environmental stewardship, enhance landscape liveability and resilience, and contribute to healthier ecosystems that sustain community well-being over the long term.

Best practices and innovation to scale up and replicate restoration efforts

Topsoil handling: Precision topsoil techniques preserve viable seedbanks and minimize microbial loss while the direct return topsoil method provides additional soil viability advantages. Stripping and spreading only high-quality topsoil (free of weeds), applied fresh and dry, is crucial, and the soil profile should be reinstated in its natural sequence, with topsoil placed above the overburden.

Maximizing first-year recruitment of seed and seedling establishment is fundamental due to the rapid onset of soil impedance in reconstructed profiles. Deep soil ripping, structured to relieve cryptic compaction, enables deeper root establishment and increases survival rates.

Seed system innovations, including smoke-water, aerosol smoke, seed coating and raking, reduce dormancy barriers and significantly increase germination.

Wind-abating fencing: Given the high winds and soil erosion on the site, more than 50 percent of seeds are displaced. Traditional topsoil stabilizers, such as paper mulches, impede seed germination, and restoration deficits increase with the thickness of the stabilizers. To mitigate seed displacement caused by wind without disturbing seed germination, the initiative developed wind-abating fencing to replace germination-inhibiting stabilizers.

Weed removal: Weeds are kept at a distance from restoration areas through careful pre-disturbance weed removal (in which you eliminate invasive or noxious weeds before soil disturbance), deep burial and capping with a minimum of 1 m of weed-free soil, and continuous weed removal.⁵⁷⁸

Restoration machinery techniques like landplaning are now widely adopted across Western Australia, to create consistent microtopography and improve establishment zones.

Monitoring: BGPA scientists have conducted annual plant monitoring of banksia woodland restoration across reference and restoration sites for approximately 30 years, collecting data on seedling emergence and plant survival across a range of sites. This work enabled the development of annual performance criteria and the measurement of restoration performance in both the short term (e.g. seedling emergence) and long term (e.g. plant survival), supporting adaptive management and confirming a positive ecological trajectory over time.

This has resulted in the largest dataset to date on banksia woodland soil-plant development and established foundational principles for restoring this ancient, nutrient-depleted ecosystem.⁵⁷⁹

Engagement of Indigenous Peoples: The restoration research collaboration is designed to build long-term partnerships with Aboriginal communities based on respect, collaboration and support for self-determination, while strengthening cultural, social and environmental outcomes. Initiatives are developed and implemented in partnership with them as traditional owners and knowledge holders. This includes co-designing programmes and activities with the Indigenous communities, establishing land-use and cultural heritage agreements that recognize Traditional Owner rights and cultural connections to country, including protocols for how HMA can operate on and care for the land, and science and knowledge-sharing collaborations that integrate Indigenous Peoples' knowledge systems and Western science to support improved land stewardship and culturally informed environmental management.

After five years, signs of recovery emerge in restored banksia woodlands, Western Australia. © Lisa-Jane Hults

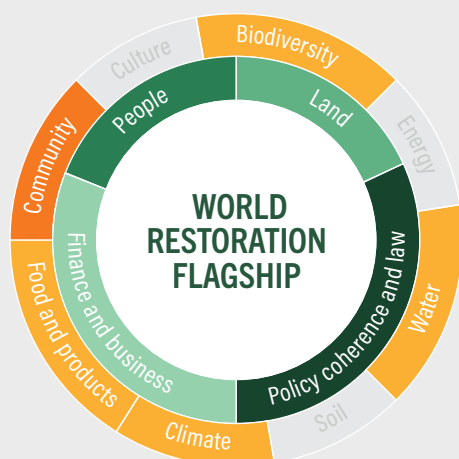


SOUTH AMERICA

CASE STUDY 17

EFFECTIVE GOVERNANCE IS KEY TO RESTORING FOREST LANDSCAPES AS PART OF THE TRINATIONAL ATLANTIC FOREST PACT IN ARGENTINA, BRAZIL AND PARAGUAY

Governance to develop capacity, knowledge, public policies, gender perspective and restored hectares



- Strong governance enabled restoration at scale. Coordinated action across Argentina, Brazil, and Paraguay supported the restoration of over 1.8 million ha, linking policy, finance and local action.
- Shared data and tools improved decision-making. Geospatial platforms and monitoring systems strengthened transparency, guided investments and supported large-scale implementation.



CASE STUDY LOCATION

Argentina, Brazil and Paraguay



IMPLEMENTATION PERIOD

2021–2030



AREA UNDER RESTORATION

Argentina: 141 866 ha
Brazil: 1 670 000 ha
Paraguay: 1 444 ha



TOTAL TARGET AREA TO RESTORE

1 000 000 ha



RESTORATION APPROACH

Planting native seeds and seedlings, guiding natural regeneration, agroforestry, production of shade-grown yerba mate, inclusion of Indigenous Peoples, some traditional and local communities, and supporting local governance structures



TOTAL NUMBER OF BENEFICIARIES*

Argentina: 1 270 000
Brazil: 125 000 000
Paraguay: 5 900 000



BUDGET**

USD 2 349 279



SOURCES OF FUNDING

Global Environment Facility (GEF), Fina Clima, Nascentes Programme, Fundo Estadual de Recursos Hídricos, Payment for Ecosystem Services Extrema, Minas Gerais, Instituto Nacional de Desarrollo Rural y de la Tierra de Paraguay, World Wide Fund for Nature (WWF), The Nature Conservancy (TNC), Birdlife International, WeForest, SOS Mata Atlântica, Funbio, World Resources Institute (WRI) Brazil, Brazilian Society for Ecological Restoration (SOBRE), Yerba Madre, Veracel, Bracell, Apremavi, Regreen, Imaflora, Agroforestry System Reflorestar Programme in Espírito Santo, Instituto Clima e Sociedade (iCS), etc.



ECOSYSTEM TYPE***

Farmlands
Forests
Freshwaters
Urban areas

NOTES: The concept of beneficiaries used in the case study is inclusive, referring to people who live within the Atlantic Forest region and who benefit directly and/or indirectly from restoration processes and the maintenance of ecosystem services (e.g. water regulation, climate stability, biodiversity conservation, livelihoods and risk reduction). **This amount corresponds exclusively to the coordination, governance and operational costs of the Atlantic Forest Pact and the Trinational Atlantic Forest Network. The budget does not include the costs of restoration implementation on the ground, such as planting, assisted natural regeneration, fencing, technical assistance or long-term maintenance, which are financed separately by projects, governments, donors and pact members. ***The types of ecosystems referenced are based on the classification provided by the United Nations Decade on Ecosystem Restoration 2021–2030.

Key takeaways and highlights

- ▶ Bottom-up effective governance system: Multiple actors, sectors and regions integrate the knowledge and needs of rural and Indigenous Peoples, promote governance of multifunctional landscapes and link ecosystem restoration with productive activities, food security, rural development and improved livelihoods.
- ▶ Public policy advocacy: Direct dialogue with national, subnational and municipal governments in three countries (Argentina, Brazil and Paraguay) ensure that the Atlantic Forest stakeholder context is considered in decision-making processes.
- ▶ Knowledge and tools: Intelligence-based tools (Pact geospatial and Mapbiomas platforms) integrate spatial data from restoration interventions and support decision-making on investments, strategic actions, shared ownership and transparency of all restoration actions, preparation of reference documents, development of guidance tools and communication through courses, events and social media.

Introduction and context

The Trinational Atlantic Forest Restoration Pact is recognized as a World Restoration Flagship that has established a robust governance structure, including knowledge, public policies and reporting on areas under restoration. It is the result of the successful combination of two multistakeholder restoration movements: the Atlantic Forest Restoration Pact and the Trinational Alliance for the Atlantic Forest Restoration in the Upper Paraná. These multistakeholder platforms are organized as bottom-up governance systems that emphasize decision-making, stakeholder coordination, knowledge generation and addressing restoration gaps.

The Atlantic Forest, a global biodiversity hotspot, spans the Misiones Province of Argentina, the eastern regions of Brazil, and eastern Paraguay. Despite its ecological importance, the biome has been reduced to fragments over the past 500 years, creating an urgent need for large-scale restoration. The original and most extensive clearance was driven by agricultural expansion and mechanization, cattle ranching,

urbanization and infrastructure development, timber extraction, both legal and illegal, and the historical cycle of slash-and-burn agriculture. These combined pressures have left the trinational Atlantic Forest with less than 30 percent of its original cover, now found mostly as isolated patches surrounded by farmland and urban areas. This fragmented state threatens endemic species, compromises watershed services for major cities, and undermines the resilience of the communities. Addressing this legacy requires moving beyond isolated conservation projects towards a coordinated, biome-wide strategy capable of reversing degradation drivers at scale. Against this backdrop of historical loss and ongoing pressure, the Trinational Atlantic Forest Restoration Pact emerges as a pivotal initiative.

Best practices and innovation to scale up and replicate restoration efforts

Technical working groups with clear responsibilities: The governance structure is based on multiple and diverse working groups (e.g. public policy, carbon, finance, science and technology, communication), responsible for implementing the Atlantic Forest strategy across governance spaces. This includes engagement with governments, dialogue with companies, and participation in global and regional alliances, where advocacy efforts and technical inputs are collectively developed and shared by members of the Trinational Atlantic Forest Restoration Pact. These technical working groups are responsible for translating strategy into action on the ground.

A shared spatial governance approach: The Atlantic Forest Restoration Pact's Geo Platform is the geospatial data hub that hosts and harmonizes restoration information from the pact and its partners. Together with the Brazilian Restoration Observatory, it establishes a connection to reporting on Target 2 under the Kunming–Montreal Global Biodiversity Framework (KMGBF) through the Food and Agriculture Organization of the United Nations (FAO) Framework for Ecosystem Restoration Monitoring (FERM) platform, while also directly supporting Brazil's official national restoration targets. This has been made possible by a shared spatial governance approach developed in collaboration with other restoration alliances, which ensures common standards, data quality

criteria and a structured flow of restoration data from the local to the global level. At the trilateral level, the partnership with Mapbiomas, a multi-institutional initiative in Brazil that produces annual, high-resolution maps of land-cover and land-use change using satellite imagery and cloud computing, is important to understand the use and occupation of the biome.

Advances in ecological and geospatial monitoring of restoration over the past two decades have enabled organizations to begin monitoring areas undergoing restoration, with emphasis on two protocols developed by the Atlantic Forest Restoration Pact. These establish the principles, criteria and indicators that should be used to guide the monitoring of ecological restoration projects developed in the Atlantic Forest biome.⁵⁶⁶ There are promising tools for large-scale monitoring using geotechnology.⁵⁸⁰

Promote multisectoral and participatory efforts: In Argentina, the initiative has united previously fragmented Atlantic Forest restoration efforts, fostering coordination and collective impact. A participatory process is underway to develop a restoration plan for the Misiones Province region (the Argentinean part of the Atlantic Forest) using a multistakeholder and intersectoral approach, thereby ensuring the inclusion of all voices interested in the forest. Also, the Misiones Native Species Network was created to strengthen the production of native seedlings, aligning their availability, quality and diversity with the specific requirements of restoration initiatives.

Enable international, national, subnational and municipal connections and the sharing of lessons learned: In Brazil, the multilevel approach has contributed to the development and implementation of public policies. For example, the National Plan for the Recovery of Native Vegetation is coordinated by a dedicated commission, and an ecological restoration reporting system is linked to national and international platforms, enabling restoration efforts reported by local actors to be consolidated and communicated at national and international levels.

Coordination among biome restoration movements in Brazil is facilitated by the Brazilian Society for Ecological Restoration (SOBRE), whose regional chapters (or hubs) exchange experiences, generate knowledge and build capacity. In Paraguay, the National Forest Institute represents the country in Initiative 20x20 and has established a Department of Restoration, funded by the Paraguayan state, with a primary focus on riparian forest restoration. At the regional level, many members of the Trilateral Atlantic Forest Restoration Pact are also partners of Initiative 20x20, which provides a strategic platform for sharing lessons learned about large-scale restoration and landscape-level governance with other countries in Latin America and the Caribbean.

Strengthen productive activities within restoration: In Paraguay, effective governance across sectors and administrative levels is fundamental to ensuring the success of restoration actions, including the integration of productive activities. For example, promoting the production of yerba mate, a native plant used to make a traditional beverage, within agroforestry systems contributes to biodiversity conservation while generating employment and income for local producers.

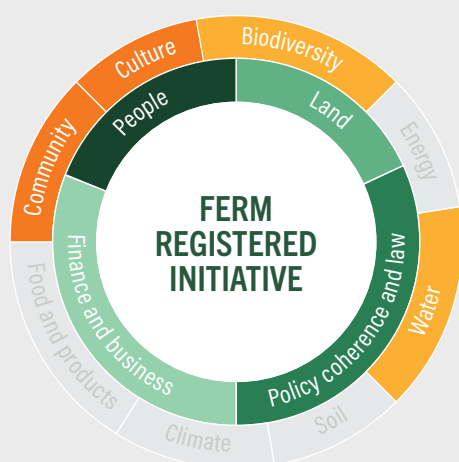


Bernadette Moschen, a Brazilian private landowner, invested in trees rather than coffee and beans or cattle to help regrow the Atlantic Forest.
© Lucca Messer

CASE STUDY 18

INDIGENOUS PEOPLES' BIOCENTRIC RESTORATION IN SACRED TERRITORIES: AN INITIATIVE LED BY XUKURU INDIGENOUS PEOPLES IN BRAZIL

Learning from nature to restore life in the caatinga biome



- Indigenous knowledge guided effective ecosystem restoration with over 48 000 seedlings across 108 native species planted to enhance biodiversity and ecosystem recovery.
- Biocentric approaches strengthened long-term resilience. Restoration integrated cultural values, water protection and ecosystem connectivity, supporting sustainable livelihoods and stewardship.



CASE STUDY LOCATION

Pesqueira, Pernambuco, Brazil



IMPLEMENTATION PERIOD

2023–2025



AREA UNDER RESTORATION

91.76 ha



TOTAL TARGET AREA TO RESTORE

347.35 ha



RESTORATION APPROACH

Indigenous Peoples' biocentric restoration approach



TOTAL NUMBER OF BENEFICIARIES

400 Indigenous persons



BUDGET

USD 132 565



SOURCES OF FUNDING

Food and Agriculture Organization of the United Nations (FAO), Spanish Agency for International Development Cooperation, Government of the United Kingdom of Great Britain and Northern Ireland



ECOSYSTEM TYPE*

Forests
Grasslands, shrublands and savannahs
Mountains

NOTE: *The types of ecosystems referenced are based on the classification provided by the United Nations Decade on Ecosystem Restoration 2021–2030.

Key takeaways and highlights

- **Indigenous Peoples biocentric restoration:** The Xukuru Indigenous Peoples integrate food and knowledge systems, cosmogony, territorial management practices and spiritual values in the restoration of degraded ecosystems, which they also see as a way to revitalize territorial memories and strengthen the intergenerational transmission of knowledge.
- **Integrated forest and landscape restoration (FLR) approach:** Indigenous Peoples' biocentric restoration supports sustainable agrifood systems transformation while contributing to implementing global commitments and promoting long-term resilience and sustainable benefits.
- **Holistic territorial management:** Indigenous Peoples led mapping, monitoring and reporting efforts to define restoration areas, protect water sources, maintain ecological connectivity and reintroduce fauna, thus integrating ecological integrity with their cosmology and sustainable resource use.

Introduction and context

In the drylands of the caatinga biome in northeastern Brazil, the Xukuru do Ororubá Indigenous Peoples are leading an exemplary Indigenous Peoples' biocentric restoration initiative in the territory they recently reacquired, which had been degraded for more than 400 years

due to intensive livestock and agricultural use, altering its delicate ecological balance. This work is deeply rooted in their food and knowledge systems, cosmogony, beliefs and territorial management practices.

Implemented from December 2023 to the present day with support from the Food and Agriculture Organization of the United Nations (FAO) Indigenous Peoples Unit, the initial pilot project restored 91 ha across five sacred villages in the Ororubá Mountains. It produced over 48 000 seedlings representing 108 native species and introduced digital monitoring systems to track survival rates and biodiversity recovery. This process also identified an additional 260 potential pilot hectares of degraded areas for present and future restoration to strengthen habitat connectivity across the landscape.

The approach is grounded in the Indigenous Peoples' right to free, prior and informed consent (FPIC) and is guided by the School of Life, called locally Ynarú da Mata, conducted within a life-way calendar that integrates nature and human times as one, blending ancestral knowledge and cosmogony with restoration actions. Restoration areas were selected based on their sacred and spiritual significance, degree of ecological degradation and potential for restoration.

A Xukuru do Ororubá Indigenous Person (Brazil) walks across sacred rocks restored by the Indigenous Peoples community within the Global Programme on Indigenous Biocentric Restoration.
© Gozman Gallego



Best practices and innovation to scale up and replicate restoration efforts

Respect for nature that transcends its utility to humans: This is a core principle of the project. Indigenous Peoples recognize rivers, forests, mountains and rocks, not merely as resources, but as living entities, as relatives, with intrinsic value and rights. Within this approach, the Xukuru Indigenous People chose to begin with the restoration of their rocky formations, the centre of their spiritual strength. These stones host a wide range of endemic animals, plant and lichen species, including medicinal and food plants.

Accelerating a natural process: The Xukuru returned stones to the rocky formations and constructed water barriers to slow water runoff, trap sediments and accumulate organic matter, thereby improving soil moisture and creating conditions for natural regeneration. This strategic intervention accelerated natural recovery processes, with visible signs of ecological recovery already emerging, including the return of fauna and flora and the resurgence of water sources.

Using a biocentric restoration monitoring system enables Indigenous Peoples' communities to carry out participatory and georeferenced mapping and monitoring of the degraded areas targeted for restoration. Beyond conventional indicators, they monitor life itself through their knowledge systems and close observation of nature to learn the timing of rain, flowering, seeding and planting.

Integrating ethno mapping, zoning and culturally informed restoration methodologies into policy frameworks: The planning of over 300 ha in the Xukuru, Guajajara, and other Indigenous Peoples' territories illustrates the value of this integration, grounded in a biocentric perspective in which the rights and needs of humans are not considered more important than those of other living organisms. The process supports ecological connectivity, water flows, rewilding, and the protection of spiritual and natural assets.

A member of the Xukuru Indigenous Peoples planting in sacred territory, advancing biocentric restoration rooted in ancestral knowledge and care for nature.
© Fabricio Brugnago



APPENDIX 1

FOREST RESTORATION COMMITMENTS IN THE NATIONAL BIODIVERSITY STRATEGIES AND ACTION PLANS

TABLE A1.1 OVERVIEW OF FOREST AND LANDSCAPE RESTORATION ABSOLUTE COMMITMENTS IN NATIONAL BIODIVERSITY STRATEGIES AND ACTION PLANS SUBMITTED TO THE CONVENTION ON BIOLOGICAL DIVERSITY IN FEBRUARY 2026

Country	Global Forest Resources Assessment region	Status of national biodiversity strategies and action plans	Commitment/target description	Area committed (ha)	National biodiversity strategies and action plans global timeline
Austria	Europe	Final	5 000 ha of degraded or lost floodplains have been restored as effective flood retention areas	5 000	2022–2030
Brazil	South America	Approved	By 2030, restore or have under restoration 12 million ha of native vegetation, encompassing restoration initiatives in public and private areas across all biomes	12 000 000	2025–2030
Burkina Faso	Africa	Approved	Annual area of land under restoration (aquatic, forest, agroforestry, pastoral): 50 000 ha in 2013 versus 275 000 ha in 2030	275 000	2025–2030
Burkina Faso	Africa	Approved	Total area of degraded land in forest and agroforestry ecosystems: 26 119 ha currently compared to 154 000 ha in 2030	154 000	2025–2030
Canada	North and Central America	Approved	At least 19 million ha by 2030	19 000 000	2024–2030
Canada	North and Central America	Approved	Canada is working to conserve, restore and enhance ecosystems through the Natural Climate Solutions Fund (Environment and Climate Change Canada, Natural Resources Canada, and Agriculture and Agri-Food Canada), with the goal of restoring 1.32 million ha by 2031	1 320 000	2024–2030
Colombia	South America	Final	By 2030, Colombia will have 5 million ha converted to sustainable productive models and undergoing multifunctional restoration processes that guarantee the recovery of ecosystem functionality and the revitalization of territorial economies	5 000 000	2024–2030
Denmark	Europe	Final	The government will establish 75 000 ha of untouched forest in Denmark	75 000	2024–2030



TABLE A1.1 (Continued)

Country	Global Forest Resources Assessment region	Status of national biodiversity strategies and action plans	Commitment/target description	Area committed (ha)	National biodiversity strategies and action plans global timeline
France	Europe	Approved	Restoring ecological continuity and bringing nature back into cities: the Government of France will continue efforts to renature and reduce impermeable surfaces in cities – 100 ha renatured in cities per year from 2023 to 2027	100 per year	2022–2030
France	Europe	Approved	Restoring wetlands: at least 50 000 ha will have been restored by 2026, and efforts will continue until the end of the decade	50 000	2022–2030
France	Europe	Approved	15.7 million ha of permanent grassland by 2030, i.e. 1 million ha more than in 2020	15 700 000	2022–2030
Hungary	Europe	Approved	Restoring at least 34 000 ha of wetlands and preventing their further degradation	34 000	2023–2030
Hungary	Europe	Approved	Interventions and restoration activities on at least 35 000 ha of permanent grasslands to prevent further deterioration, to conserve their natural values in the long term, and to establish the necessary ecological conditions	35 000	2023–2030
Hungary	Europe	Approved	Interventions and restoration activities on at least 135 000 ha of forest ecosystems to prevent further deterioration of forest habitats, to conserve the natural resources in the long term, and to establish the necessary ecological conditions	135 000	2023–2030
Ireland	Europe	Approved	By 2026, Bord na Móna to rehabilitate 33 000 ha of its peatlands under the Enhanced Decommissioning, Restoration and Rehabilitation Scheme (EDRRS)	33 000	2023–2030
Jordan	Asia	Draft	One of Jordan's most ambitious restoration initiatives is the Badia Restoration Programme (BRP), overseen by the Ministry of Environment. The BRP aims to rehabilitate 1.2 million ha of degraded rangelands in the Badia region, constituting about 68 percent of the country's land area	1 200 000	2024–2050
Luxembourg	Europe	Approved	Managing 13 000 ha of agricultural land under a “biodiversity” contract, without the use of fertilizers or pesticides	13 000	2023
Malaysia	Asia	Approved	By 2030, at least 200 000 ha of degraded sites are being actively restored	200 000	2023–2030
Mauritania	Africa	Final	500 000 ha reforested/restored in areas of sensitive and high biodiversity	500 000	2022–2030



TABLE A1.1 (Continued)

Country	Global Forest Resources Assessment region	Status of national biodiversity strategies and action plans	Commitment/target description	Area committed (ha)	National biodiversity strategies and action plans global timeline
Mauritania	Africa	Final	1 000 ha of soil in former mining sites restored across at least ten different locations	1 000 at least ten different locations	2022–2030
Republic of Korea	Asia	Approved	Restore, on a yearly basis, 295 ha of naturally or artificially damaged or fragmented forests near Baekdudaegan, the Demilitarized Zone, islands and coastal areas to maintain or improve the biodiversity and health of forest ecosystems	295 per year	2024–2028
Republic of Moldova	Europe	Draft	Restoration/reconstruction works of degraded and inadequate stands on 16 920 ha by 2027	16 920	2024–2030
Republic of Moldova	Europe	Draft	Works to create forest curtains for the protection and afforestation of riparian strips on 12 080 ha completed by 2027	12 080	2024–2030
Republic of Moldova	Europe	Draft	Wetlands cover by 2027 – up to 65 km ² including the wetlands on an area of 50 ha of the Lower Prut Biosphere Reserve, 3 000 ha of aquatic and marsh ecosystems from RPBJ restored, 11 000 ha of meadow ecosystems from the Pădurea Domneasca Reserve (Middle Prut) restored	6 500 (converted in ha)	2024–2030
Tunisia	Africa	Final	The 3rd strategy for the development and conservation of agricultural land (ACTA) identifies priority restoration areas covering 2 717 508 ha, i.e. 17.5% of the national territory.	2 717 508	2018–2030
Uganda	Africa	Draft	Wetland areas restored Restore at least 11 250 ha annually to contribute to the achievement of the national target in Vision 2040	11 250 per year	2025–2030
United Kingdom of Great Britain and Northern Ireland	Europe	Approved	Scotland: commitment to restore 250 000 ha of peatland by 2030	250 000	2025–2030
United Kingdom of Great Britain and Northern Ireland	Europe	Approved	England: restore more than 35 000 ha of peatland	35 000	2025–2030

<https://doi.org/10.4060/ce0633en-tab1.1>


APPENDIX 2

GLOBAL AND REGIONAL INITIATIVES THAT INCLUDE ECOSYSTEM RESTORATION

TABLE A2.1 GLOBAL INITIATIVES THAT INCLUDE ECOSYSTEM RESTORATION: SCOPE, LEGAL STATUS AND ALIGNMENT WITH NATIONAL FRAMEWORKS

Instrument (effective date)	Legally binding or non-legally binding	Description	Linkages to national legal and policy frameworks	Number of parties and signatories
Convention on Biological Diversity (CBD) (1992) ⁱ	Legally binding	Each contracting party shall, as far as possible and as appropriate, rehabilitate and restore degraded ecosystems and promote the recovery of threatened species (Art. 8 [f]).	Countries develop national biodiversity strategies and action plans (NBSAPs) (Art. 6 [a]) and translate Convention on Biological Diversity (CBD) obligations into national laws, policies and programmes (Art. 6 (b)). Compliance is supported by reporting to the CBD Secretariat (Art. 26).	196 ⁱⁱ
United Nations Framework Convention on Climate Change ⁱⁱⁱ (UNFCCC) (1992)	Legally binding	Parties commit to protecting and enhancing sinks and reservoirs of greenhouse gases, including forests (Art. 4 [1][d]). The UNFCCC encourages the conservation and enhancement of forest carbon stocks and supports actions that contribute to ecosystem restoration and climate change mitigation and adaptation (Art. 4 [1][e]).	Countries must develop, periodically update, and publish national inventories of greenhouse gas emissions and removals (Art. 4 [1][a]).	198 ^{iv}
United Nations Convention to Combat Desertification (UNCCD) (1994) ^v	Legally binding	Combat land degradation in arid, semi-arid and dry subhumid areas. Land degradation is understood as the reduction or loss, in arid, semi-arid and dry subhumid areas of the biological or economic productivity and complexity of rainfed cropland, irrigated cropland, or range, pasture, forest and woodlands resulting from land uses or from a process or combination of processes, including processes arising from human activities and habitation patterns (Art. 1).	Implementation through National Action Programmes that guide national policies and laws (Art. 4). Parties must report back to the Secretariat on measures taken to implement the UNCCD (Art. 26).	197 ^{vi}
United Nations Decade for Deserts and the Fight against Desertification (2010–2020) ^{vii}	Non-legally binding (global mobilization campaign)	Promote action that will protect the drylands. Intended to support the implementation of the UNCCD.	The decade revolved around awareness raising, finance mobilization and monitoring.	



TABLE A2.1 (Continued)

Instrument (effective date)	Legally binding or non-legally binding	Description	Linkages to national legal and policy frameworks	Number of parties and signatories
Aichi Biodiversity Targets (2010) ^{viii} (2011–2020) (see also below, as replaced by the Kunming–Montreal Global Biodiversity Framework [KMGBF])	Non-legally binding	By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, considering the needs of women, Indigenous Peoples and local communities, and the poor and vulnerable (Target 14). By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks have been enhanced, through conservation and restoration, including restoration of at least 15 percent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification (Target 15).	See the CBD	
Bonn Challenge ^{ix} (2011)	Non-legally binding	Bring 150 million ha of degraded and deforested landscapes into restoration by 2020 and 350 million ha by 2030 (pledge).	Encourages countries and other actors to make voluntary pledges. Implementation is left to national discretion.	61 ^x
New York Declaration on Forests (2014) ^{xi}	Non-legally binding	Restoring 350 million ha of degraded landscapes by 2030 (pledge).	Focus on governance processes including through law reform processes	41 ^{xii}
Sustainable Development Goals (2015) ^{xiii}	Non-legally binding	Goal 15: “Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.”	Resolution A/RES/74/4 calls on countries to “mainstream the 2030 Agenda into (their) national planning instruments, policies, strategies and financial frameworks”.	
Paris Agreement (2015) ^{xiv}	Legally binding	Parties should take action to conserve and enhance, as appropriate, sinks and reservoirs of greenhouse gases, including forests and other terrestrial, coastal and marine ecosystems. Parties should promote and cooperate in the conservation and enhancement of sinks and reservoirs, including through reforestation and afforestation and other ecosystem-based approaches for climate change mitigation (Art. 5). These include REDD+ activities, recognized under earlier UNFCCC decisions such as the Warsaw Framework (2013) ^{xv} and the enhancement of forest carbon stocks most directly linked to restoration.	Countries must prepare and communicate nationally determined contributions (NDCs) setting forth their priorities for mitigation and adaptation. They are required to report on implementation progress (Art. 4). Forest-related actions, including restoration and REDD+ activities recognized under Article 5, are typically reflected in NDCs and implemented through national legal and policy frameworks, including REDD+ strategies or action plans that set out measures to reduce emissions from deforestation and forest degradation and enhance carbon stocks, supported by monitoring, reporting and verification systems. Cooperative approaches under Article 6 provide additional support.	195 ^{xvi}



TABLE A2.1 (Continued)

Instrument (effective date)	Legally binding or non-legally binding	Description	Linkages to national legal and policy frameworks	Number of parties and signatories
United Nations Decade on Ecosystem Restoration 2021–2030 (2019) ^{xvii}	Non-legally binding (global mobilization campaign)	Support and scale up efforts to prevent, halt and reverse the degradation of ecosystems.	Strong political signal for action. Calling countries to adopt, strengthen or implement legal instruments.	
Kunming–Montreal Global Biodiversity Framework (KMGBF) (2022) ^{xviii} (see also above, as preceded by the Aichi Biodiversity Targets)	Non-legally binding	Ensure that by 2030 at least 30 percent of areas of degraded terrestrial, inland water, and coastal and marine ecosystems are under effective restoration to enhance biodiversity and ecosystem functions and services, ecological integrity and connectivity (Target 2).	Under Decision 15/4 adopting the KMGBF, Parties must set national targets through their NBSAPs. Decision 15/6 provides guidance on aligning NBSAPs with the KMGBF.	196 ^{xix}
Land Degradation Neutrality (LDN) targets	Non-legally binding	Land degradation neutrality is a state whereby the amount and quality of land resources necessary to support ecosystem functions and services to enhance food security remain stable, or increase, within specified temporal and spatial scales and ecosystems.	Countries are encouraged to set LDN targets that aim to maintain or enhance land-based natural capital through sustainable land management practices that avoid or reduce degradation, coupled with efforts to reverse degradation through restoration or rehabilitation of degraded land.	131

NOTES: ⁱSee <https://www.cbd.int/doc/legal/cbd-en.pdf>; ⁱⁱSee <https://www.cbd.int/information/parties.shtml>; ⁱⁱⁱSee https://unfccc.int/files/essential_background/background_publications_htmlpdf/application/pdf/conveng.pdf; ^{iv}See https://treaties.un.org/pages/ViewDetailsIII.aspx?src=TREATY&mtdsg_no=XXVII-7&chapter=27&Temp=mtdsg3&clang=_en; ^vSee https://www.unccd.int/sites/default/files/2022-02/UNCCD_Convention_ENG_0_0.pdf; ^{vi}See <https://www.unccd.int/convention/ratification>; ^{vii}See <https://docs.un.org/en/A/RES/62/195>; ^{viii}See <https://www.cbd.int/sp/targets>; ^{ix}See <https://www.bonnchallenge.org/>; ^xSee <https://www.bonnchallenge.org/about>; ^{xi}See <https://forestdeclaration.org/wp-content/uploads/2021/10/EN-NYDF-Refresh.pdf>; ^{xii}See <https://forestdeclaration.org/about/endorsers/>; ^{xiii}See <https://maintenance.un.org/ods/>; ^{xiv}See https://unfccc.int/sites/default/files/english_paris_agreement.pdf; ^{xv}See <https://unfccc.int/topics/land-use/workstreams/redd/redd-resources>; ^{xvi}See <https://unfccc.int/process/the-paris-agreement/status-of-ratification>; ^{xvii}See <https://docs.un.org/en/a/res/73/284>; ^{xviii}See <https://www.cbd.int/doc/decisions/cop-15/cop-15-dec-04-en.pdf>; ^{xix}See <https://www.cbd.int/article/cop15-cbd-press-release-final-19dec2022>

TABLE A2.2 REGIONAL INITIATIVES THAT INCLUDE ECOSYSTEM RESTORATION: SCOPE, LEGAL STATUS AND ALIGNMENT WITH NATIONAL FRAMEWORKS

Initiative	Legally binding or non-legally binding	Description	Number of parties and signatories
Africa			
AFR100 ⁱ (2015)	Non-legally binding	Restore 100 million ha by 2030.	34 ⁱⁱ
Central African Forest Initiative (CAFI) ⁱⁱⁱ (2015)	Non-legally binding	Sustainable land management, forest conservation and forest and landscape restoration.	16 members including 6 African countries
Central African Forest Commission (COMIFAC) ^{iv} (2005)	Legally binding	Forest conservation and sustainable management.	10
Congo Basin Forest Partnership ^v (2002)	Non-legally binding	Member organizations cooperate to improve technical and financial assistance, promote biodiversity conservation and sustainable management of forest ecosystems, combat climate change and reduce poverty in line with COMIFAC's Convergence Plan.	138 members including 11 Central African countries
Great Green Wall ^{vi} (2007)	Non-legally binding	Restore 100 million ha of degraded lands by 2030.	
Asia and the Pacific			
Asia-Pacific Reforestation Effort ^{vii} (2007)	Non-legally binding	Increase forest cover in Asia and the Pacific by at least 20 million ha of all types of forests by 2020.	21 ^{viii}
Asian Forest Cooperation Organization (AFoCO) ^{ix} (2018)	Legally binding	Contribute to the global goals of increasing forest cover and implementing the Paris Agreement on climate change.	15 ^x
RESULT Asia-Pacific ^{xi} (2024)	Non-legally binding	Restore and sustain 100 million ha of degraded landscapes in 22 countries in Asia and the Pacific by 2030.	22 ^{xii}
Europe and Central Asia			
European Union Nature Restoration Regulation ^{xiii} (2024)	Legally binding	Restore at least 30 percent of habitats in poor condition by 2030, 60 percent by 2040 and 90 percent by 2050.	27
ECCA30 ^{xiv}	Non-legally binding	Bring 30 million ha of degraded and deforested land in Europe, the Caucasus and Central Asia into restoration by 2030.	
Latin America and the Caribbean			
Amazon Cooperation Treaty (ACT) ^{xv} (1994)	Legally binding	Establishes transboundary environmental cooperation among Amazon countries. Through the Amazon Cooperation Treaty Organization (ACTO), provides a regional framework for cooperation and voluntary targets, including restoration commitments (e.g. the 2023 Belém Declaration), while implementation and enforcement remain at the national level	8 ^{xvi}
Initiative 20x20 ^{xvii} (2014)	Non-legally binding	Protect and restore 50 million ha of forests, farms, pasture, and other landscapes by 2030	17 national and 1 subnational
Mediterranean			
Agadir Commitment (2018)	Non-legally binding	Restore 8 million ha of degraded forest landscape by 2030.	10 ^{xviii}



TABLE A2.2 (Continued)

Initiative	Legally binding or non-legally binding	Description	Number of parties and signatories
Near East and North Africa			
Saudi and Middle East Green Initiative ^{xix}	Non-legally binding	Implement a reforestation programme, rehabilitate over 74 million ha of land, and achieve emissions reduction targets under the Paris Agreement.	
North America			
Environmental Cooperation Agreement (2018)	Legally binding	Trilateral Treaty, implemented through the Commission for Environmental Cooperation (CEC) governing environmental cooperation, enforcement, and sustainability. It enables conditions for effective forest and landscape restoration by strengthening forest governance, combatting illegal logging, and promoting sustainable practices.	3

NOTES: ⁱSee <https://afr100.org/>; ⁱⁱSee <https://afr100.org/about/>; ⁱⁱⁱSee <https://cafi.org/>; ^{iv}See <https://comifac.org/>; ^vSee <https://pfbc-cbfp.org/en/>; ^{vi}See <https://thegreatgreenwall.org/about-great-green-wall/>; ^{vii}See <https://www.apfnet.cn/>; ^{viii}See <https://www.apec.org/who-we-are/what-is-apec/>; ^{ix}See <https://afocosec.org/>; ^xSee <https://afocosec.org/about-us/members/>; ^{xi}See <https://www.fao.org/in-action/forest-landscape-restoration-asia/result-asia-pacific/en/>; ^{xii}See <https://www.fao.org/in-action/forest-landscape-restoration-asia/result-asia-pacific/>; ^{xiii}See <https://environment.ec.europa.eu/forests/restoration.htm>; ^{xiv}See <https://www.ecca30.org/>; ^{xv}See <https://otca.org/en/publicacao/amazon-cooperation-treaty/>; ^{xvi}See <https://otca.org/en/who-we-are/#member-countries>; ^{xvii}See <https://initiative20x20.org/>; ^{xviii}See <https://www.fao.org/silva-mediterranea/resources/news/detail/the-agadir-commitment-five-years-after-its-adoption/en/>; ^{xix}See <https://www.sgi.gov.sa/about-mgi/?csrt=6282077992777129996>

APPENDIX 3

LIST OF RESTORATION INTERVENTION TYPES INCLUDED IN RESTORATION OPPORTUNITY ASSESSMENTS USING THE RESTORATION OPPORTUNITIES ASSESSMENT METHODOLOGY

Table A3.1 comes from published and unpublished restoration assessments in over 30 national and subnational restoration opportunity assessments carried out between 2014 and 2019 using the restoration opportunities assessment methodology.⁶¹ Though many intervention types appear to be the same (e.g. agroforestry, improved management and restoration), the contextual

understanding and expected benefits of each of these interventions all differ substantially based on the local and national contexts. As these were only assessments of restoration opportunity, costs were not typically evaluated unless the assessment proceeded to planning and implementation.

TABLE A3.1 LIST OF RESTORATION INTERVENTION TYPES INCLUDED IN RESTORATION OPPORTUNITY ASSESSMENTS USING THE RESTORATION OPPORTUNITIES ASSESSMENT METHODOLOGY

Afforestation	Enrichment of acahuales	Native forest restoration (humid secondary vegetation)	Restocking degraded natural forests
Afforestation/ reforestation	Enrichment planting	Native species introduction	Restoration (afro-alpine)
Afforestation/ reforestation of natural forests	Enrichment planting (acahuales)	Natural forest rehabilitation	Restoration (mangrove)
Afro-alpine restoration	Enrichment planting (with payment for ecosystem services support)	Natural regeneration	Restoration (native forest)
Afro-montane: natural regeneration/ agroforestry	Enrichment planting/assisted natural regeneration	Natural regeneration, mangroves	Restoration (riparian forest)
Agricultural technologies	Enrichment planting/assisted natural regeneration (with payment for ecosystem services support)	Non-green belt mangrove area	Restoration (silvo-pastoral and grasslands)
Agroforestry	Enrichment strip plantation and perennial crops associated with trees	Northern moist: woodlots/ agroforestry	Restoration (wetland)
Agroforestry (cacao)	Enrichment strip plantations and mixed plantations associated with annual crops	Palm oil: fertilizer management	Restoring biodiversity corridors
Agroforestry (cereal-dominated)	Enrichment strip plantations, mixed plantations associated with annual crops and perennial crops associated with trees	Passive regeneration: beef cattle	Riparian forest restoration
Agroforestry (coffee)	Enrichment strip planting	Perennial crops associated with trees	Riparian green belt
Agroforestry (flood plain)	Extended rotations and/or native species introduction/ just enrichment planting	Pineapple, palm oil and banana: restoration of riparian forest	River and stream bank restoration
Agroforestry (hinterland)	Farm forestry (<10% tree cover)	Pineapple: contouring and crop residue management	SE Lake Kyoga flood plain: agroforestry
Agroforestry (improved Milpa)	Farm forestry (10% -30% tree cover)	Plantation (associated with annual crops)	Secondary forest management

TABLE A3.1 (Continued)

Agroforestry (irrigation)	Farm forestry with less than 10% tree cover	Plantation (commercial tree and agroforests (including bamboo))	Shade/sun coffee: fertilizer management and agroforestry
Agroforestry (perennial crops associated with trees)	Farm forestry with tree cover between 10% and 30%	Plantation (commercial tree and bamboo in unstocked forests)	Silviculture
Agroforestry (Quesungual system)	Fertilizer management	Plantation (dendroenergy)	silvo-pastoral and grasslands restoration
Agroforestry (rainfed)	Fertilizer management (palm oil)	Plantation (enrichment strip plantations and mixed plantations associated with annual crops)	Silvopastoral systems in natural pasture
Agroforestry (staple grains)	Forest conservation (mature)	Plantation (enrichment strip planting)	Silvopasture
Agroforestry irrigation	Forest in marginal strips	Plantation (enrichment strip)	Silvopasture (dairy cattle pasture)
Agropastoral	Forest management	Plantation (Extended rotation system)	Silvopasture (in natural pasture)
Agro-silvopastoral systems of crops and pasture	Forest plantation	Plantation (forest)	Silvopasture intensification
Agro-silvopastoral systems of crops and pasture	Forest restoration (marginal strip)	Plantation (high value timber)	Silvopasture: dairy cattle pasture
Assisted natural regeneration	Forest restoration interventions	Plantation (mixed associated with annual crops)	Social forestry (silvo-fisheries)
Banana: fertilizer management	Green harvest of sugar cane	Plantation (mixed in open field)	social forestry (silvo-fisheries)
Barren soil restoration	High value timber plantations, humid secondary vegetation	Plantation (renewal coffee)	Soil and water conservation
Biodiversity corridors	Hinterland agroforestry	Plantation (strip plantation and perennial crops associated with trees)	Soil conservation
Bioengineering	Improved fallow	Plantation (timber in pasture outside of livestock areas)	Stabilization of stream banks and gullies
Buffer zones (coastal green belt)	Improved farming system (staple grains alley farming)	Plantations	Staple grains agroforestry
Buffer zones (protective forests)	Improved management (forest)	Progressive terraces	Staple grains alley farming system
Buffer zones (riparian)	Improved management (mature forest)	Protected forest	Sustainable woodland management
Buffer zones (trees along roads)	Improved management (natural forest)	Protection (against forest fire)	SW rangeland: woodlots
Buffer zones along water bodies and wetlands	improved management (natural regeneration and living fences in pastures)	Protection (parks, reserves, and protected areas)	Timber plantation management
Cacao agroforestry 1	Improved management (pastures and silvopasture)	Protection against forest fire, dense coniferous	Timber plantations in pasture outside of NAMA livestock
Cacao agroforestry 2	Improved management (secondary forest)	Protection and natural regeneration of parks and reserves	Tree buffers along roads
Cacao agroforestry	Improved management (sustainable woodland)	Protective forests	Tree planting



TABLE A3.1 (Continued)

Cereal-dominated agroforestry	Improved management (timber plantation)	Pure plantation associated with annual crops	W mid-altitude: agroforestry
Coastal green belt	Improved management (woodlots)	Quesungual agroforestry system	Watershed conservation
Coffee agroforestry > 900 metres above sea level	Improved management of natural forest	Radical terraces	Wetland restoration
Commercial tree and bamboo plantations in unstocked forests	Improved Milpa	Rainfed agroforestry	Woodlot establishment
Commercial tree plantations and agroforests (including bamboo)	Improved pastures and silvopasture: beef cattle	Reforestation	Woodlot management
Community forests	Intensive silvopastoral	Reforestation (mangrove)	Woodlots
Community forests and woodlots	Lake Victoria crescent: agroforestry	Reforestation (thin coniferous forest)	
Conservation agriculture (Green harvest of sugar cane)	Management of natural regeneration and living fences in pastures	Reforestation and enrichment planting	
Contouring and crop residue management	Mangrove reforestation, barren soil	Reforestation of thin coniferous forest (infested by weevils)	
Crop mosaics	Mangrove restoration	Rehabilitation (degraded natural forests)	
Current forest nuclei	Mature forest conservation	Rehabilitation (natural forest)	
Deciduous secondary vegetation	Mature forest management	Rehabilitation (quarries)	
Dendroenergy plantation, deciduous secondary vegetation	Mixed plantation in open field	Rehabilitation of degraded natural forests	
Ecological agriculture	Native forest restoration	Rehabilitation of quarries	
Ecological restoration		Renewal coffee plantation	

APPENDIX 4

METHODOLOGICAL APPROACH FOR ESTIMATING THE MITIGATION POTENTIAL OF VARIOUS RESTORATION ACTIVITIES

This appendix describes the methodological approach used in the study presented in [Box 3.1](#). This study estimated the carbon mitigation potentials associated with key restoration activities in forests, soils and mangrove ecosystems, using The Food and Agriculture Organization of the United Nations (FAO) Environmental eXternalities ACcounting Tool (EX-ACT). EX-ACT was developed to support governments, donors and project developers in evaluating the climate impacts of investments and policies. It is based on available guidelines from the Intergovernmental Panel on Climate Change (IPCC).^{162, 580, 581}

To estimate the ranges of carbon mitigation potential for different restoration activities, the study simulated restoration practices using EX-ACT activity categories. Simulations were conducted across successive permutations of climate, soil type, moisture conditions and activity categorizations to capture geographical and climatic variability in the implementation of restoration interventions. Multiple scenarios were built into the tool to reflect potential variance among restoration efforts, providing yearly mitigation potentials over a 20-year accounting period per unit of land (1 ha). IPCC climatic zones (e.g. tropical montane, cool temperate dry) and soil types (e.g. sandy soils, low-activity clays, high-activity clays) were compared to develop aggregate ranges at the global level. These are provided as yearly mitigation potentials over a 20-year accounting period per unit of land. The study considered carbon dioxide (CO₂) emissions and removals resulting from changes in carbon stocks in five quantifiable carbon pools: above ground biomass, below ground biomass, litter and deadwood, and soil. Non-CO₂ emissions, such as methane (CH₄) and nitrous oxide (N₂O), were also considered.

To reflect heterogeneity in implementation modalities and ensure conservative estimates, several restoration activities were represented through multiple configurations within EX-ACT. This approach allowed alternative assumptions on land-use transitions, biomass accumulation pathways, and soil carbon responses to be tested for the same underlying restoration intervention. All restoration activities were defined and parameterized in EX-ACT in line with internationally recognized definitions from scientific literature and existing restoration assessment frameworks. The sources used are reported in [Box 3.1](#). Activity typologies were mapped to EX-ACT land-use and management categories following a structured review process, including internal quality control and validation by forestry and climate change experts, to ensure consistency with IPCC guidelines.

For some restoration activities, limitations in the available scientific evidence constrained the level of disaggregation of mitigation outcomes. This is notably the case for assisted natural regeneration (ANR). A distinct global mitigation factor could not be defined for ANR because of the lack of robust and globally applicable parameters to quantify differentiated growth rates for biomass and soil carbon. To avoid overestimation, ANR, therefore, was modelled using the same biomass accumulation rates as those used for natural regeneration, consistent with IPCC default coefficients.

Given the high levels of uncertainty involved in deriving globally representative mitigation potentials for individual restoration practices, the results were grouped into four broader restoration categories based on land use: i) forest restoration; ii) soil and land restoration; iii) agroecological and productive systems; and iv) aquatic restoration. For each restoration category, mitigation

potentials were reported as minimum, maximum, median and mean values, with ranges explicitly reflecting variability across climatic zones, soil types and restoration pathways.

Soil types were selected to reflect the predominance of restoration initiatives globally and to avoid outliers reflecting soil classes with atypical carbon dynamics, such as volcanic or spodic soils. Accordingly, simulations focused on sandy soils, low-activity clays and high-activity clays, consistent with the IPCC classification. Organic soils and coastal wetland soils were targeted for aquatic restoration activities. Mineral wetland soils were not included in the simulations. Climatic zones and moisture regimes were selected to reflect the geographical distribution of large-scale restoration initiatives, with an emphasis on tropical (including tropical montane) and temperate climates. This selection ensured that estimated mitigation potentials were representative of contexts where restoration investments are most frequently implemented.

All analyses were conducted on a standardized reference area of 1 ha per restoration practice. Each practice was assumed to be implemented over one year, followed by a capitalization period of 19 years, resulting in a 20-year

TABLE A4.1 NUMBER OF COMPUTATIONS CAPTURED TO DEVELOP THE MITIGATION SCENARIOS FOR EACH RESTORATION CATEGORY ASSESSED

Category	Computations
Forest restoration	23 180
Soil and land restoration	25 632
Agroecological and productive systems	21 568
Aquatic restoration	3 200

accounting horizon. This time frame was deemed suitable for capturing medium- to long-term mitigation effects, avoiding distortions linked to short-term biomass accumulation or delayed soil carbon responses.

Table A4.1 shows the number of computations captured to develop the mitigation scenarios used in estimating the ranges of carbon mitigation potential of key restoration activities in forests, soils and mangrove ecosystems (Box 3.1).

The results provided do not account for potential cross-influences, synergies and trade-offs that may be generated by the implementation of individual or multiple restoration activities.

TABLE A4.2 RANGES OF CARBON MITIGATION POTENTIAL ESTIMATED FOR KEY RESTORATION ACTIVITIES IN FORESTS, SOILS AND MANGROVE ECOSYSTEMS USING FAO'S ENVIRONMENTAL EXTERNALITIES ACCOUNTING TOOL

Land types	Type of restoration	General description	Minimum*	Maximum*	Median	Mean
tCO ₂ eq/ha						
FOREST RESTORATION**	Natural regeneration	The gradual recovery of a forest's structure, function, species composition and functions after disturbance, relying mainly on existing seed sources and natural successional processes, with little to no human involvement. ⁱ				
	Assisted natural regeneration***	Actions that enhance natural successional processes by removing or reducing barriers to forest regeneration, while relying on natural seed sources.	-15.33	1.34	-3.27	-4.43
	Reintroduction of threatened species	Restoration actions focused on establishing viable populations of native tree species that have been extirpated, with the aim of conserving biodiversity. ^{ii, iii}				
	Riparian restoration	Re-establishing native vegetation along riverbanks to stabilize soils, restore hydrological and ecological processes, improve water quality, and increase biomass and soil carbon in riparian corridors. ^{iv}				
	Direct planting	Establishing native tree species using nursery-grown seedlings combined with land management practices to improve survival rates. This also includes direct seeding, where tree seeds are introduced directly into the target area. ^{v, vi}				
	Enrichment planting	Increasing the density of desirable, often shade-tolerant, tree species under a partial canopy to enhance structural and species diversity. ^{vii, iv}	-19.91	-0.37	-6.57	-7.83
	Infill planting	Establishing native tree species typically performed to fill specific gaps in existing forest cover, often using nursery stock to accelerate stand development. ^{iv}				
SOIL AND LAND RESTORATION	Soil amendments	Application of organic or inorganic materials that supply nutrients or otherwise improve soil fertility, function and health. ^{viii, ix}				
	Soil remediation	Interventions in contaminated soils aimed at reducing environmental and human health risks and improving soil functions. ^{ix}	-18.01	1.06	-1.05	-2.52
	Erosion control and soil conservation (terracing and decompaction)	Actions to reduce soil loss, runoff and nutrient depletion on slopes, while enhancing water infiltration and nutrient retention. ^x				



TABLE A4.2 (Continued)

Land types	Type of restoration	General description	Minimum*	Maximum*	Median	Mean
AGROECOLOGICAL AND PRODUCTIVE SYSTEMS	Agroforestry systems	Land-use systems that deliberately integrate trees with crops and/or livestock to diversify production, enhance soil fertility and increase carbon storage in both biomass and soil. ^{xi}				
	Agrosilvopastoral systems	Integrated systems that combine trees, forage plants and livestock in the same land management unit. These systems improve pasture productivity, increase biomass and soil carbon stocks, reduce land degradation and lower greenhouse gas emissions intensity from livestock production. ^{xii}	-13.24	-2.44	-6.87	-6.91
	Sustainable farming practices	Agricultural practices that enhance soil organic matter and reduce emissions through actions such as residue retention, reduced tillage, cover cropping, crop diversification and improved nutrient management. These practices support long-term soil carbon accumulation and improve soil health and productivity. ^{viii}				
AQUATIC RESTORATION	Mangrove replanting****	Active restoration of degraded coastal areas by planting mangrove propagules or seedlings at selected sites for rehabilitation or restoration. ^{xiii}				
	Natural recruitment	A restoration approach that restores natural tidal flow and reduces disturbances so mangrove propagules can naturally disperse, germinate and establish. ^{xiv}	-35.83	-8.79	-19.24	-21.56
	Coastal zone stabilization	Stabilizing shorelines using coastal vegetation (e.g. mangroves, saltmarsh grasses, seagrasses) to reduce erosion, buffer storm surge and enhance blue carbon storage in biomass and sediments. ^{xv}				

NOTES: tCO₂e/ha = tonnes of carbon dioxide-equivalent per hectare. *Minimum and maximum refer to numerical values only, meaning that, for each activity, the "minimum" refers to the maximum mitigation potential or the lowest emissions, while the "maximum" indicates the smallest mitigation potential or the highest emissions. **Planting activities under forest restoration refer to activities carried out in areas that fall under a forestland categorization, thereby excluding land-use changes linked to afforestation of non-forest land. ***Due to a lack of reliable information on globally validated growth rates for assisted natural regeneration that can be achieved by removing barriers (e.g. grazing, fire and competition), natural growth rate values provided by the Intergovernmental Panel on Climate Change (IPCC) were used to avoid misleading mitigation estimations. ****Mangrove replanting is included under aquatic restoration to reflect the linkage between biomass recovery and hydrological restoration.

SOURCES: ⁱChazdon, R.L. & Guariguata, M.R. 2016. Natural regeneration as a tool for large-scale forest restoration in the tropics: prospects and challenges. *Biotropica*, 48(6): 716–730. <https://doi.org/10.1111/btp.12381>; ⁱⁱKirkwood, J. 2013. Guidelines for reintroductions and other conservation translocations. *Animal Welfare*, 22(4): 489–490. <https://doi.org/10.1017/S0962728600005637>; ⁱⁱⁱShono, K., Cadaweng, E.A. & Durst, P.B. 2007. Application of Assisted Natural Regeneration to Restore Degraded Tropical Forestlands. *Restoration Ecology*, 15(4): 620–626. <https://doi.org/10.1111/j.1526-100X.2007.00274.x>; ^{iv}IUCN & WRI. 2014. *A guide to the restoration opportunities assessment methodology (ROAM): Assessing forest landscape restoration opportunities at the national or sub-national level*. Gland, Switzerland, IUCN; ^vCeccon, E., González, E.J. & Martorell, C. 2016. Is Direct Seeding a Biologically Viable Strategy for Restoring Forest Ecosystems? Evidences from a Meta-analysis. *Land Degradation & Development*, 27(3): 511–520. <https://doi.org/10.1002/ldr.2421>; ^{vi}Stanturf, J., Mansourian, S. & Kleine, M. 2017. *Implementing forest landscape restoration: A practitioner's guide*. Vienna, International Union of Forest Research Organizations, Special Programme for Development of Capacities (IUFRO-SPDC). https://www.srs.fs.usda.gov/pubs/books/2017/book_2017_stanturf_001.pdf; ^{vii}Daljit Singh. 2013. Status of soil microbial population, enzymatic activity and biomass of selected natural, secondary and rehabilitated forests. *American Journal of Environmental Sciences*, 9(4): 301–309. <https://doi.org/10.3844/ajessp.2013.301.309>; ^{viii}FAO & ITSP. 2021. *Recarbonizing global soils – A technical manual of recommended management practices*. Rome, FAO. <https://doi.org/10.4060/cb6606en>; ^{ix}FAO & UNEP. 2021. *Global assessment of soil pollution: summary for policymakers*. Rome, FAO. <https://doi.org/10.4060/cb4827en>; ^xFAO. 2015. *Status of the world's soil resources: main report*. Rome; ^{xi}FAO. 2017. *Agroforestry for landscape restoration*. Rome. <https://doi.org/10.4060/i7374e>; ^{xii}FAO. 2013. *Climate-smart agriculture sourcebook*. Rome; ^{xiii}IPCC. 2014. *2013 supplement to the 2006 IPCC guidelines for national greenhouse gas inventories: wetlands: methodological guidance on lands with wet and drained soils, and constructed wetlands for wastewater treatment*. Geneva, Switzerland, IPCC; ^{xiv}Lewis, R.R. 2005. Ecological engineering for successful management and restoration of mangrove forests. *Ecological Engineering*, 24(4): 403–418. <https://doi.org/10.1016/j.ecoleng.2004.10.003>; ^{xv}Spalding, M.D. & Leal, M., eds. 2021 *The State of the World's Mangroves 2021*. Global Mangrove Alliance. https://www.nature.org/content/dam/tnc/nature/en/documents/state_of_word_mangroves.pdf

<https://doi.org/10.4060/ce0633en-tab4.2> 

APPENDIX 5

ASSESSING THE CLIMATE CHANGE MITIGATION POTENTIAL OF FOREST AND LANDSCAPE RESTORATION MEASURES OF COUNTRIES ENGAGED IN KEY INTERNATIONAL INITIATIVES USING THEIR OFFICIAL CLIMATE CONVENTION SUBMISSIONS

CONTEXT AND OBJECTIVE

This appendix describes the methodology used in the study presented in [Box 3.5](#). This study estimated the climate change mitigation potential of forest and landscape restoration (FLR) measures conducted by countries participating in the Bonn Challenge, African Forest Landscape Restoration Initiative (AFR100) and Initiative 20x20, and reported in their official submissions to the United Nations Framework Convention on Climate Change (UNFCCC).

The Bonn Challenge, AFR100 and Initiative 20x20 are major global and regional efforts to restore degraded landscapes:

- ▶ Bonn Challenge launched by Germany and the International Union for Conservation of Nature (IUCN) in 2011: global goal of 150 million hectares (ha) by 2020 and 350 million ha by 2030.
- ▶ AFR100 launched in 2015: targets 100 million ha by 2030; current commitments total approximately 129.5 million ha.
- ▶ Initiative 20x20 launched in 2014 at the Twentieth Conference of the Parties to the UNFCCC: country-led regional platform that evolved from an initial ambition to restore 20 million ha by 2020 to a broader commitment of 50 million ha across Latin America and the Caribbean by 2030, explicitly in support of the Bonn Challenge.

The objective of this study was to produce standardized, comparable estimates of cumulative greenhouse gas (GHG) mitigation expressed in tonnes of carbon dioxide-equivalent (tCO₂eq) for 2021–2030, based on FLR actions reported in official UNFCCC submissions, using the Food and Agriculture Organization of the United Nations (FAO) Nationally Determined Contribution Expert Tool (NEXT) and subsequent analysis

in [R](#). The methodology follows a stepwise approach to generate the figures presented in the table in [Box 3.5](#).

COUNTRY COVERAGE

A total of 75 participants (sovereign states and subnational pledging entities and jurisdictions) participate in at least one of the three forest restoration initiatives analysed: the Bonn Challenge, AFR100 and Initiative 20x20.

- ▶ Bonn Challenge: 69 participants, including 30 that also participate in AFR100 and 16 that overlap with Initiative 20x20. Twenty-three countries (including one subnational entity) participate exclusively in the Bonn Challenge (Armenia, Azerbaijan, Bangladesh, Canada, Cuba, Gambia, Georgia, Iceland, India, Kazakhstan, Kyrgyzstan, Mongolia, Montenegro, North Macedonia, Pakistan, the United Kingdom of Great Britain and Northern Ireland [Scotland], Slovenia, Sri Lanka, Tajikistan, Türkiye, Ukraine, United States of America and Uzbekistan).
- ▶ AFR100: 34 African countries, with four participating exclusively (Lesotho, Namibia, Somalia, Zambia) and 30 overlapping with the Bonn Challenge. Not all AFR100 commitments are reflected as stand-alone Bonn Challenge pledges.
- ▶ Initiative 20x20: 18 participating Latin American and Caribbean jurisdictions (including one subnational entity), with two participating exclusively (Santa Cruz Department of the Plurinational State of Bolivia and Paraguay) and 16 overlapping with the Bonn Challenge.
- ▶ Data were available for 67 of the 75 participants: all 18 Initiative 20x20 countries, 33 out of the 34 AFR100 participants (all except the United Republic of Tanzania), and

61 out of 69 Bonn Challenge participants (all but India, Montenegro, North Macedonia, Slovenia, Türkiye, Ukraine and the United States of America). Participants were excluded based on not having explicit surface areas for FLR measures in their submissions to the UNFCCC to maintain comparability. Even when other national sources were available, only official UNFCCC submissions were used to ensure a standardized reference across countries and initiatives. These were the nationally determined contributions (NDCs), Biennial Update Reports (BURs) and Biennial Transparency Reports (BTRs).

This may bias the sample towards countries reporting area-explicit measures.

SCOPE OF FOREST AND LANDSCAPE RESTORATION MEASURES

According to IUCN, FLR is the ongoing process of regaining ecological functionality and enhancing human well-being across deforested or degraded forest landscapes. It goes beyond tree planting, promoting multifunctional landscapes that provide carbon storage, biodiversity, water regulation and productive land uses.

For this analysis, FLR actions were categorized into ten standardized types to allow consistent estimation of mitigation potential:

- ▶ Afforestation/reforestation (A/R): establishment or re-establishment of forests on non-forested or previously forested lands.
- ▶ Reduction of deforestation: actions preventing conversion of forest to other land uses.
- ▶ Forest restoration: rehabilitation, reconstruction, reclamation or replacement of degraded forests to enhance ecosystem functions.
- ▶ Sustainable forest management: practices that maintain and enhance the economic, social and environmental values of forests over time.
- ▶ Fire, fuelwood and disturbances management: mitigation of emissions from fires, harvesting, pests and other disturbances.
- ▶ Agroforestry systems: integration of trees with crops or livestock, including alley cropping, multistrata systems, silvopastoral systems, parklands, and shaded perennial crops.
- ▶ Assisted natural regeneration (ANR): facilitation of natural forest recovery on degraded lands.
- ▶ Sustainable or better management of non-forest lands: improved practices in cropland or grassland, such as conservation or reduced tillage.
- ▶ Wetland and mangrove restoration: rewetting and revegetation of mangroves, peatlands and other wetlands.
- ▶ Urban green: establishment of green spaces and infrastructure within settlements.

This categorization ensures consistent accounting of reported FLR measures across countries and initiatives, forming the basis for the NEXT analysis.

FAO'S NATIONALLY DETERMINED CONTRIBUTION EXPERT TOOL

The Nationally Determined Contribution Expert Tool (NEXT) is a new generation GHG accounting tool developed by FAO to support the annual environmental impact assessment of agrifood systems. It provides a 30-year time series of annual and cumulative estimates of carbon uptake and GHG emission reductions resulting from actions determined by the Parties in their climate policies. NEXT was developed using the methodologies of the Intergovernmental Panel on Climate Change (IPCC), and estimates can be made using either the 2006 IPCC Guidelines or the 2019 refinement of those guidelines, both of which are supplemented by the 2013 IPCC Wetlands Supplement. The tool has been designed to provide results that fulfil the provisions of the Enhanced Transparency Framework and support the development of NDCs as required by the modalities, procedures and guidelines. NEXT provides detailed time series of results and a wide range of indicators, including the social value of carbon, providing an environmental and economic overview of climate actions taken to meet mitigation targets. This tool helps countries to interpret, monitor and strengthen the ambition of their climate actions. NEXT is a land accounting standard for national and subnational GHG reduction targets, which measures annual changes in carbon stocks per unit of land (ha), as well as methane (CH₄) and nitrous oxide (N₂O) emissions, expressed in tonnes of carbon

dioxide-equivalent (tCO₂eq) per year. Thanks to the 30-year reading grid, NEXT can be used at several points in time over the period of a climate action taken to achieve climate change mitigation commitments:

- ▶ before the implementation of a climate action to assess potential changes in terms of GHG emission reductions;
- ▶ during the implementation of a climate action to assess and report on progress towards the mitigation goal, and assess the additional GHG emission reductions needed to meet mitigation commitments; and
- ▶ at the end of the climate action period, to assess the results achieved in terms of GHG emission reductions.

The 30-year time series of results by gas, by activity and by carbon reservoir helps understand the impact of past and current climate actions and define the actions needed and the corresponding international and national investments required if countries are to meet their climate targets. The full description of the tool is available in the technical manual.⁵⁸³

DATA SOURCES

Activity data for FLR measures were extracted from official UNFCCC submissions published between 2019 and 2025, including, NDCs, BURs and BTRs. Only measures with clearly defined surface areas were included to ensure comparability across countries and initiatives, thus excluding measures reported solely in qualitative terms (without area data). This approach provides a standardized, consistent reference across countries, even where other national datasets are available. Detailed sources for each country and initiative are presented in [Table A5.1](#), [Table A5.2](#) and [Table A5.3](#).

OVERALL ASSUMPTIONS MADE WITH FAO'S NATIONALLY DETERMINED CONTRIBUTION EXPERT TOOL

To ensure consistent and comparable results across countries, the following assumptions were made in the FAO NEXT study:

- ▶ Standardized climate, soil and ecological zones were used: Earth Map data were used, drawing on IPCC Climate Zones (2021 update), the IPCC Soil Classification (HWSD 2) and the FAO Global Ecological Zones (2010).
- ▶ Mitigation activities were assumed to occur at a linear rate over the implementation period.
- ▶ The base year was set to 2021, with projections extending through 2051. While NEXT generates results for the full 2021–2051 period, the study focused on the 2021–2030 decade to align with near-term climate change mitigation objectives.
- ▶ In terms of methodological framework, the analysis follows IPCC 2006 Guidelines, supplemented by the 2013 IPCC Wetlands Supplement.
- ▶ In terms of global warming potential (GWP), values were based on AR5 100-year horizon estimates, excluding climate–carbon feedbacks.
- ▶ Tier 1 default emission factors were used, except in explicitly stated cases where Tier 2 data were applied.

ASSUMPTIONS BY TYPE OF FOREST AND LANDSCAPE MEASURE

A standardized methodology was applied for each FLR measure to ensure comparability across countries. The following assumptions were made:

- ▶ Afforestation/reforestation (forest land module, afforestation/reforestation submodule):
 - Basic afforestation/reforestation: initial land use assumed to be grassland (or another specified land use); final land use assumed to be forest (most common type in country/region).
 - On degraded lands: initial land use assumed to be annual cropland (a proxy for degraded land); final land use assumed to be forest.
 - When measures were reported in tree numbers, 1 000 trees per ha was assumed.
- ▶ Reduction of deforestation (forest land module):
 - Initial land use: forest (most common type).
 - Final land use: grassland or other specified non-forest type.
- ▶ Forest restoration (forest land module, forest management submodule):
 - Land use: forest (most common type).
 - Biomass regrowth in target scenario: 40 percent.

- ▶ Sustainable forest management (forest land module, forest management submodule):
 - Land use: forest (most common type).
 - Biomass regrowth in target scenario: 10 percent.
- ▶ Fire, fuelwood and disturbances management (forest land module, forest management submodule):
 - Land use: forest (most common type).
 - Disturbance in reference scenario assumed linear (percent area per year).
 - Target scenario assumes no forest lost; all biomass in disturbed areas considered lost unless specific areas are provided.
- ▶ Agroforestry systems (cropland and grassland module):
 - Conversion to agroforestry: initial land use: perennial monoculture; final land use: agroforestry (most common type, using IPCC 2019 Tier 2 values).
 - Better management: modelled as conversion of 10 percent of the total area into agroforestry systems.
- ▶ Assisted natural regeneration (ANR, cropland and grassland module):
 - Initial land use: annual cropland – full tillage (proxy for degraded land); final land use: agroforestry (most common type, using IPCC 2019 Tier 2 values).
- ▶ Sustainable or better management of non-forest lands (cropland and grassland module):
 - Better management: initial land use: annual cropland – full tillage, low input; final land use: grassland (assessing soil carbon changes).
 - Reduced tillage: initial land use: annual cropland – full tillage; final land use: annual cropland – reduced tillage.
- ▶ Wetlands and mangroves restoration (wetlands module):
 - Mangrove restoration: initial land use: mangrove; final land use: rewetting and revegetation; biomass: initial = 0 tC, final = 70 percent of Tier 1.
 - Mangrove implementation on other coastal land: initial land use: other coastal land; final land use: mangrove.

- ▶ Urban green (cropland and grassland module):
 - Initial land use: settlement; final land use: urban green.

ESTIMATION OF CLIMATE CHANGE MITIGATION POTENTIAL

Each country was analysed in a dedicated FAO NEXT file. For each initiative, country-level results were compiled into a structured database capturing:

- ▶ FLR measure type (10 categories);
- ▶ action surface area (ha);
- ▶ climate type;
- ▶ soil type;
- ▶ NEXT line identifier; and
- ▶ annual and cumulative GHG mitigation (tCO₂eq) for 2021–2050.

The consolidated datasets were then processed in R, a statistical computing software, to aggregate results, calculate summary statistics, and generate the figures presented in the table in [Box 3.5](#).

Using the FAO NEXT Tool, the cumulative climate change mitigation potential of reported FLR measures for 2021–2030 was estimated for each country and measure. Outputs of annual and cumulative GHG removals and emission reductions were compiled by initiative, providing standardized and comparable estimates of mitigation potential across countries and FLR measure types.

DATA SOURCES FOR EACH COUNTRY

TABLE A5.1 DATA SOURCES FOR AFRICAN FOREST LANDSCAPE RESTORATION INITIATIVE COUNTRIES

Country	United Nations Framework Convention on Climate Change (UNFCCC) submission data used in the analysis	Comments
Benin	NDC2, 2021, p. 23, Table 7	—
Burkina Faso	NDC2, 2021, p. 34, Appendix 1	Only the ANR measure with clearly defined surfaces was assessed; other measures lacked surface data.
Burundi	NDC2, 2021, p. 62, Table 48 and Table 49	—
Cameroon	NDC2, 2021, p. 46, Table 4	—
Central African Republic	NDC2, 2021, p. 17 and p. 24	Only measures with clearly defined surfaces were assessed.
Chad	NDC2, 2021, p.22	—
Congo	NDC2, 2021, p. 13, Table 10	—
Côte d'Ivoire	NDC2, 2022, p. 31, Appendix 1	—
Democratic Republic of the Congo	NDC2, 2021, p. 45; BUR1, 2022, p. 54	Only measures with clearly defined surfaces were assessed.
Eswatini	NDC2, 2021 p. 2	Only measures with clearly defined surfaces were assessed.
Ethiopia	NDC2, 2021, p. 12, Table 3	—
Ghana	BUR1, 2021, 4.4.3.3.1, p. 109	—
Guinea	NDC2, 2021, p. 25 and p. 30	Only measures with clearly defined surfaces were assessed.
Kenya	BTR1, 2024, p. 12 and p. 68	NDC and BUR lacked area data; only one measure from BTR1 was assessed.
Lesotho	NDC2, 2021, p. 30, Table 5	—
Liberia	NDC2, 2021, p. 8, Table 3.1	Only measures with clearly defined surfaces were assessed.
Madagascar	NDC2, 2021, p. 49	Four measures presented; only two included surface areas.
Malawi	NDC2, 2021, p. 43	—
Mali	NDC2, 2021, p. 44	—
Mozambique	NDC2, 2021, p. 65	Forest fire management measure excluded due to unclear surface.
Namibia	NDC2, 2023, p. 29	Only measures with clearly defined surfaces were assessed.
Niger	NDC2, 2021, p. 14	—
Nigeria	NDC2, 2021, p. 25, Table 2	—
Rwanda	BUR1, 2021, p. 124, Table 3.13	Actions represent 43 percent of national land area.
Senegal	NDC1, 2021, p. 28	—
Sierra Leone	NDC2, 2021, Tables 7 and 8, p. 28	—
Somalia	BUR1, 2022, Table 47, p. 149	—
South Africa	BUR5, 2023, Table 3.3, p. 138	—
Sudan	BUR1, 2022, p. 51, Table 3.3	—
Togo	NDC2, 2021, p.106, Appendix 1	Only measures with clearly defined surfaces were assessed.



TABLE A5.1 (Continued)

Country	United Nations Framework Convention on Climate Change (UNFCCC) submission data used in the analysis	Comments
Uganda	NDC2, 2022 p.30, Table 4	–
United Republic of Tanzania	–	NDC provides no surface data; the National Forest Policy (2021–2031) includes surfaces but not clear.
Zambia	BUR1, 2021, p. 158	–
Zimbabwe	NDC3, 2025, p. 10, Table 3	–

TABLE A5.2 DATA SOURCES FOR INITIATIVE 20X20 PARTICIPANTS

Country	United Nations Framework Convention on Climate Change (UNFCCC) submission data used in the analysis	Comments
Argentina	BUR2, 2019, p. 224	There were three actions: afforestation, reduction of deforestation, and better management. Only afforestation had a specific goal, so mitigation potential is underestimated.
Belize	NDC2, 2021, p. 14	–
Bolivia (Plurinational State of) – Santa Cruz Department	NDC2, 2021, p. 19	Only Santa Cruz pledged to 20x20. National NDC reports at national level; 27 percent of total area was used for Santa Cruz estimate. The Plurinational State of Bolivia is not in the Bonn Challenge.
Brazil	BTR1, 2024, p. 70	NDC lacked details; BTR1 partially fills gaps but does not cover all actions.
Chile	NDC2, 2020, p. 55	Measures on reducing deforestation and wetlands mentioned; no surface area data provided.
Colombia	Adjunto2, NDC2, 2020, pp. 20–70	–
Costa Rica	NDC1, 2020, p. 78	Only measures with clearly defined surfaces were assessed.
Dominican Republic	NDC2, 2020, p. 29	Other measures on reforestation and deforestation lacked clarity, so they were not included.
Ecuador	BTR1, 2024, p. 32	Only measures with clearly defined surfaces were assessed.
El Salvador	NDC1, 2021, p. 44	–
Guatemala	NDC2, 2022, p. 39	–
Honduras	NDC2, 2021, p. 20	Only one major restoration action analysed; other actions lacked data.
Mexico	NDC2, 2022, p. 10	Only measures with clearly defined surfaces were assessed.
Nicaragua	NDC3, 2025, p. 69	Only deforestation reduction measure analysed; other targets lacked hectares or concrete actions.
Panama	NDC2, 2020, p. 49	–
Paraguay	NDC2, 2021, p. 89	–
Peru	BTR1, 2024, p. 68	No actions in NDC; BTR used. Measures grouped into single action but lacked precision.
Uruguay	NDC2, 2022, p. 22	Measures indicating areas to be “maintained” were not included due to lack of a reference baseline.

TABLE A5.3 DATA SOURCES FOR BONN CHALLENGE REMAINING PARTICIPANTS

Country	United Nations Framework Convention on Climate Change (UNFCCC) submission data used in the analysis	Comments
Armenia	BUR3, 2021, p. 65 and NDC2, 2021, p. 9	NDC2 included only afforestation; BUR3 presented multiple measures, most completed by 2021, only one relevant.
Azerbaijan	NDC3, 2025	—
Bangladesh	NDC3, 2025, p. 16	—
Canada	BTR1, 2024, p. 417	Few surfaces provided; surface area and mitigation potential likely underestimated.
Cuba	NDC2, 2020, p. 30	—
Gambia	BTR1, 2024, p. 80	—
Georgia	BTR1, 2024, p. 118	Eight forest goals; three lacked surface data, minimum values used to avoid double counting.
Iceland	BTR1, 2025, p. 85	NDC lacked surfaces; BTR1 2025 used; wetland restoration measure requires refinement.
India	—	NDC provided CO ₂ goal but no surface; not analysed due to potential double counting and overestimation.
Kazakhstan	NDC2, 2021, p. 17	Exact surface pledged for Bonn Challenge provided.
Kyrgyzstan	BTR1, 2024, p. 155	NDC2 lacked surface or mismatched; BTR1 used as most precise source.
Mongolia	BUR2, 2023, REDD+ policy: 2019 and 2024, p. 23, Tables 5, 6 and 7	NDC2 lacked surfaces; BUR2 used for 2015–2020 period.
Montenegro	—	No surfaces provided in NDCs or BURs.
North Macedonia	—	No surfaces provided in NDCs or BURs.
Pakistan	NDC2, 2021, p. 40	Other measures lacked areas; many measures outside the time range.
Slovenia	—	No surfaces provided in NDCs or BTR.
Sri Lanka	NDC2, 2021, p. 22	—
Tajikistan	NDC2, 2021, p. 30	Only surfaces explicitly provided in NDC and BUR were assessed.
Türkiye	—	No surfaces provided in NDCs or BTR.
Ukraine	—	No surfaces provided in NDCs.
United Kingdom of Great Britain and Northern Ireland (Scotland)	CLIMATE CHANGE PLAN The Third Report on Proposals and Policies 2018–2032, p. 165	—
United States of America	—	BTR1 mentioned 200 million ha, considered too high; no clear surface in NDC, not analysed.
Uzbekistan	BTR1, 2024, p. 59	—

NOTES

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- 10 **FAO**. 1996. *Rome Declaration on World Food Security*. Rome. [Cited 17 July 2026]. <https://www.fao.org/4/w3613e/w3613e00.htm>
- 11 **UNPFII (United Nations Permanent Forum on Indigenous Issues), EMRIP (Expert Mechanism on the Rights of Indigenous Peoples) & Special Rapporteur on the Rights of Indigenous Peoples**. 2023. *Joint statement by the United Nations mechanisms on the rights of Indigenous Peoples*. New York, NY, United Nations. [https://social.desa.un.org/sites/default/files/Statement-Three%20Mechanisms%20\(002\).pdf](https://social.desa.un.org/sites/default/files/Statement-Three%20Mechanisms%20(002).pdf)
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2026

THE STATE OF THE WORLD'S FORESTS

RESTORING FORESTS AND LANDSCAPES THE WAY FORWARD FOR A SUSTAINABLE FUTURE

Forest and landscape restoration is essential for achieving the 2030 Agenda for Sustainable Development and addressing the interconnected challenges of climate change, biodiversity loss, land degradation and food insecurity. Restoration can strengthen ecosystem resilience, support sustainable livelihoods and transform agrifood systems while also contributing to more sustainable and inclusive economies.

Restoration at scale does not happen by chance. It requires enabling policies and institutions, secure rights and tenure, sustained investments, effective partnerships, and approaches that are grounded in the science and local knowledge that meet local needs. Coordinated action across sectors and scales is necessary for people to effectively address the underlying drivers of degradation and create the conditions for long-term success.

This edition of *The State of the World's Forests* examines how forest and landscape restoration can be scaled to deliver lasting benefits for people and the planet. Drawing on the latest evidence and experiences from around the world, it explores four key pathways for accelerating restoration: empowering people and strengthening rights; implementing restoration at the landscape scale; mobilizing finance and business models that work for restoration; and creating coherent policies, institutions and legal frameworks.

Through case studies that span diverse ecosystems and contexts, this report highlights how restoration is being implemented in real-world conditions and the lessons that can be learned from these experiences. It identifies key barriers to scaling restoration and presents practical actions for bridging the gap between global commitments and on-the-ground impact, supporting a future in which restored landscapes contribute to resilient communities, thriving economies and healthy ecosystems.



ISBN 978-92-5-140871-1 ISSN 1020-5705



CE0633EN/1/09.26