Guidelines for forest landscape restoration in the tropics

ITTO Policy Development Series No. 23

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These guidelines are a joint effort of ITTO and members of the Collaborative Partnership on Forests, particularly the Center for International Forestry Research, the Food and Agriculture Organization of the United Nations, the Global Environment Facility, the International Union for Conservation of Nature, the International Union of Forest Research Organizations and UN-Environment. Other major collaborating institutions are the Asian Forest Cooperation Organization, the Center for People and Forests, WeForest and the World Resources Institute.

International Tropical Timber Organization

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The International Tropical Timber Organization (ITTO) is an intergovernmental organization promoting the conservation and sustainable management, use and trade of tropical forest resources. Its members represent the bulk of the world's tropical forests and of the global tropical timber trade. ITTO develops internationally agreed policy documents to promote sustainable forest management and forest conservation and assists tropical member countries to adapt such policies to local circumstances and to implement them in the field through projects. In addition, ITTO collects, analyzes and disseminates data on the production and trade of tropical timber and funds projects and other actions aimed at developing sustainable forest industries at both the community and industrial scales. Since it became operational in 1987, ITTO has funded more than 1000 projects, pre-projects and activities valued at more than USD 400 million. All projects are funded by voluntary contributions, the major donors to date being the governments of Japan and the United States of America.

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Foreword

Enormous changes have occurred in tropical forest landscapes in recent decades, and large areas—nearly a billion hectares—have become degraded and require urgent restoration. Considerable knowledge and experience exists on how to restore degraded forest landscapes, and there are many inspiring examples of success in the tropics. These guidelines have been compiled by two world-renowned experts with invaluable inputs from other dedicated forest landscape specialists and institutions around the globe, and they are presented in a comprehensive and easy-to-use form for policymakers, practitioners and other stakeholders.

Since its establishment in the 1980s, ITTO has been at the forefront of international policies on tropical forests and tropical timber trade. The Organization published the first guidelines for the sustainable management of tropical forests in 1990, and, through projects and training, it has assisted its tropical member countries to implement these and subsequent guidelines and other tools.

This new set of guidelines complements and builds on the *ITTO Guidelines for the Restoration, Management and Rehabilitation of Degraded and Secondary Tropical Forests*, published in 2002. Those guidelines represented the first international effort to provide overall guidance on tropical forest restoration, and they remain valid today. Under a joint initiative of the Collaborative Partnership on Forests (CPF), the present guidelines take a broader, landscape view, structured around six principles of forest landscape restoration (FLR) developed by the Global Partnership on Forest and Landscape Restoration. The principles are enriched in this document by 32 guiding elements and, for each of these, by recommended actions to put them into effect in the field. The publication includes 18 impressive case studies in the tropics—showing how FLR can be achieved and the challenges and opportunities it presents, especially for local people.

Interest in FLR has grown enormously in the international forestry community in recent years, perhaps because it is an inclusive, whole-of-landscape approach with promise to reverse land degradation, increase carbon storage, help conserve biodiversity and—importantly—create sustainable livelihoods for local communities. Inevitably, the restored, ecologically functional tropical landscapes of the future will differ from what we have known in the past. It is crucial, however, that they are able to deliver the ecosystem services and forest products we need—as local people and as national and global citizens. By adopting and implementing these guidelines, countries and communities will take an important step towards achieving the Sustainable Development Goals (SDGs). Indeed, the guidelines embody the aspirations of many of the SDGs and, in effect, offer a blueprint for achieving them.

I thank all those involved in the development of these guidelines, especially the two lead authors, Dr Jürgen Blaser and Dr Cesar Sabogal, without whose commitment the guidelines would not have attained such an exemplary standard. I also thank our partner institutions, including the members of the CPF, donors, and the experts who attended two preparatory workshops and helped make these guidelines so comprehensive and useful.

Considerable help is already available to tropical countries in the implementation of FLR, including that offered by ITTO and our partners in the CPF's Global Forest Landscape Restoration Initiative. It is our hope that this addition to the toolkit on FLR will prove catalytic in the widespread uptake and success of FLR in degraded tropical landscapes.

Dr Gerhard Dieterle
ITTO Executive Director

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- AFoCO, the Global Programme Climate Change and Environment of the Swiss Development Cooperation, the Collaborative Partnership on Forests Joint Initiative on Forest Landscape Restoration, and the Government of the Republic of Korea, for their financial contributions.

Acronyms and abbreviations

AFoCO	Asian Forest Cooperation Organization
ANR	assisted natural regeneration
Apremavi	Environmental and Life Preservation Association (Associação de Preservação do Meio Ambiente e da Vida) (Brazil)
BAM	Bosques Amazónicos SAC (Peru)
CBD	Convention on Biological Diversity
CF	community forestry
CFMC	community forestry management committee (Cambodia, Myanmar)
CFUG	community forest user group
CIFOR	Center for International Forestry Research
COBA	local basic community (Madagascar)
DECOIN	Defensa y Conservación Ecológica de Intag (Ecuador)
EETS	endangered, endemic and threatened plant species
FAO	Food and Agriculture Organization of the United Nations
FLR	forest landscape restoration
FORRU	Forest Restoration Research Unit (Chiang Mai University, Thailand)
FPIC	free, prior and informed consent
GE	guiding element
GIZ	German Corporation for International Cooperation (Deutsche Gesellschaft für Internationale Zusammenarbeit)
GPFLR	Global Partnership on Forest and Landscape Restoration
ha	hectare(s)
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
ITTO	International Tropical Timber Organization
IUCN	International Union for Conservation of Nature
IUFRO	International Union of Forest Research Organizations
LUD	Land-Use Dialogue
NGO	non-governmental organization
NTFP	non-timber forest product
REDD+	reducing emissions from deforestation and forest degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries
RESTS	Restoration Ecosystem Service Tool Selector
ROAM	Restoration Opportunities Assessment Methodology
ROOT	Restoration Opportunities Optimization Tool
SDG	Sustainable Development Goal
SER	Society for Ecological Restoration
SFM	sustainable forest management

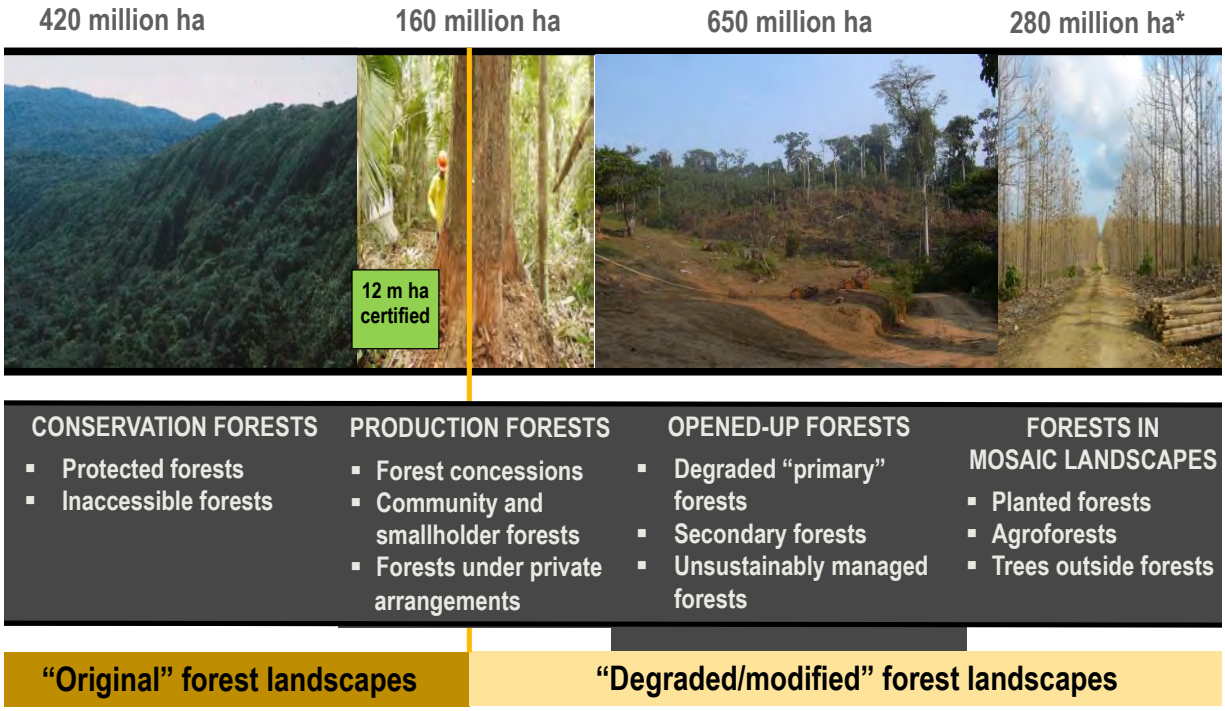
SLM	sustainable land management
SPS	silvopastoral system(s)
TPTI	Selective Cutting and Planting Technique (Indonesia)
TPTJ/SILI	Selective Cutting with Line Planting/Intensive Silviculture Technique (Indonesia)
USD	United States dollar(s)
WRI	World Resources Institute
WWF	World-Wide Fund for Nature

Introduction

Tropical forest landscapes worldwide have undergone unprecedented changes in the last several decades. Many that were once covered almost entirely by dense forests now feature vast areas of degraded forests and unforested lands, and primary forests have dwindled in area and become fragmented. Until quite recently, deforestation was linked to the intensification of shifting cultivation and pasture development; today, economically powerful actors are further changing tropical forest landscapes for agro-industrial uses, mining and infrastructure. Ecosystem services long provided by tropical forest landscapes are under threat, with major implications for sustainability—locally, nationally, regionally and even globally.

Figure 1 presents an estimate of the distribution of forest landscape elements in the humid and semihumid tropics in 2019. The total area is estimated at 1.51 billion hectares (ha), of which 580 million ha is classified as dense forest with either protection or production status. Another 650 million ha is considered "opened-up" forest at various stages of degradation, and 280 million ha is categorized as mosaic landscapes comprising a mix of agricultural land, rangelands, woodlots, agroforestry and silvopastoral systems. Thus, the area of degraded or otherwise modified landscapes in the humid and semihumid tropics is estimated at 930 million ha (i.e. the sum of opened-up forests and mosaic landscapes). This estimate is in the range of Brancalion et al. (2019), who estimated the restorable area in tropical rainforest landscapes globally at 863 million ha.

Figure 1: Estimated area of tropical forest landscapes globally



*Areas estimated by J. Blaser and C. Sabogal (based on Blaser et al. 2011 and FAO 2015).

Published in 2002, the *ITTO Guidelines for the Restoration, Management and Rehabilitation of Degraded and Secondary Tropical Forests* represented the first international effort to provide overall guidance on tropical forest restoration. Developed in close collaboration with the International Union for Conservation of Nature (IUCN), the World-Wide Fund for Nature (WWF), the Center for International Forestry Research (CIFOR) and the Food and Agriculture Organization of the United Nations (FAO), the guidelines were considered innovative at the time of publication because they targeted both policymakers and forest managers in promoting the restoration of degraded natural forests and the sustainable management of secondary forests. ITTO and IUCN subsequently published a complementary technical guide on forest landscape restoration (FLR) in 2005, encompassing landscape-scale approaches.

Since then, interest in the development of FLR has grown enormously in the international forestry community. Today, FLR is one of the three most prominent international themes in global forestry.[1] New international commitments and initiatives relevant to FLR have emerged, such as Aichi Biodiversity Target 15 set by the Convention on Biological Diversity (2011), the Bonn Challenge (2011), the New York Declaration on Forests (2014), the Global Partnership on Forest and Landscape Restoration (GPFLR) and the Global Landscapes Forum. FLR is embedded in the Sustainable Development Goals (SDGs), particularly SDG 15.,2 and the Global Forest Goals of the United Nations Strategic Plan for Forests. FLR processes and interventions are expected to be integral components of the national climate-change programmes of most tropical countries as a means to reduce greenhouse-gas emissions and increase carbon storage and in national plans to adapt forests and agricultural landscapes to changing climatic and environmental conditions.

The United Nations General Assembly has declared 2021–2030 the United Nations Decade on Ecosystem Restoration with the aim of scaling up restoration work to address the severe degradation of landscapes (including wetlands and aquatic ecosystems) worldwide. The intention is to boost ecosystem restoration to the top of national agendas, build on public demand for action on climate change and biodiversity loss and minimize the resultant impacts on economies, livelihoods and human wellbeing.

In addition to growing political interest, dramatic advances have been made in technical approaches to FLR, and new guidelines and tools have been developed in recent years.

The overall rationale for FLR is to restore degraded forests and forest lands and thereby enable the sustainable management of landscapes over time. As outlined in this document, FLR focuses on the restoration of degraded forests and supports a pathway for the sustainable management of restored landscapes. In a schematic view, restoration can be directed towards two main scales of intervention Figure 2):

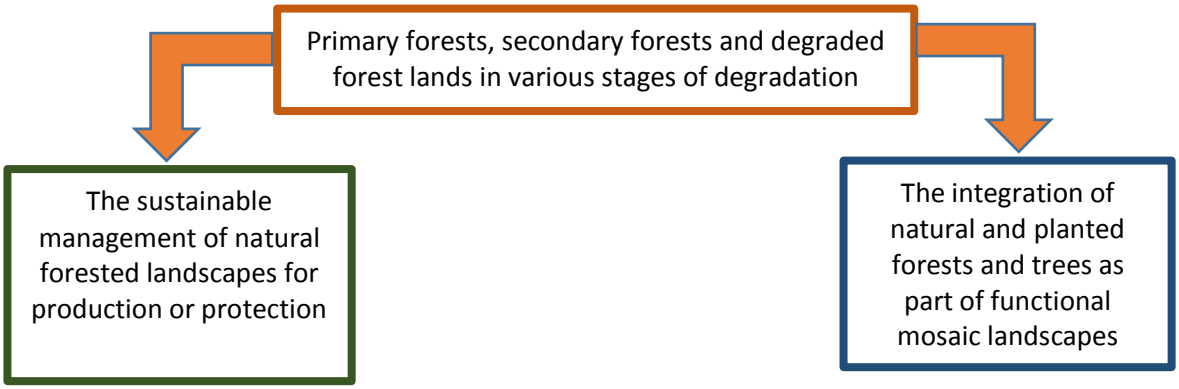
1) enabling the sustainable management of natural forests as part of the permanent forest estate containing both production and protection forests; and

[1] The other two are REDD+ and forest law enforcement, governance and trade.

2 “Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reverse land degradation and halt biodiversity loss.”

2) enabling the functionality of mosaic landscapes comprising a mix of land used for agriculture, rangelands, infrastructure, natural forests, planted forests and trees outside forests.

Figure 2: Two main scales of intervention for the restoration of tropical forest landscapes



Note: both intervention scales may co-exist within the same landscape.

Overall, the aim of FLR is to restore ecological functions and associated goods and ecosystem services while improving social outcomes (Mansourian & Vallauri 2014). Thus, FLR not only addresses degradation processes, it puts in place sustainable systems for the provision of forest goods and services and agricultural products (e.g. food, fodder and bioenergy).

These guidelines are directed towards both scales of FLR intervention outlined in Figure 2. They are linked fundamentally to the six globally agreed FLR principles using a conceptual framework of guiding elements and recommended actions, in line with other guidelines developed by ITTO, especially the *Voluntary Guidelines on the Sustainable Management of Natural Tropical Forests* (published in 2015).

In addition to this introductory section, this publication comprises two parts. **Part I** presents the guidelines themselves, with the following four main chapters:

- **Chapter 1** provides background and context for the document, defines its scope and sets out key definitions.
- **Chapter 2** presents the six globally agreed principles for FLR and elaborates these through a set of guiding elements. The principles are the fundamental rules for defining FLR, and the guiding elements are the components that should be in place to ensure adherence to those principles.
- **Chapter 3** sets out FLR interventions and recommended actions as they flow from the guiding elements in Chapter 2, and it lists tools and other knowledge materials to assist in such interventions and actions.
- **Chapter 4** provides recommendations on the use of the guidelines.

Part I also contains a glossary and a list of references and further reading.

Part II provides 18 illustrative case studies for implementing FLR under certain broadly representative restoration scenarios. The scenarios are defined in terms of the desired outcomes according to objectives set by local and other stakeholders, as well as by their specific drivers and degradation scenarios. Part II also distils some of the lessons learned from the case studies.

Part I: The guidelines

1 Background

Existing guidelines and tools for forest landscape restoration

Interest in the development of FLR has grown enormously in the international forestry community since the publication of the *ITTO Guidelines for the Restoration, Management and Rehabilitation of Degraded and Secondary Tropical Forests* in 2002 (Box 1).

The launch of the Bonn Challenge in 2011 and the New York Declaration on Forests in 2014 prompted the development of several sets of guidelines on the restoration of degraded lands and forests and their application through various processes and projects. Table 1 gives an overview of FLR guidelines developed since 2012.

Box 1: ITTO's guidelines on the restoration and management of degraded tropical forests

The *Guidelines for the Restoration, Management and Rehabilitation of Degraded and Secondary Tropical Forests*, published by ITTO in 2002, were the first forest restoration guidelines designed for pantropical use. Developed when tropical forest restoration was in its initial stages of development, the guidelines arose along with a realization that the extent of forest degradation in the tropics is vast, with an early analysis estimating that 350 million ha of tropical forest land had been so severely damaged that forests would not grow back spontaneously and a further 500 million ha of forest was either degraded or had regrown after initial deforestation. The existence of such large areas of damaged forest land was both a cause for concern and an opportunity to create a resource of immense value.

The 2002 guidelines stressed that the policy, legal and social conditions in and outside the forest must be analyzed and addressed before restoration, management and rehabilitation activities could be decided on. Many people have a stake in forests, and any restoration, management or rehabilitation efforts must be made with their full participation. It was further noted that tenure must be resolved, and transparent mechanisms were needed to resolve conflicts over property and access rights.

The guidelines identified a need to develop silvicultural techniques that could be understood and implemented by forest owners and managers. They were designed for humid natural forests and, given ITTO's emphasis on the permanent forest estate, excluded trees in agricultural landscapes.

Table 1: Overview of major guidelines and assessment tools for FLR

Guidelines	Year	Promoter(s)	Scope
Guidelines for the Restoration, Management and Rehabilitation of Degraded and Secondary Tropical Forests	2002	ITTO	Tropical, forest level, policy level. First comprehensive guidelines on tropical forest restoration. Has several shortcomings from today's perspective, but marked the starting point of today's broad FLR discussions
Rehabilitation and Restoration of Degraded Forests	2003	IUCN, WWF	Global, forest and landscape level, policy and implementation. Approaches to the restoration and rehabilitation of vast areas of degraded, fragmented and modified forests
Global Guidelines for the Restoration of Degraded Forests and Landscapes in Drylands	2015	FAO	Drylands, landscape level, policy, implementation and monitoring. Reference book with detailed step-by-step instructions for different levels of FLR
Scaling Up Regreening: Six Steps to Success	2016	WRI	Global, landscape level, policy level. Description of six important steps for successful FLR

Guidelines	Year	Promoter(s)	Scope
Implementing Forest Landscape Restoration: A Practitioner's Guide	2017	IUFRO	Global, landscape level, policy and implementation level. Modular packages on governance, design, technical aspects, monitoring, communication and climate-change mitigation and adaptation in FLR
International Standards for the Practice of Ecological Restoration	2019	SER	Global, landscape level, policy level. Sets out the steps required to plan, implement, monitor and evaluate restoration projects to increase the likelihood of success
Tools			
Restoring Forest Landscapes: An Introduction to the Art and Science of Forest Landscape Restoration	2005	ITTO, IUCN	Tropical forest, forest and landscape level, policy level. Presentation of complex restoration initiatives in a simplified way to provide a quick rating of where a given FLR project stands relative to various criteria
Forest Restoration in Landscapes: Beyond Planting Trees	2005	WWF	Synthesis of knowledge and expertise to help understand how forest restoration can be integrated with other aspects of conservation and development in landscapes
The Atlas of Forest and Landscape Restoration Opportunities	2009	WRI, IUCN, University of Maryland	Global, landscape level, policy level. Information management tool in the form of an interactive atlas aimed at helping identify opportunities for restoration
Principles and Practice of Forest Landscape Restoration	2011	IUCN	Case studies and analysis from dryland Latin America. Presents the results of an international research project designed explicitly to examine the application of an FLR approach to dryland forest ecosystems in the region
Forest Restoration Monitoring Tool	2012	FAO	Global, forest and partly landscape level, planning, implementation, monitoring. Checklist for the assessment of initial situations, implementation, monitoring and result-checking
Restoring Tropical Forests: A Practical Guide	2013	Forest Restoration Research Unit	Tropical biome, forest level, implementation and application. Generic, comprehensive practitioner's guide, with concepts and practices that can be applied widely in the tropics
Restoration Opportunities Assessment Methodology (ROAM)	2014	IUCN, WRI	Global process framework, national level, policy level. A step-by-step analytical framework for identifying suitable restoration techniques and priority areas for restoration
The Restoration Diagnostic	2015	WRI	Global, landscape level, monitoring. A tool for rapidly assessing the status of key success factors. Developed to help implement ROAM findings
Spotlight Tool	2015	IUFRO	Global, landscape level, policy level
Sustainable Financing for Forest and Landscape Restoration: Opportunities, Challenges and the Way Forward	2015	FAO, Global Mechanism	Overview of existing funding sources and financial instruments that could be used and adapted specifically for the implementation of FLR efforts at the national, regional and global levels. Also identifies innovative financing mechanisms such as payments for ecosystem services and crowdfunding that can support the achievement of global targets

Guidelines	Year	Promoter(s)	Scope
Short-term Action Plan on Ecosystem Restoration	2016	CBD	Restoration of degraded natural and seminatural ecosystems, including in urban environments, as a contribution to reversing the loss of biodiversity, recovering connectivity, improving ecosystem resilience, enhancing the provision of ecosystem services, mitigating and adapting to the effects of climate change, combating desertification and land degradation, and improving human wellbeing while reducing environmental risks and scarcities. The purpose of the action plan is to help Parties, as well as any relevant organizations and initiatives, to accelerate and upscale activities on ecosystem restoration
Restoration Opportunities Optimization Tool (ROOT)	2016	Stanford University, IUCN	Global, process framework at national level, policy level. A checklist for the assessment, monitoring and result-checking of FLR activities
Restoration Ecosystem Service Tool Selector (RESTS)	2016	IUCN	Global, process framework at national level, policy level. A decision framework for identifying models to estimate ecosystem services gains from FLR
Gender-responsive Restoration Guidelines: A Closer Look at Gender in the Restoration Opportunities Assessment Methodology	2017	IUCN	Guidelines developed to ensure that the application of ROAM and the ensuing FLR implementation, including any policy uptake and land-use planning, is gender-responsive. This means identifying, understanding, negotiating and implementing FLR in ways that can address gender gaps, overcome historical gender biases in policies and interventions related to FLR and ensure that the outcomes of FLR interventions benefit women equally
Decision Support Tools for Forest Landscape Restoration: Current Status and Future	2018	CIFOR	Global, landscape level, planning and monitoring. A review of available tools for guiding decision-making before and during FLR. The need for additional tools and analytical approaches is addressed
The Road to Restoration: A Guide to Identifying Priorities and Indicators for Monitoring Forest and Landscape Restoration	2019	FAO, WRI	A guide to help stakeholders develop monitoring systems tailored to their needs by identifying indicators and metrics to monitor progress toward their set goals
A Companion to the Short-Term Action Plan on Ecosystem Restoration (STAPER): Resources, Cases Studies, and Biodiversity Considerations in the Context of Restoration Science and Practice	2019	CBD	Provides step-by-step guidance to support governments in the development and implementation of their national restoration strategies. It is based on four main groups of activities and 24 steps. The document is intended as an introduction and guide to the broader collection of resources available on an online portal
Case-study collections			
WWF case studies	Since 2002	WWF	Series of lessons learned on forest landscape restoration (web-based)
GPFLR case studies	2019	GPFLR	Global, landscape level, case studies. A comprehensive collection of case studies on FLR providing an evidence base for FLR outcomes

Guidelines	Year	Promoter(s)	Scope
Diagnostic for Collaborative Monitoring in Forest Landscape Restoration	2019	CIFOR	A systematic way for FLR planners to assess their FLR initiatives against a checklist of success factors. Helps practitioners to: 1) determine whether they are ready for collaborative monitoring; 2) identify what elements need to be strengthened; and 3) assess whether existing monitoring systems are on the right track

Notes: See Annex 1 for more details. See "acronyms and abbreviations" for the full names of promoters.

To a greater or lesser extent, most existing sets of guidelines cover both policy and implementation. They strive for comprehensiveness and thus the spatial scope is usually relatively broad. On the other hand, several tools (e.g. ROAM, RESTS, ROOT, Restoration Diagnostics, Spotlight, and the FAO Forest Restoration Monitoring Tool—see Table 1) comprise more hands-on approaches to FLR implementation because they deal with its upstream and downstream processes;[3] such tools should be integrated into any new guidelines to the greatest extent possible.

The following main lessons can be obtained from the existing FLR guidelines and tools:

- **Geographical and thematic scope.** A large number of guidelines and tools exist covering various topics; many are global in scope. Drylands (tropical and temperate) are addressed in a specific set of guidelines, and there are also guidelines on mangroves and mined areas as well as for specific regions and ecosystems (e.g. highlands/Andean forests in Colombia; dry forests in some Indian states; and Atlantic forests in Brazil).

- **Policy and implementation.** Clear and applicable processes are often not provided, and the need to connect upstream and downstream processes is often neglected.

- **Reporting.** Success is commonly reported based on activities (projects) rather than outcomes (processes).

- **Stories of failures.** There is a tendency towards conformational bias favouring motivational "success" stories. Failed attempts are less reported.

- **Lack of data.** There is a lack of sufficient and reliable data on long-term outcomes.

Scope of these guidelines

The present guidelines constitute an international reference document for the development and improvement of national and subnational guidelines on FLR in the tropics. They provide guidance at the policy and operational levels for restoring degraded (production and protection) forests and formerly forested landscapes in tropical forest biomes.[4] The focus is on restoring functional forest ecosystems and multipurpose tree-based agricultural production systems in landscapes. The objectives are to increase the positive contributions of trees and forests to the ecological health,

[3] Upstream processes relate to the conceptualization and planning of FLR, downstream to monitoring and evaluation.
[4] The guidelines focus on forest lands; other land-use categories—cropland, grassland and settlements—are not addressed directly.

productivity and resilience of landscapes and to produce forest products (e.g. wood products, energy and food).

The guidelines are designed to provide a basis for policy decisions and a technical reference that can be used or adapted to the needs and capacities of users. They present the rationale for action and indicate the roles and responsibilities of stakeholders.

The guidelines are voluntary. They may be adapted as appropriate according to national and local circumstances.

Given the overall aims of regaining ecological functionality and enhancing human wellbeing in degraded forest landscapes, FLR (in the scope of the present guidelines) entails one or a combination of the following four broader intervention levels:

1) **Restoring degraded natural (production and protection) forests.** This option is typically implemented in areas where socioeconomic and environmental pressures have led to forest degradation (in terms of its extent, structure, composition and functions). This type of restoration may include conservation and silvicultural measures to ensure that previously productive forest has time to regenerate naturally, enrichment tree planting, and, above all, protecting land from uses that previously led to degradation. The aims of forest restoration in production forests may include interventions to sustainably increase the production of timber and non-timber forest products (NTFPs) and improve the supply chains for these; and, in production and protection forests alike, interventions to increase carbon storage, conserve biodiversity through the restoration of natural habitats, increase watershed protection and enhance landscape resilience.

2) **Managing secondary forests.** Secondary forests are usually an integral part of local and regional land-use and production systems in the tropics. Depending on the context (e.g. regarding tenure, site quality, biological potential, market, labour availability and managerial capacity), strategies may include managing secondary forest as an improved fallow in the crop–fallow cycle (e.g. as part of an agroforestry system) or as a high-forest production system for timber, multiple uses and conservation (ITTO 2002; Sabogal 2007). Secondary forest management as part of a landscape approach can be a cost-effective option that contributes to multifunctionality by accelerating natural regeneration, biodiversity recovery and carbon sequestration. The products and ecosystem services derived from secondary forests can diversify income through value-added processing and commercialization.

3) **Rehabilitating degraded forested or formerly forested land to improve protective and productive functions.** The rehabilitation of degraded lands and their buffer zones set aside for protective and production functions may involve establishing planted forests and trees (the latter, for example, distributed in patches across a landscape). The aim is to re-establish the landscape's protective functions, such as for water, soils and biodiversity, as well as the production of goods and ecosystem services to support livelihoods and generate income.

4) **Integrating trees in agricultural landscapes.** In this option, interventions may include increasing the density of trees in a landscape; preventing land degradation through improved conservation agricultural practices, such as agroforestry; the adoption of resource management

practices that minimize (for example) overgrazing, wildfire, overlogging and the overharvesting of woodfuel; and the protection of naturally occurring trees and shrubs on farms. The judicious integration of trees in agricultural landscapes can help sustain and increase crop yields, improve community livelihoods and incomes, and help in adapting landscapes and communities to climate change. Agroforestry is widely acknowledged as a climate-smart agricultural practice that can increase the productivity, sustainability and resilience of agricultural and pastoral landscapes. It represents a valuable means for restoring overexploited and low-productivity agricultural lands.

Target audience

These guidelines are designed for the widest possible set of stakeholders. Many actors have interests in the use and management of tropical forest landscapes. While some uses are mutually compatible, others are not. For example, some actors may wish to preserve natural forests (although interpretations of the term "preserve" may vary), and others may want to clear the same forest to better exploit its soils or minerals. Between these two extremes will be a wide range of actors with a broad set of uses for forests and landscapes. Therefore, the guidelines address the following stakeholder groups:

- **National and subnational forest and natural-resource policymakers**, such as government agencies dealing with forest management and conservation, agriculture, land-use planning, the environment, energy, water and mining; national development and extension agencies dealing with broader development issues, including the implementation of the SDGs, nationally determined contributions under the Paris Agreement on climate change, national adaptation programmes of action, and other development plans; and legislators, such as parliamentarians and political parties.

- **Restoration practitioners**, including forest managers and agricultural extensionists in state or local agencies.

- **Community-based organizations**, including **indigenous peoples and smallholder forest producer associations**.

- **Private-sector organizations**, such as small, medium-sized and large forest entrepreneurs and companies and their umbrella organizations, community enterprises and agricultural investment and trading groups.

- **Civil-society organizations**, such as environmental and development non-governmental organizations (NGOs) and advocacy groups.

- **Research and education institutions**—public and private forest research, education and training institutions and organizations.

- **Governments of ITTO consumer countries and other developed and emerging economies**, as well as **public and private international funding and development agencies**.

Structure: principles, guiding elements and suggested actions

The guidelines are based on the six globally agreed principles of FLR, which are elaborated through a set of guiding elements. The principles are the fundamental rules for defining FLR, and the guiding elements are the components that should be in place to ensure adherence to those principles. Interventions are suggested for each of the guiding elements, and tools and other knowledge materials are listed to assist in such interventions. The guidelines also provide illustrative case studies for the implementation of FLR.

Terms and definitions

A glossary is presented at the end of this document. Here, we address three crucial clusters of terms: 1) "forest"; 2) "landscape" and "restoration"; and 3) the unifying "forest landscape restoration". Because FLR includes a policy and implementation framework, FLR is also defined both as a process and at the intervention level (programmes and projects).

The term **forest** refers here to an area covered with trees (i.e. a forested area) according to national definitions of forests. Such definitions are mostly based on the definition used in the FAO Global Forest Resources Assessment (FRA) involving a minimum tree crown cover (e.g. 10%), a minimum tree height (e.g. 5 m), and a minimum area covered with trees attaining at least the minimum crown cover and tree height (e.g. 0.5 ha, as stated in the FRA guidelines for the 2015 and 2020 assessments).

Generally, three types of forest can be distinguished (see Box 2 for more details):

1) **natural forests**, which grow naturally on a site (generally from seeds that occur naturally);

2) **semi-natural forests**, which are natural forests that have been enriched with planted tree species and are managed through guided natural regeneration; and

3) **planted (or plantation) forests**, which have been established by planting or direct seeding. A tree-intensive agroforestry system that fulfils the forest definition can also be categorized as planted forest.

Multifunctional planted forests and close-to-nature planted forests are special types of planted forest. Multifunctional planted forests pursue silvicultural approaches designed to restore degraded landscapes and ecosystems, sustain rural people's livelihoods and provide ecosystem services. Close-to-nature planted forests are generally established with more than one tree species, with locally adapted and indigenous species, are often vertically structured in more than one layer, and may be uneven-aged (Thiel 2018).

Based on definitions in ITTO (2002), forests that have been altered beyond the normal effects of natural processes are categorized as either degraded forest, secondary forest or degraded forest land (Box 2). This is done for the purpose of illustrating concepts and as a simplified categorization of what is always a much more complex reality on the ground. Degraded primary forests, secondary forests and degraded forest lands usually exist in complex mosaics that are subject to constant change. Intermediate stages or combinations of conditions often exist in close proximity, and it may be difficult to distinguish between them. Each of the three conditions, however, has characteristics (as shown in Table 2) that must be taken into account when developing FLR strategies.

Secondary forest—a type of natural forest—is also sometimes called successional, regenerating or second-growth forest. Secondary forest is defined as woody successional vegetation regrowing on land that was largely cleared of its original forest cover by human intervention (Brown & Lugo 1990; Finegan 1992; ITTO 2002). Secondary forests are important for many rural people because they contribute to their livelihoods as sources of timber and non-timber products for meeting domestic local needs and for sale in markets. Secondary forests can also help conserve biodiversity, for example by maintaining connectivity in fragmented landscapes and by providing habitat for certain species, and they perform ecosystem services such as soil conservation and watershed protection.

The formation and subsequent dynamics of degraded and secondary forests are often influenced by interrelated forces acting at a landscape scale. The forces that lead to forest degradation exist across a continuum of forest-use intensity (Table 2).

Box 2: Categories of forests in the tropics

Natural forest

Primary forest.[5] Natural forest that has never been subject to human disturbance, or has been so little affected by hunting, gathering and tree cutting that its natural structure, functions and dynamics have not undergone any changes that exceed the elastic capacity of the ecosystem.

Modified natural forest. Natural forests managed or exploited for wood or non-wood forest products, wildlife or other purposes. The more intensive the use, the more the structure and composition has been altered from that of primary forests. Ecologically, the alteration often represents a shift to an earlier successional stage. Two major categories can be distinguished:

1) **Managed natural forest**—natural climax forest in which sustainable timber and non-timber harvesting (e.g. through integrated harvesting and silvicultural treatments), wildlife management and other uses have changed the forest structure and species composition from the original primary forest. All major goods and ecosystem services are maintained. A specific type of managed natural forest, **semi-natural forests**, is managed through enrichment planting or assisted regeneration with the objective of creating forests dominated by desirable (e.g. locally useful or high-value-timber) tree species.
2) **Degraded and secondary forests**—forests and forest lands that have been altered beyond the normal effects of natural processes through unsustainable use or through natural disasters such as storm, fire, landslide or flood. The following three conditions can be distinguished within this subcategory

i) **Degraded [primary] forest**[6]—natural climax forest in which the initial cover has been adversely affected by the unsustainable harvesting of timber and non-timber forest products so that its structure, processes, functions and dynamics are altered beyond the short-term resilience of the ecosystem. In other words, the capacity of these forests to fully recover from exploitation in the near to medium term has been compromised.

ii) **Secondary forest**—woody vegetation regrowing on land that was largely cleared of its original forest cover (e.g. to less than 10% of the original forest cover). Secondary forests commonly develop naturally on land abandoned after shifting cultivation, settled agriculture, pasture, failed tree plantations, surface mining, etc.

[5] Forests used by indigenous and local communities with traditional lifestyles consistent with the conservation and sustainable use of biodiversity are included in this category (as per the CBD).
[6] ITTO (2002) used the term "degraded primary forests", which is not commonly employed in international terminology.

iii) **Degraded forest land**—former forested land severely damaged by the excessive harvesting of timber or non-timber forest products, poor management, repeated fire, grazing or other disturbances or land uses that damage soil and vegetation to a degree that inhibits or severely delays the natural re-establishment of forest (i.e. secondary forest).

Planted forest and agroforestry

A forest stand that has been established by planting or seeding:

- **Afforestation**—the establishment of a planted forest on non-forested land.
- **Reforestation**—the re-establishment of trees and understorey plants at a site immediately after the removal of natural forest cover.
- **Agroforestry systems**—forest trees introduced to agricultural landscapes for specific purposes as isolated trees, in rows or woodlots, or in other configurations not necessarily qualifying as "forest". Woodlots are small patches of trees, either natural or planted, distributed within a mosaic landscape to form part of an agroforestry system (see also specific definitions of agroforestry in FAO 2018c).

Source: Modified from ITTO (2002).

Deforestation is the conversion of forests to land used for other purposes. Deforestation is often permanent, but sometimes forest land may revert to forest via natural recovery (successional vegetation) or reforestation. Deforestation inevitably results in the partial loss of soil fertility. Although small-scale deforestation for subsistence agriculture still plays a role in some tropical countries, most deforestation today is caused by the large-scale commercial conversion of forests for agriculture or livestock raising, the expansion of urban areas, and infrastructure development.

Forest degradation refers to the reduction of the capacity of a forest to produce goods and ecosystem services (FAO 2002), where "capacity" includes the maintenance of the elasticity of ecosystem structure and functions (ITTO 2005). Forest degradation can also be defined as human-induced arrested succession, which severely constrains underlying ecological processes. A degraded forest thus delivers a reduced supply of goods and ecosystem services at a given site. It has lost the structure, function, species composition, productivity and biodiversity normally associated with the natural forest type expected at that site.

Most forest degradation is driven by unplanned or uncontrolled timber extraction, logging, woodfuel collection, charcoal production, livestock grazing and fire (Hosonuma et al. 2012; Kissinger et al. 2012). Forest degradation is not a permanent state but a process in which various drivers intervene over time (Table 2).

Table 2: Differences between the three major categories of degraded and secondary forests

Status	Degraded [primary] forest	Secondary forest	Degraded forest land
	different stages →		
Intensity of disturbance	Slight-to-moderate intensity within the range of common natural disturbances	Severe intensity, caused by the clearing of most of the original forest cover	Drastic and repeated intensity, with the complete removal of the forest stand, soil losses, and changes in microclimate
Common causes of disturbance	▪ Excessive wood exploitation ▪ Overharvesting of non-timber forest products ▪ Destructive natural disturbances such as fire, storm and drought	▪ The clearcutting, burning and subsequent abandonment of an area without conversion to long-term agricultural use ▪ Catastrophic large-scale natural disturbances (e.g.	▪ Repeated overuse, repeated fire, overgrazing, and ecological mismanagement on fragile soils ▪ Soil erosion

Status	Degraded [primary] forest	Secondary forest	Degraded forest land
	different stages →		
	▪ Overgrazing; small-scale and long-rotation shifting cultivation	fire, flood, storm, landslide, drought)	▪ Surface mining operations ▪ Land-use change
Vegetation recovery process	▪ Relatively small changes in growth and regeneration dynamics, except where overgrazing prevents natural regeneration ▪ Relict trees are often damaged, are potential "losers" unable to achieve dynamic regrowth, or are phenotypically inferior ▪ Recovery is mainly through autogenous and spontaneous cycle replacement regeneration, usually complemented by coppicing and seed banks ▪ Overexploitation of timber may change the species composition from the original stand	▪ A sequence of successional changes takes place after the perturbation. In this process, several stages with specific floristic, structural and dynamic characteristics can be distinguished. The composition of plant species changes gradually, from early to late successional species ▪ A highly dynamic growth process begins, with high rates of carbon assimilation and biomass aggregation	▪ There is only very sluggish successional development after the cessation of the main disturbance ▪ The process generally leads directly from forest cover to grassland, bushland or, in extreme cases, bare soil surface
Site characteristics	▪ Forest structure remains more or less intact ▪ Light-demanding species regenerating after the disturbance are usually similar to those in the original forest stand	The regrowing forest differs in species composition and physiognomy from primary forest. Species are highly light-demanding	Forest vegetation is lacking; single or small groups of pioneer trees and shrubs may occur

Source: Modified from ITTO (2002).

Landscape and the landscape approach. The term landscape refers to an area of land containing a mosaic of ecosystems, including human-altered ecosystems. The term cultural landscape refers to landscapes containing significant human populations (Millennium Ecosystem Assessment 2003). ITTO (2002) defined landscape as a "cluster of interacting ecosystem types".

A landscape approach is broadly defined as a framework for integrating policy and practice on multiple land uses in a given area to ensure the equitable and sustainable use of land while strengthening measures to mitigate and adapt to climate change (Reed et al. 2014). Landscape approaches deal with processes that aim to reconcile conservation and development trade-offs (Sayer 2009) in a defined geographic area. FAO (2012) defined a landscape approach as one that deals with large-scale processes in an integrated and multidisciplinary manner, combining natural resource management with environmental and livelihood considerations.

According to Sayer et al. (2013), "landscape approaches seek to provide tools and concepts for allocating and managing land to achieve social, economic, and environmental objectives in areas where agriculture, mining, and other productive land uses compete with environmental and biodiversity goals". The Global Landscapes Forum (undated) defines a landscape approach as "about balancing competing land-use demands in a way that is best for human well-being and the environment. It means creating solutions that consider food and livelihoods, finance, rights, restoration and progress towards climate and development goals".

Integrated landscape management involves long-term collaboration among various groups of land managers and stakeholders to achieve multiple objectives, typically including agricultural and wood production; the provision of ecosystem services (such as water-flow regulation, the

maintenance of water quality, pollination, carbon sequestration, reducing forest degradation, and cultural values); biodiversity conservation; landscape beauty, identity and recreational value; and local livelihoods and human health and wellbeing (Scherr et al. 2013; Mankad 2014).

Sustainable land management (SLM) is "the use of land resources, including soils, water, animals and plants, for the production of goods to meet changing human needs, while simultaneously ensuring the long-term productive potential of these resources and the maintenance of their environmental functions" (United Nations 1992). Liniger et al. (2011) defined SLM as "land-use systems that foster appropriate management practices to enable land users to maximize the socioeconomic benefits for their land-based livelihoods, while maintaining or improving the ecological functions of the land resources".

A **mosaic landscape** is a landscape with moderate human occupancy that generally combines forests or woodlands with agriculture and small settlements, typical of many rural landscapes globally (Stanturf et al. 2019).

A **productive landscape** is a landscape capable of providing not just agricultural or forest products, but a wide range of products and (environmental) services and fulfilling the social, economic and environmental requirements and aspirations of present and future generations at the local, national and global levels (Zagt & Chavez-Tafur 2014).

A **forest or forested landscape** is a landscape dominated by forests (either natural or planted, or both).

Restoration is the "process of assisting [through human intervention and actions] the recovery of an ecosystem that has been degraded, damaged or destroyed" (SER 2004). IPBES (2018) defined restoration "as any intentional activity that initiates or accelerates the recovery of an ecosystem from a degraded state". Restoration efforts should be planned at the landscape level as an integrated part of the mosaic of land uses with the aim of re-establishing ecological integrity and supporting human wellbeing (Maginnis & Jackson 2003).

Landscape restoration involves a process aimed at restoring landscape structure, dynamics or functions, while understanding the landscape as a mosaic of interactive landscape units (Metzger 2001).

The term **forest landscape restoration**[7] (FLR) lacks a universal definition. Maginnis and Jackson (2002) defined it as "a planned process that aims to regain ecological integrity and enhance human wellbeing in deforested or degraded forest landscapes". Overall, it is understood that FLR focuses on restoring landscapes, not individual sites (Beatty et al. 2018) and aims to reverse the degradation of soils, agricultural areas, forests and watersheds, thereby regaining ecological functionality, both in discreet areas and at the landscape scale. Laestadius et al. (2011) defined FLR as an "integrating framework that can, and should, be applied across a range of land uses to ensure that key ecosystem functions and societal requirements are maintained and strengthened". FAO and RECOFTC (2016) considered FLR to be "an innovative approach that integrates restoration work in the forest with other activities across the landscape for achieving optimum productivity, both in commercial and

[7] Some experts and organizations favour the term "forest and landscape restoration", without changing the meaning (Laestadius et al. 2015). This document makes no differentiation between the two terms.

ecological terms". The GPFLR (Besseau et al. 2018) defined FLR as "an active process that brings people together to identify, negotiate and implement practices that restore an agreed optimal balance of the ecological, social and economic benefits of forests and trees within a broader pattern of land uses".

In these guidelines, FLR is defined as an ongoing process of regaining ecological functionality and enhancing human wellbeing across degraded and deforested forest landscapes. FLR is not an end but, rather, a means for regaining, improving and maintaining vital ecological and social functions, leading, in the long term, to SFM and SLM. FLR is more than planting trees—the aim is to restore entire landscapes to meet present and future needs and to offer multiple benefits over time. It is about:

- **forests**—because it involves increasing the number and health of trees in an area;
- **landscapes**—because it involves biophysical aspects, such as whole watersheds, as well as policy dimensions, multiple sectors and communities, potentially several jurisdictions, and diverse and potentially complex legal, social and cultural situations; and
- **restoration**—because it involves bringing back the biological productivity and economic, social and cultural values of landscapes to achieve benefits for people and the planet.

These guidelines distinguish between FLR as a process and FLR interventions.

FLR is a process, with three key elements: 1) participation; 2) adaptive management; and 3) a consistent monitoring and learning framework. It is mostly implemented through FLR interventions. Thus, FLR relates to policy and strategic decisions taken by governments or stakeholder platforms at the national, subnational or local level (or, ideally, a combination of these) and involves various intersectoral elements (e.g. institutions, policies, legal prescriptions, governance and technical approaches) that help advance FLR. FLR is the unfolding of activities or actions that create particular outcomes through the conscious decisions of those engaged in the process. It leads to a progression of states and stages that form a trajectory that has been communally defined but which allows adaptation over time.

An **FLR intervention** entails development-orientated implementation arrangements at either a relatively large scale (e.g. within a given political jurisdiction) or a small scale (e.g. within a local watershed). An FLR intervention is carried out in a certain timeframe, which may or may not span the long-term process of FLR. FLR interventions involve several phases (visioning, conceptualizing, implementing and sustaining; Table 3). Within an FLR intervention, a distinction can be made between an FLR programme, an FLR project and FLR activities:

- An **FLR programme** is an FLR intervention at a relatively large scale, such as within a given political jurisdiction, and it involves a written plan or defined policy aimed at achieving specified goals. An FLR programme generally features a process to develop the programme, the involvement of various organizations and institutions, specified arrangements and protocols for implementation, and assessment and evaluation against agreed criteria. FLR programmes are usually initiated by decision-makers in governmental or non-governmental organizations and therefore can be considered top-down. They can be time- and space-bound but also open-ended.

Most existing FLR programmes (as of early 2020) are linked to large-scale financing frameworks such as the Green Climate Fund, the Global Environment Facility and the Forest Carbon Fund.

- An **FLR project** is usually a site-specific intervention within a larger landscape and is often dedicated to local development, which is limited in scope and time and financed with national or international development resources. An FLR project can be self-standing or integrated within a wider programmatic approach.

FLR activities are performed to achieve certain goals or fulfil particular programmes. They can be top-down, bottom-up, or a mix of these encompassing multiple actors, collaborators and stakeholders; and they can involve a single or multiple sites. FLR activities are time- and space-bound and have budgets and clear deliverables.

SFM and FLR—how do they relate?

Sustainable forest management (SFM) is defined here as the "process of managing forest to achieve one or more clearly specified objectives of management with regard to the production of a continuous flow of desired forest products and services without undue reduction of its inherent values and future productivity and without undesirable effects on the physical and social environment" (ITTO 2016).

Sustainably managed natural forests can be sources of a diverse array of products, ecosystem services and economic, social and cultural opportunities. They also have many local and non-local stakeholders. Managing a natural forest for a single product or service may affect its capacity to provide others—for example, a relatively high rate of timber harvesting may affect a forest's value as habitat for wildlife. Decisions on trade-offs in the provision of various goods and ecosystem services are best made using processes that involve the full range of stakeholders. Forest managers applying SFM must continually balance various management objectives that inevitably change over time as society's needs and values change; this is the challenge of SFM. Although embedded in the laws of many countries, multipurpose forest management has proven to be a complex endeavour that faces a range of economic, social and institutional barriers (Garcia-Fernandez et al. 2008; Guariguata et al. 2010; Sabogal et al. 2013). Nevertheless, success stories in the tropics in both private and community-based forest management show that it can be made to work for the benefit of communities and forests (Gilmour 2016; Sabogal & Casaza 2010; FAO 2005).

Natural tropical forest management will likely take place increasingly in what might be called "anthropogenic" forests and in predominantly agricultural landscapes (mosaic landscapes). Thus, FLR will increasingly need to address the trajectories and quality of forest patches in spatially and temporally dynamic landscape matrices (Chazdon et al. 2016). FLR can enable the restoration of the ecological functioning and production potential of landscapes, including patches of natural and planted forests, based on an assessment of needs and conditions. Thus, depending on those needs and conditions, various technical approaches—such as ecological restoration, natural regeneration, assisted natural regeneration, enrichment planting, reforestation, afforestation and agroforestry—may be adopted across the mosaic of land uses as part of FLR.

SFM and FLR have strong linkages with adaptation. Forest management and restoration practices decrease the vulnerability of forests to climate change and the overall vulnerability of forest-

dependent communities (Rizvi et al. 2015). Measures that reduce the vulnerability of a forest stand or landscape play a positive role in ensuring resilience after disturbance; for example, appropriate site preparation can enhance the regenerative capacity of an ecosystem by removing inhibiting factors for seedling growth or by increasing the variability of site conditions (Spathelf et al. 2018). FLR is a promising option for integrating climate-change mitigation and adaptation through REDD+ activities in forests while ensuring the sustainable management of forest goods and services across an entire landscape with the active engagement and collaboration of all stakeholders (Rizvi et al. 2015).

Adaptive measures comprise all actions that increase the adaptive capacity of forests and forest landscapes to changing environmental conditions (IUFRO 2016). This may be at the scale of individual forest stands (e.g. regeneration, tending and thinning) or landscapes (e.g. disturbance management) (Spathelf et al. 2018). Another important measure to increase the restoration capacity of a forest after disturbance is to retain sufficient ecosystem "legacies" (e.g. seed trees, deadwood and stand remnants), thus increasing the structural diversity of stands. Legacies provide seed dispersal, nutrient translocation, water storage, and the maintenance of genetic information in the recovery phase of an ecosystem after disturbance. Legacies increase the number of potential pathways for ecosystem restoration after disturbance (Spathelf et al. 2018).

The application of internationally accepted principles of SFM in forests being degraded by forest practices can contribute to climate-change mitigation, biodiversity conservation and sustainable use goals (Collaborative Partnership on Forests 2009).

Financing and investing in FLR

FLR is a major effort that requires substantial resources to develop a vision and to subsequently conceptualize and implement this vision before arriving at sustainability. The ambition is that, over time, restored forests and mosaic landscapes will become economically, socially and environmentally sustainable. The first three phases of FLR—designing/visioning, conceptualization and implementation—typically require targeted funding. Potential funding sources include national governments (including national forest funds and locally generated funds), bilateral (governmental and private) donors, and multilateral finance bodies such as the Green Climate Fund, the Global Environment Facility and development banks. Opportunities for private investment or blended finance (with shares of both public and private finance) are likely to increase as a project transitions towards the sustainability phase.

A forest can become degraded quickly, but FLR entails continuous effort over long periods. There are two main potential investment types, which may be intertwined in a given landscape:

1) those aimed at more intensively used landscapes in mosaics that include various land uses, potentially ranging from small-scale agroforestry to industrially managed agroforestry commodities, timber concessions and planted forests; and

2) those aimed at restoring natural forests for protection or production purposes, including secondary forests, in which the provision of multiple ecosystem services (including biodiversity conservation) is the primary objective, at least in the early stages of restoration.

Industrially managed forest landscapes can create significant economic benefits in addition to meeting important social and environmental goals, including net positive financial impacts (private benefits) and net positive economic impacts (public benefits) relative to the *status quo* land use.

The economics of the second development pathway listed above are less attractive to private investors than the first. The suite of ecosystem services produced in such forests is typically broader than in commercially oriented planted forests, but many of the benefits have the characteristics of public goods and are not traded in markets. The availability of financial resources for restoring degraded natural forests is limited, and few value chains for timber and NTFPs exist that generate marketable products early in the restoration process. One option may be to require investors pursuing a commercially oriented FLR pathway to earmark a certain proportion of a landscape for natural forest restoration. Alternatively, fiscal returns from commercially managed forests could be allocated for this.

The two basic types of investments for FLR—that is, weighted either towards commercial outcomes or towards public good outcomes—are both legitimate, but one cannot substitute for the other. At the larger scale, both are needed and should be viewed as complementary, with the relative spatial allocation of the two strategies a matter of societal need and choice.

Strategic landscape planning is recommended for both. Stakeholders should be identified and the expected costs and benefits of FLR interventions—monetary and non-monetary—assessed. This will help identify likely trade-offs among competing interests. Moreover, modalities for achieving an equitable distribution of costs and benefits among stakeholders need to be agreed in order to achieve lasting restoration outcomes. Such a planning process entails significant data requirements, including evidence-based estimates of economic, social and environmental outcomes.

A possible funding stream that serves the purposes of FLR as well as climate-change mitigation is REDD+. There are many synergies in the two approaches, but it is important to recognize that they have different emphases. REDD+ focuses on reducing carbon emissions and enhancing carbon sinks, while other benefits, such as increased ecological integrity and social wellbeing, are ancillary. FLR aims to improve ecological integrity and social wellbeing, including through the enhancement of carbon stocks and other benefits. Nevertheless, aligning FLR and REDD+ can create positive incentives and encourage jurisdictional-level programmes and projects.

Monitoring and communication to attain commitment and public support

A lack of adequate data, knowledge and expertise on the ecological, socioeconomic, silvicultural and institutional dimensions of forest landscapes affects and influences people's understandings and often results in poor policies and management, further resource degradation and inappropriate land use. Communicating the outcomes of FLR monitoring, therefore, is essential for increasing understanding of the costs and especially the benefits of FLR, ensuring that all stakeholders continue to "buy into" FLR and supporting related decision-making.

Effective monitoring and communication are essential for ensuring:

- broad political commitment and ongoing multisectoral coordination;

- the mobilization and use of available scientific, local and traditional knowledge and technical expertise;
- the ongoing sharing of knowledge and dissemination of lessons learned to scale up successful FLR programmes and projects to the landscape scale and beyond;
- a broad understanding of the economic, social, cultural and environmental context, and changes in this context, in which this knowledge is being applied;
- stakeholder support, the development of policies and measures conducive for FLR, national budgetary allocations, international financing and private-sector investments in FLR; and
- that the necessary changes are made when interventions are not delivering the expected outcomes—that is, the application of an adaptive management approach.

2 Principles and guiding elements for forest landscape restoration in the tropics

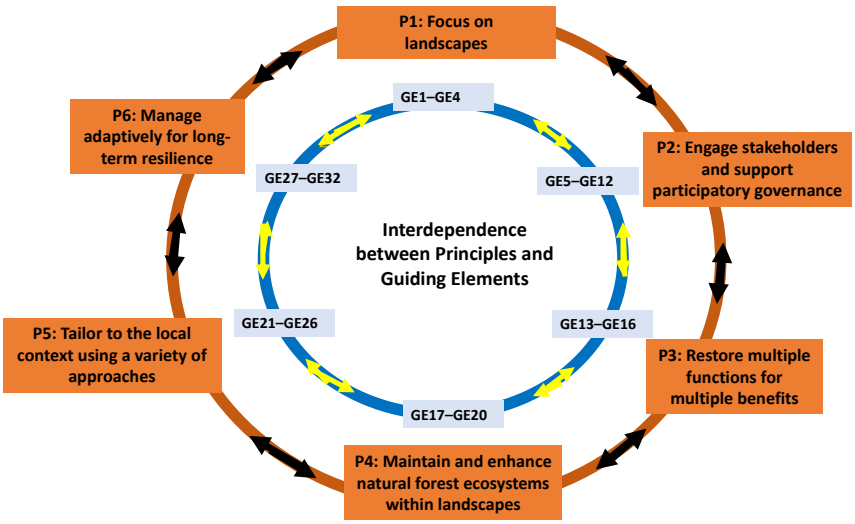
The principles and guiding elements presented here have been formulated to assist stakeholders in the development and monitoring of national policies aimed at creating enabling conditions for successful FLR implementation and outcomes. FLR is not an end in itself but, rather, a means for regaining, improving and maintaining vital ecological and social functions (Besseau et al. 2018). Policies aimed at encouraging FLR should help create resilient, sustainable tropical landscapes in which forests play a major role.

The six internationally recognized principles of FLR adopted in 2018 (Besseau et al. 2018) are:

1) Focus on landscapes
2) Engage stakeholders and support participatory governance
3) Restore multiple functions for multiple benefits
4) Maintain and enhance natural forest ecosystems within landscapes
5) Tailor to the local context using a variety of approaches
6) Manage adaptively for long-term resilience.

These principles, which are explained and elaborated on below in accordance with Besseau et al. (2018), provide the conceptual basis of the present FLR guidelines. The guiding elements herein further describe each principle and the conditions needed for successful FLR (Table 3); together, the principles and guiding elements form a continuum defining FLR as a concept (Figure 3). Note, however, that although a strong effort has been made to encompass all the important aspects of FLR in the guiding elements, they are not exhaustive given the complexity of forest landscapes and the huge diversity of site-specific contexts.

Figure 3: Principles and guiding elements of FLR—a continuum



Note: P = principle; GE = guiding element.

Table 3: Overview of the six principles and 32 guiding elements of FLR

P1	Focus on landscapes
GE1	Undertake inclusive, gender-responsive landscape-level assessment & land-use planning
GE2	Gain recognition that FLR must transcend sector policies
GE3	Conduct FLR at an appropriate scale
GE4	Address tenure and access rights
P2	Engage stakeholders & support participatory governance
GE5	Build adequate governance capacity for decentralized FLR
GE6	Obtain strong stakeholder engagement
GE7	Conduct joint stakeholder analysis of the drivers of degradation
GE8	Strive for social equity and benefit sharing
GE9	Conduct participatory FLR planning, decision-making and monitoring
GE10	Build stakeholder capacity for sharing responsibility for FLR
GE11	Address long-term financing for FLR initiatives
GE12	Establish a favourable investment environment for FLR
P3	Restore multiple functions for multiple benefits
GE13	Generate multiple functions and benefits
GE14	Conserve biodiversity and restore ecological functions
GE15	Improve livelihoods
GE16	Make full use of locally based knowledge
P4	Maintain and enhance natural forest ecosystems within landscapes
GE17	Avoid the conversion of natural forests
GE18	Restore degraded forests and rehabilitate degraded forest land
GE19	Avoid forest fragmentation
GE20	Conserve natural grasslands, savannas and wetlands
P5	Tailor to the local context using a variety of approaches
GE21	Assess local context and restrictions
GE22	Allow for future changes in conditions
GE23	Tailor FLR interventions to the local context and generate local benefits
GE24	Achieve the financial and economic viability of FLR investments
GE25	Identify opportunities to increase local incomes
GE26	Develop sustainable supply chains
P6	Manage adaptively for long-term resilience
GE27	Take an adaptive management approach
GE28	Continually measure the biophysical dimensions of the landscape
GE29	Periodically assess vulnerability to climate change
GE30	Develop participatory monitoring of FLR
GE31	Encourage open access to, and the sharing of, information and knowledge
GE32	Report on FLR outcomes

Note: P = principle; GE = guiding element.

Principle 1: Focus on landscapes

Rationale

FLR takes place within and across entire landscapes. It focuses on restoring landscapes, not individual sites (Beatty et al. 2018). FLR needs to be planned and organized at the landscape scale and not in forested areas alone. It should consider the variety of existing interacting land uses and tenure and governance arrangements in the landscape and, to the greatest extent possible, it should enable flexibility as conditions change in the future.

The rationale for this principle is to attain commitment for the restoration of degraded forests and non-forest land at the landscape scale, based on adequate land-use planning. All types of forests need to be managed sustainably in any given landscape. Appropriate policies and associated legal frameworks are needed to create the necessary enabling conditions, requiring, among other things, a policy and governance framework that goes beyond the forest sector (to include, for example, the agricultural, livestock, mining and energy sectors). A broader focus on forest landscapes is supported at the international level by, for example, the SDGs (particularly SDG 15), the Bonn

Challenge, REDD+, and financing mechanisms such as the Green Climate Fund and the Global Environment Facility.

FLR will only be successful when the underlying causes of deforestation and forest degradation are understood and addressed, particularly those related to land tenure, governance, market failure and a lack of policy coordination (Mansourian 2017), taking into consideration the interests of all stakeholders (IPBES 2018). Understanding, influencing and building consensus among all land-user groups and shaping landscape governance is crucial for the successful implementation of FLR.

Guiding elements

GE1: Undertake inclusive, gender-responsive landscape-level assessment and land-use planning

Knowing the resource base—including the biophysical, economic, social and ecological conditions—is crucial for developing effective FLR. Robust baseline data should be gathered at the landscape scale, and inclusive land-use planning processes should be in place that will enable the development of multifunctional landscapes.

As part of land-use planning, clear decisions are needed on which areas will be used for agriculture in the short and long terms and which will be devoted to conservation, SFM and the permanent forest estate.[8] The right balance among FLR interventions can vary widely according to context.

Sustaining FLR must go beyond projects. A participatory diagnosis of the economic, social and biophysical conditions is required as a basis for the implementation, monitoring, evaluation and adaptive management of FLR.

Land-use planning should be conducted jointly and cross-sectorally with the participation of all stakeholders, supported by experts, to ensure fair and transparent decision-making and to minimize and best manage conflicts over land use within a landscape, taking into consideration the specific context for both women and men and for indigenous peoples.

GE2: Gain recognition that FLR must transcend sector policies

Policies are needed to promote FLR, leading to laws and regulations that enable the retention of natural forests and favour FLR programmes that simultaneously restore the productivity of degraded forest lands, increase their value in the range of goods and ecosystem services provided, and use the most appropriate methods for sustaining restoration. FLR policies need to be people-centred and applied cross-sectorally.

FLR will only succeed if broader land-use governance is effective. Adequate, enforceable land-use policies need to be in place to ensure the long-term success of FLR.

Not all deforestation is avoidable. Economic and social drivers may make it necessary to convert substantial areas of degraded forest and deforested land to agriculture and other land uses. Appropriate conditions and rules should be in place, however, before land-use change is undertaken to ensure that such conversion does not risk sustainability and that FLR is applied to the fullest possible extent. it is crucial that agricultural policies do not contradict forest policies and that environmental policies are taken into account in all land-use decisions. Thus, multisectoral approaches are key to achieving sustainable landscapes.

Policy instruments should have a sound economic base. Given that FLR will bring social benefits that may not be accounted for in the market, policies are needed to buffer such schemes from market failure.

GE3: Conduct FLR at an appropriate scale

A landscape does not always correspond with a single jurisdiction.

Focusing on landscapes requires the identification of an appropriate scale for FLR that balances economic, social and environmental

GE4: Address tenure and access rights

Transparent and equitable approaches to land tenure, access, customary rights and property rights are essential for ensuring the long-term security of FLR investments.

[8] The permanent forest estate is that part of the overall forest of a country or other jurisdictional region designated (generally by law) to be retained as forest indefinitely.

needs. Defining the scale is essential when visioning and conceptualizing FLR. Landscapes often transcend political boundaries and jurisdictions and achieving FLR may require coordination and cooperation across these. This will become more achievable if FLR commitments are aligned with national and subnational policy objectives on land use, climate, biodiversity and desertification, as appropriate.

Clear land-tenure and property rights need to be in place to prevent further forest degradation and inappropriate conversion to other land uses. In many cases, degraded and secondary forests have overlapping tenure claims involving the state, the private sector and local communities. As a result, conflicts over access rights are common, often resulting in unsustainable use and further degradation of the resource.

For successful FLR, land-tenure, resource-access and management rights must be unambiguous and universally respected. Conflicts over such rights must be resolved through transparent processes that also benefit marginalized groups.

Principle 2: Engage stakeholders and support participatory governance

Rationale

Stakeholder participation and collaboration is essential for optimal FLR outcomes. In developing FLR interventions, the diverse requirements, values and perspectives of stakeholders need to be harmonized and their knowledge and experience adequately used.

FLR actively engages stakeholders—including women, young people and vulnerable groups—in planning and decision-making regarding land use, restoration goals and strategies, implementation methods, benefit sharing, and monitoring, assessment and review.

Understanding how stakeholders relate in a landscape is crucial for successful FLR programmes and projects (Stanturf et al. 2017; Mansourian & Parrotta 2018). Some may have been living in a landscape for generations, some may be relatively recent arrivals, and others may be affected by (and affect) the landscape indirectly. To a greater or lesser extent, the various stakeholder groups are responsible for land-use dynamics in a landscape, including degradation processes. It is important, therefore, to engage them in the analysis of drivers of landscape degradation and to collaboratively formulate meaningful FLR interventions and define the costs and benefits for each group of actors. Substantial time may be required to develop a common FLR vision and achieve an agreed, equitable distribution of costs and benefits among stakeholders.

Guiding elements

GE5: Build adequate governance capacity for decentralized FLR

Decentralized control and decision-making can provide the enabling conditions for FLR interventions.

Sustainable outcomes for FLR require understanding and collaboration among institutions at all levels. Local-level institutions that oversee on-the-ground implementation require adequate capacity, including to address sectoral policies and actors (e.g. in forestry, agriculture, land-use planning, transport,

GE6: Obtain strong stakeholder engagement

It is important that local communities and stakeholders participate actively in and share responsibility for decision-making in planning and implementing FLR. Local leadership, trust and social cohesion are crucial ingredients for representative, long-lasting FLR.

FLR stakeholders may operate at vastly different scales; for example, they may comprise both global corporations and local vulnerable groups. Stakeholder engagement processes should aim to ensure the appropriate participation of all actors, minimize power imbalances and achieve equitable outcomes.

Partnerships and strong working relations should be forged among communities, local and regional governmental organizations, NGOs

energy and mining) with potential to influence FLR.

and donor organizations to help communities enforce forest use and management rules, provide financial and technical support for restoration and conservation activities, and increase capacity to sustainably and equitably manage forests and other natural resources. Engagement should include indigenous peoples and local communities and their prior and informed consent.

GE7: Conduct joint stakeholder analysis of the drivers of degradation

The causes of forest and land degradation should be eliminated. To do so, a common and sustained effort is required among all stakeholder groups.

FLR requires a good understanding of the underlying processes causing change in a landscape. Such an understanding will form the basis for developing scenarios and a shared vision among stakeholders. Landscape degradation may have been caused by a single major event (e.g. planned deforestation) or by repeated low-level disturbances. It is important to ensure that the causes of degradation have ceased to influence the landscape (or can be adequately controlled) before a formal FLR process begins.

To be effective, analyses of the causes of degradation, and decisions regarding their elimination, should be made at the appropriate level as part of the participatory process.

GE8: Strive for social equity and benefit sharing

Stakeholders should strive for the equitable sharing of the market and non-market costs and benefits of FLR, which should enhance and diversify local livelihoods.

For FLR to be effective and sustainable, all stakeholders must understand and support the process underlying it. Stakeholders should strive for agreement on the equitable distribution of incentives, costs and benefits. Local people should be empowered to participate fairly in reaching such agreement.

GE9: Conduct participatory FLR planning, decision-making and monitoring

The effective participation of stakeholders in the planning and monitoring of FLR processes and projects is vital for success.

As outlined in GE1, all stakeholders need to be included in the planning of FLR from the beginning. It is also crucial that all stakeholders have the opportunity to be involved in monitoring and evaluating FLR based on transparent procedures, including to provide a range of perspectives on outcomes and to ensure that the full suite of lessons is learned from successes and failures.

GE10: Build stakeholder capacity for sharing responsibility for FLR

There is a need to strengthen the capacities of institutions operating within landscapes.

Unleashing the potential of FLR may require developing the capacity of local stakeholder groups and institutions to work effectively together and with other, more-powerful stakeholders.

The collaborative use of decision-support tools and the development of scenarios, maps and restoration plans can be means for engaging stakeholders in FLR.

Building community capacity in leadership, participatory decision-making, negotiation and monitoring may be needed for empowerment and meaningful engagement.

Institutions must have the capacity to monitor the effectiveness of their programmes, learn from their experiences, manage their knowledge, and adapt their programmes on the basis of continued learning.

GE11: Address long-term financing for FLR initiatives

Sufficient resources must be committed to initiate FLR processes and implement FLR interventions.

FLR needs considerable initial resources. Returns are often only realized in the mid to long term, however, particularly when the

GE12: Establish a favourable investment environment for FLR

Investments are needed to ensure the restoration and sustainable management of degraded forests and landscapes, and

restoration effort is focused on forestry. Restoration and rehabilitation efforts incur what has been called a "time tax", which is the time that society must spend waiting for a resource to regrow—during which the resource cannot be used and must be nursed. This implies costs without immediate returns on investment.

Small projects can be clustered to create synergies and increase efficiency, but additional funding sources may need to be unlocked by highlighting the importance of FLR to sectors beyond forestry.

Successful FLR projects need to address long-term funding with multiple strategies tailored to the various phases of FLR. The funding portfolio can be broadened to include payments for ecosystem services or to tap the potential of mechanisms such as biodiversity offsets, financing for deforestation-free commodities, and climate funding, including carbon markets and results-based payments for climate-change mitigation.

these are most likely to be forthcoming with conducive policies and institutions.

The economic challenge for FLR is to ensure positive financial returns and hence the attractiveness of FLR to investors and competitiveness with other land-use options. For forest products, supply-chain management (e.g. supported by chain-of-custody insurance) can help create a conducive investment environment. To date, however, most forest ecosystem services are unpaid, with only a few payment mechanisms functioning effectively. Thus, creating the conditions for investment and resource mobilization to include payments for ecosystem services is key.

Principle 3: Restore multiple functions for multiple benefits

Rationale

The aims of FLR are to restore multiple economic, social and environmental functions in a landscape and to generate a range of environmental goods and services that equitably benefit stakeholders. FLR can, for example, restore soil fertility, increase carbon storage, reduce erosion, provide shade, improve habitat quality for wildlife and downstream water supplies, produce timber, woodfuel and NTFPs, create jobs and diversify livelihoods, provide recreational areas and cultural and spiritual sites, and increase the resilience of landscapes and human communities to climate change and other perturbations.

Many environmental functions at the landscape scale are closely associated with the presence of natural forests, which can be managed or restored to meet multiple complementary objectives, including those listed above. Multipurpose forest management can be found in the livelihood strategies of many forest-dependent peoples. Although, in practice, multipurpose management is not a dominant strategy in the forest sector, exemplars are emerging through FLR ranging from the small scale, such as community forestry regimes, to the large scale, such as jurisdictional programmes to implement REDD+ strategies.

As outlined in the *Voluntary Guidelines for the Sustainable Management of Natural Tropical Forests* (ITTO 2015), multipurpose forest management combines three protection-oriented purposes with the productive functions of forests, as follows:

1) the conservation of soil and water and the permanence of carbon pools in forests, which have a bearing on the productivity, health and condition of the forests themselves;

2) the maintenance (at the landscape scale) of downstream benefits, such as water quality and flow and reducing flooding and sedimentation; and

3) the conservation of biodiversity, which is essential as a buffer against changing environmental conditions and as a genetic resource for tree breeding and improvement.

The multipurpose approach also applies to the restoration of degraded natural forests. In particular, the multipurpose nature of many species growing in tropical forests is an important feature to take into account in FLR. Conflicts over use can be minimized by clearly defining the objectives of the restoration and by legally designating forests for uses that generate the most appropriate economic and social benefits at a given site. Thus, when plantation forestry is under consideration as part of FLR, the use of non-native species and species with potential to become invasive should be avoided.

Guiding elements

GE13: Generate multiple functions and benefits

At the landscape scale, generating multiple benefits from a variety of interventions is a fundamental aspect of FLR. FLR should find and use synergies between people-centred functions in landscapes and ecological goals to achieve sustainable restoration outcomes.

New programmes have emerged that place greater value on forests and landscapes and strengthen the multipurpose role of forests, including results-based programmes on REDD+ and nationally determined contributions to climate-change mitigation and adaptation. FLR enables the integration of climate-change mitigation and adaptation through REDD+.

GE14: Conserve biodiversity and restore ecological functions

Conserving biodiversity will help sustain the intrinsic values of nature and ensure the healthy functioning of landscapes.

Biological processes underpin all FLR activities. Without increasing plant, animal, fungal and microbial diversity, there is little hope of restoring highly degraded lands to the extent that they are capable of sustaining high productivity. There is evidence that, over time, biodiverse landscapes are more likely than biodiversity-depleted landscapes to produce valuable products and be resilient to environmental change, including climate change.

Protecting and restoring the soil—particularly replenishing soil organic matter—is crucial for facilitating restoration.

GE15: Improve livelihoods

The diversity of FLR strategies in a landscape helps increase opportunities to improve livelihoods and long-term resource security among landscape stakeholders.

Strategies may include increasing the contributions of goods and services to livelihoods, improving forest and agricultural value chains to retain more value locally, creating market-based incentives, increasing and diversifying employment opportunities, and devolving natural resource management and land rights. FLR also aims to increase the resilience of landscapes and of the people—including women—living within them, which will help in sustaining livelihoods into the future.

GE16: Make full use of locally based knowledge

Local and indigenous knowledge is a valuable resource that should be given equal weight to other knowledge systems in defining FLR outcomes.

Local stakeholders and indigenous peoples in particular often possess vast knowledge about biodiversity, soils and multifunctional landscape uses. This must be taken into account when determining appropriate FLR interventions, programmes and projects.

FLR requires the engagement and mobilization of the social capital that exists in landscapes, including the integration of multiple knowledge systems. In doing so, local communities, government agencies, landholders and other stakeholders will be better able to participate in and lead FLR processes and ongoing landscape management. Systematic efforts should be devoted from the onset to identifying, acknowledging and incorporating traditional knowledge and practices in FLR planning and implementation.

Principle 4: Maintain and enhance natural forest ecosystems within landscapes

Rationale

FLR encourages and pursues the sustainable management of all types of forest in the landscape. It aims to halt the degradation of natural forests and other ecosystems, ensure the recovery, conservation and sustainable management of forests and other natural ecosystems, promote

biodiversity conservation, and increase the capacity of landscapes to deliver goods and ecosystem services. FLR should not cause the loss or conversion of natural forests, natural grasslands or other natural habitats.

This FLR principle is directed at restoring, managing and conserving natural ecosystems and habitats in degraded and deforested landscapes. The degradation of natural forests is commonly a result of unsustainable (and often overly destructive) timber and woodfuel harvesting, hunting, the patchy clearance and regrowth associated with shifting agriculture and, more recently, small- and large-scale mining. Degradation caused by these pressures rarely leads, on its own, to deforestation; nevertheless, if exploitation exceeds the capacity of a forest to recover, it will cause the loss of carbon stocks and biodiversity and reduce ecological and climate resilience. To deal effectively with forest degradation, it is important to see it not as the beginning of a deforestation process but as a form of poor forest management that can be reversed and improved.

In timber harvesting, extraction pressure on certain high-value species may cause a dysgenic trend (i.e. the removal of large trees in each harvest, leaving genetically inferior trees as future seed sources), further reducing sustainable, economically viable management options. In general, investments in silvicultural treatments are likely to be needed to overcome the economic depletion of such forests and ensure their future value. Before deciding at a process level to restore degraded forests, key corrective measures should be put in place to avert further degradation and provide a basis for future sustainable use. A comprehensive, broad-based evaluation is needed of the factors that created the present forest condition at a given site.

Based on the stage of degradation, a wide array of possibilities exists for regaining the ecological integrity and productive capacity of tropical forests of almost all types (see ITTO 2002). At a landscape scale, secondary forests can be an important resource for multipurpose management, including the production of timber and NTFPs and the provision of ecosystem services (particularly carbon sequestration) in exchange for payments. Important prerequisites for sustainable secondary forest management are social acceptance, adequate policies and the recognition of the forest's economic and environmental values.

Restoring degraded forest ecosystems and avoiding the fragmentation of natural forests are key elements of FLR. The aim of forest restoration in the framework of FLR is to restore dynamic forest processes related to species composition, structure, productivity, biodiversity, pollination and floral and faunal genetic diversity. FLR programmes and projects, therefore, may aim to restore the productivity, ecosystem functions and carbon stocks of degraded tropical forests.

Guiding elements

GE17: Avoid the conversion of natural forests	**GE18: Restore degraded forests and rehabilitate degraded forest land**
Natural forests are an integral part of functional landscapes in the tropics and fulfil important landscape functions. Addressing the drivers of land-use change from forests to other land uses is crucial for ensuring functional landscapes. Conserving and restoring biodiversity, including genetic resources, is a particular concern of FLR. Given the overall	**Restore and sustainably manage degraded forests and degraded forest land, as appropriate.** Degraded natural forests are generally less biodiverse and have reduced capacity to supply goods and ecosystem services compared with healthy natural forests that would normally

rapid loss of primary forests worldwide and their importance for biodiversity conservation, carbon storage, local climate, water protection and the maintenance of cultural values, efforts should be made to avoid the conversion of primary forests to other land uses and, rather, to designate them as part of the permanent forest estate or take other steps to ensure their protection. It may be necessary—for economic or social reasons—to convert certain degraded and secondary forests to other uses, but this should be done as part of an overall land-use plan that optimizes the allocation of land uses within a landscape, including for biodiversity conservation.

The underlying causes of land-use change and forest degradation need to be understood and addressed as part of an overall FLR strategy because these causes usually involve socioeconomic factors relating to local needs. The value systems of local actors must also be taken into account, as well as their tenure and access rights to resources.

The assessment of, and decisions on, the causes of deforestation and forest degradation should be made using participatory processes.

occur on the same site. Depending on the stage of degradation, stand structure, functionality, species composition and productivity may all be affected. Nevertheless, many degraded forests can maintain soil condition and support considerable native biodiversity, and the potential exists to restore full functionality if the causes of degradation are recognized and addressed. Seed dispersers, pollinators and wildlife are particularly important for FLR interventions aiming to maximize the contribution of natural regeneration processes.

When forest cover has been fully removed due to disturbances such as recurrent fire, wood collection and grazing, and such pressures remain, natural succession will be interrupted, soils are likely to become highly nutrient-depleted, and recovery may be impossible without intervention. Considerable investment may be required to rehabilitate such land.

GE19: Avoid forest fragmentation

In mostly deforested mosaic landscapes, strategies to increase connectivity through biological corridors will be needed to ensure gene flows of fauna and flora between otherwise isolated forests and other ecosystems in a landscape.

FLR involves the establishment or improvement of mosaics of various (but interactive) land uses with often differing economic, social and environmental objectives to shape landscape structure and dynamics. In highly altered landscapes, the further fragmentation of natural habitats should be avoided; the creation of biological "stepping stones" is likely to be important in many localities for effective FLR.

GE20: Conserve natural grasslands, savannas and wetlands

Under FLR, planted forests, particularly afforestation, should not replace native tropical grasslands, wetlands or savanna ecosystems.

Grasslands and savannas are ecosystems formed by species adapted to open habitats. Wetlands function as buffers against coastal storm surges, reduce wave damage and floods, and stabilize shorelines, water supplies and local microclimates. Peatland forests provide many ecosystem services, both directly and indirectly, in the form of forestry and fisheries, energy, flood mitigation, water supply and groundwater recharge.

In general, natural grasslands, savannas, wetlands and peatlands should not be converted to other land uses as part of FLR.

Because most tropical old-growth grasslands are the result of natural processes dependent on recurring endogenous disturbances, FLR must plan for the long-term maintenance of original fire regimes and megafauna herbivory, as necessary, to prevent the encroachment of woody plants into such ecosystems.

Principle 5: Tailor to the local context using a variety of approaches

Rationale

This principle helps ensure that the planning and implementation of FLR respond to the needs of local people and ecosystems. Ideally, FLR uses a variety of restoration interventions adapted to local social, cultural, economic and ecological values and needs and which take the history and legal context of the landscape into account. The best way to ensure that FLR is well adapted to local conditions is for local stakeholders to be fully involved in its development, implementation, monitoring and assessment.

Guiding elements

GE21: Assess local context and restrictions

In a landscape, the ecological, sociocultural and economic context determines the opportunities for and restrictions on FLR.

It is important to understand the dynamics of past, present and predicted future land uses and to recognize the potential multifunctionality of a landscape.

The actual and potential drivers of ecological change in a landscape must be understood. Interventions may be needed to avoid reaching ecological thresholds, beyond which change may be irreversible.

This also applies to the changing economic context in a landscape, driven by market (e.g. enabling commodity production to expand onto forest lands) or human pressure (e.g. the expansion of settlements due to migration), potentially conflicting with existing land-use plans.

GE22: Allow for future changes in conditions

FLR should take into account and be adaptable in the face of future change.

Pressures exerted on a landscape by changes not directly linked to resource use (e.g. external economic policies, out- or in-migration, and climate change) may have strong impacts on FLR success. Moreover, opportunities (e.g. infrastructure development and new technologies) may arise with the potential to lead to rapid improvements in the enabling conditions. Thus, ongoing monitoring of the local context is vital to enable adaptive approaches to FLR and sustainable landscape management.

GE23: Tailor FLR interventions to the local context and generate local benefits

Context-tailored interventions consider how FLR can benefit local stakeholders without compromising ecological stability.

The benefits of FLR are likely to change over time in both nature and extent, requiring ongoing exchanges and decision-making among stakeholders to strive for the equitable sharing of such benefits.

It may be necessary and appropriate to invoke the principle of free, prior and informed consent (FPIC). FPIC is a specific right that pertains to indigenous peoples and is recognized in the United Nations Declaration on the Rights of Indigenous Peoples. FPIC embodies the right of indigenous peoples and other traditional peoples to give or withhold consent to any project that may affect them or their territories.

GE24: Achieve the financial and economic viability of FLR investments

Financial and economic viability is essential for the success of FLR in the field.

FLR interventions, programmes and projects can only be sustainable if they are economically and financially viable. Where local stakeholders lack sufficient capital, however, it may be difficult to justify and attract investment if initial financial costs are high and returns uncertain and in the distant future. Strategies might be needed to create immediate benefits to encourage local buy-in, such as increased tenure security, agroforestry-based annual or perennial crops, fast-growing woodlots and payments for incipient ecosystem services, as well as longer-term benefits associated with the production of high-quality timber and the sustainable supply of ecosystem services.

In addition to achieving the financial viability of FLR, work should be undertaken to demonstrate and communicate—with sound data and easy-to-use tools—the long-term economic benefits of FLR at the landscape scale and for various stakeholder groups as a means for obtaining strong acceptance of FLR, including among governments and donors.

GE25: Identify opportunities to increase local incomes

Identifying new income-earning opportunities, including through entrepreneurship, will be a powerful incentive for local people to participate in FLR.

An ultimate aim of FLR is for local people to improve their livelihoods and incomes in sustainable ways. Market demand (and the prices paid) for the products and ecosystem services obtained from FLR will be a determining factor in the profitability of FLR-related

GE26: Develop sustainable supply chains

FLR should seek to support entrepreneurship and build sustainable supply chains for the goods produced in restored forests and landscapes.

Sustainable supply chains comprise the organizations, activities and processes associated with all stages of forest-related businesses, including planning, sourcing, processing, manufacturing and delivering goods and ecosystem services in forests and landscapes. In creating a new resource through FLR, opportunities

interventions and hence their uptake by farmers, forest users and rural communities. The local processing of forest products will add value to FLR-derived products and may also mean higher prices for producers.

The creation of revenue-generating activities and the promotion of viable small and medium-sized enterprises can contribute to the success of FLR initiatives.

Crucially for attracting investments in local-scale ventures is reducing their risk profiles, such as by ensuring secure tenure; building local capacity in business management and the creation of local enterprises; and providing ongoing technical advice.

exist for entrepreneurs to help develop sustainable, value-adding supply chains.

A sustainable supply chain is one that minimizes negative environmental and social impacts, addressing issues such as water and energy use, pollution, the treatment of workers, and the engagement of local communities. FLR initiatives should encourage the development of sustainable supply chains to increase marketing potential and help ensure fair remuneration at each link in the chain. FLR initiatives should also examine ways of nurturing and supporting local entrepreneurs to make efficient, profitable and sustainable use of emerging resources.

Principle 6: Manage adaptively for long-term resilience

Rationale

FLR seeks to increase the resilience of landscapes and communities in the medium to long term. To do so, its interventions may need to be adjusted over time to reflect changes in the local socioeconomic context, environmental conditions, knowledge, capacities, stakeholder needs, technologies and societal values and choices. Information and learning from ongoing monitoring, research and stakeholder feedback should be integrated into management plans.

A fundamental problem in achieving long-term successful outcomes in FLR is the issue of change over time in a landscape. Human communities evolve—in numbers, skills, aspirations, expectations and interrelations. Markets change and fluctuate in response to intrinsic dynamics and changing human values and demands. FLR is a long-term undertaking, however, and the economic and social conditions that exist when, for example, a tree is planted are seldom the same as when it is harvested perhaps decades later, and nor do the priorities of stakeholders remain the same. FLR must adopt a long-term perspective and, as far as possible, anticipate future change. It must be tailored to the local conditions prevailing at the time of commencement but capable of adaptation to changing economic and social circumstances.

Climate change is likely to have a wide range of biophysical impacts on forests and landscapes, such as the increased incidence and severity of pests, fire, flooding and drought and reduced plant productivity and health. Farmers and forest managers should be aware of the risks posed by such impacts and take measures to reduce the vulnerability of their production systems, increase ecological resilience and adapt production systems to changing climatic conditions.

FLR has considerable potential to enable the adaptation of tropical landscapes to climate change. Adaptive management will be essential for maintaining resilient, productive forest landscapes in the future, in which resilience has both human and ecological dimensions, with the former requiring fair and equitable governance and benefit sharing.

Guiding elements

GE27: Take an adaptive management approach

GE28: Continually measure the biophysical dimensions of the landscape

Adaptive management interventions minimize the economic, social and environmental risks associated with FLR.

FLR interventions are complex and dynamic, with associated risks and uncertainties. There is a lack of information on the implementation of FLR and ongoing change in, for example, stakeholder needs and aspirations, the drivers of landscape degradation, and the impacts of climate change. To overcome potential risks and respond to changes in priorities, FLR should take an adaptive management approach. Information collected in the monitoring of economic, social and environmental aspects of FLR should be used to evaluate success and to adjust interventions to attain desired outcomes.

Basic, applied and participatory research is also essential for supporting the implementation of adaptive FLR strategies and for facilitating information sharing and capacity building among local stakeholders.

The initial environmental conditions, particularly the stressors and risk factors present in a landscape, must be assessed.

Monitoring change against this baseline information will enable the effective adaptation of FLR over time.

The success of FLR depends on the extent and nature of existing environmental stresses. Sites with a strong seasonal climate, exposure, low soil fertility and other environmental stresses are likely to be more difficult to restore than those that have more benign conditions.

The evaluation and measurement of success or failure depend in part on being able to contrast a site before and after initiating an FLR intervention.

GE29: Periodically assess vulnerability to climate change

The vulnerability of ecosystems and social systems in a landscape must be assessed periodically to ensure the effectiveness of FLR interventions to reduce this.

Periodic but unpredictable stressors (e.g. fire and drought), episodic climatic anomalies, and the potential for long-term global climate change may make FLR goals more difficult to achieve. Limited adaptive capacity within social and governance systems will further increase vulnerability.

FLR can increase the resilience of ecosystems and social systems to climate change and thereby reduce their vulnerability. FLR should consider climate-change scenarios and favour climate-appropriate land-use interventions and species selection.

GE30: Develop participatory monitoring of FLR

Participatory and user-friendly FLR monitoring should form the basis for adaptive management.

No single stakeholder has a unique claim to information, and the validity of different knowledge systems should be recognized. All stakeholders should be able to generate, gather and integrate the information they require to understand and monitor FLR activities and progress.

The participatory monitoring of FLR will enable all stakeholders to understand the changing needs of landscapes and communities and the management adaptations required to optimize FLR outcomes in the face of climate change and other perturbations.

Participatory monitoring built into social and ecological systems can be an enduring process (as opposed to project-based monitoring, which will likely end when the project ends).

GE31: Encourage open access to, and the sharing of, information and knowledge

Adequate access to information and the dissemination and management of knowledge will maximize the effectiveness of, and public support for, FLR.

All stakeholders should have continuous and easy access to information on all aspects of FLR.

FLR requires the changing of people's perceptions, attitudes and behaviours. Unless those people affected by FLR interventions appreciate the reasons for it and the benefits they may ultimately derive from it, they will have little motivation to participate in it.

Traditional agricultural extension services, which are often highly effective in reaching local farmers and

GE32: Report on FLR outcomes

Measuring outcomes at the landscape level, and reporting on these to all stakeholders, is fundamental for FLR success.

Effective monitoring depends to a large extent on choosing appropriate indicators at the site and landscape scales and at various points in the restoration process.

Monitoring needs to take place at different timescales, and it will likely occur under conditions of varying data quality and technical capacity. FLR initiatives should build in robust reporting processes to ensure that all stakeholders are fully informed of progress, changes and ongoing challenges and that lessons are learned from

producers, could be a powerful means for informing local people about the potential of FLR to improve their livelihoods and incomes. However, they need to be better equipped for facilitation, conflict resolution and the teaching of business skills.	both successes and failures as a means for increasing effectiveness in the future.

3 Implementation processes and operational guidance

Chapter 2 sets out six principles for FLR and 32 guiding elements that flesh out the principles. This chapter presents recommended actions for putting the principles and guiding elements into effect through FLR interventions, as appropriate.

FLR interventions

Development-orientated implementation arrangements at either a larger scale (e.g. in a jurisdictional area) or a small scale (e.g. at the level of a local watershed).

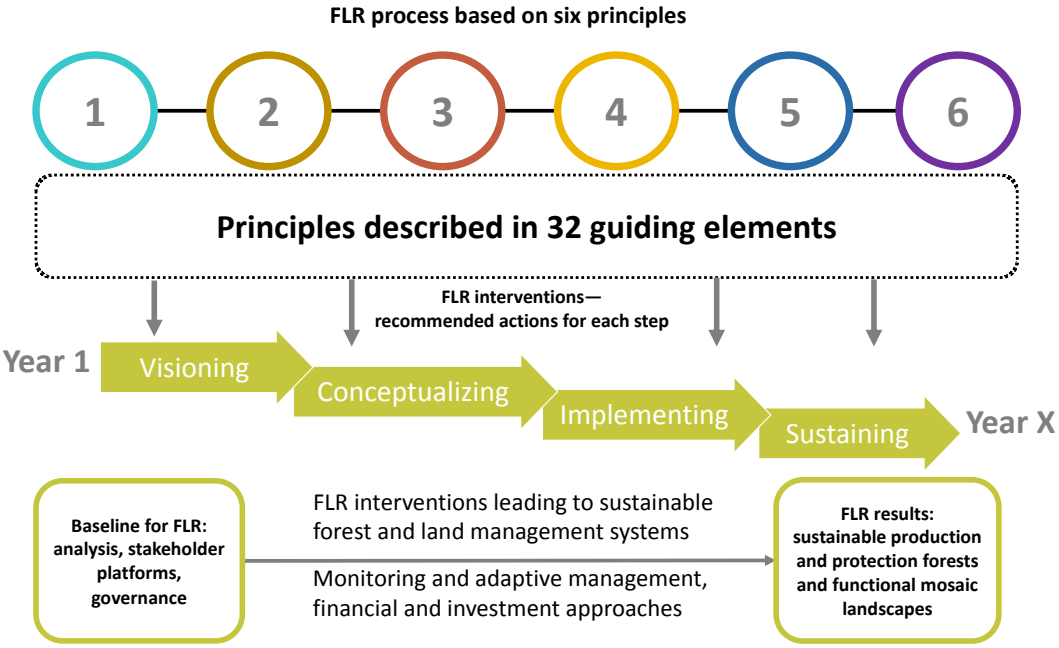
FLR can benefit from a practical working strategy to define, plan, initiate, sustain, scale up and adapt interventions to address changing local needs and changing environmental conditions (Gutierrez et al. 2019), following the logic of project-cycle management (Battisti 2017 in Stanturf et al. 2019). The project-cycle management framework is not a simple, linear process but, rather, iterative, adaptive and hierarchical, with recurring consultations among stakeholders (Stanturf et al. 2017) (see Figure 4;

Table 4 gives an example of the hierarchical nature of the project-cycle management). In FLR, project-cycle management has four phases that progress toward greater specificity with flexible timing (Box 3). Feedback at regular intervals in the cycle provides opportunities to shuffle priorities, shift implementation activities and re-align resources in light of changing conditions and new information gained through continuous learning and adaptation (Stanturf et al. 2019).

Box 3: The phases of project-cycle management in FLR
▪ **Visioning** sets out the aspirational goals for FLR. This is often done at a national or subnational level, but obtaining a vision and buy-in is also needed locally. Goals generally describe expected long-term outcomes and may or may not be strictly measurable or tangible, depending on the scope and level of consideration. Goals may acknowledge international commitments such as biodiversity targets. Monitoring, assessment and research on the drivers of forest degradation and deforestation may inform the visioning phase by identifying opportunities and obstacles
▪ **Conceptualizing** turns goals into clear, measurable objectives that can be acted on. This phase determines the most feasible and effective interventions for a target landscape that may be derived from national, subnational or local goals. During the conceptualizing phase, the selection of priority regions, landscapes or units within a landscape on which to focus activities may gain the most benefit from limited resources
▪ The **acting phase** turns objectives into accomplishments through a sequenced list of what will be done, where, when, by whom and at what cost. Restoration decision-making at the local level may comprise site selection, choice of FLR activities, the pace and schedule of implementation, costs, monitoring of work linked to expenditure, and evaluation
▪ **Sustaining FLR** over the long term requires adaptive management that combines management planning with monitoring and evaluation in order to provide feedback on earlier phases for potential corrective actions

Sources: Modified from Stanturf et al. (2017, 2019).

Figure 4: The four phases of FLR implementation



Source: Basic structure inspired by Stanturf et al. (2019).

Table 4: Hierarchical nature of project-cycle management, with an example from Myanmar

Phase	**Visioning (preparation)**	**Conceptualization (planning)**	**Implementation (acting)**	**Sustainability (sustaining the achievement)**
Realization	**Goal**	**Objective**	**Action plan**	**Feedback**
Meaning	Purpose and direction of an FLR intervention	Expected accomplishments or targets of project action	Activities to achieve targeted outcomes	Adaptive management to sustain assets
Measure	Overall ambitions: goals may or may not be measurable	Definition of tangible and measurable outcomes	Sequenced list of what will be done, where, when, by whom and at what cost	Monitoring, management plan
Timeframe	Long-term	Short- to mid-term	Short- to mid-term	Long-term
Example in the Ayeyarwady Delta, Myanmar (see also Case study 17)	Degraded mangrove forests and abandoned paddy fields were enriched and replanted with a variety of mangrove species under community forestry (CF) management, thereby helping protect coastal villages from tropical storms, tsunamis and sea-level rise	• At least 500 ha of degraded forest has been restored and is fulfilling its protective functions • Two-thirds of abandoned paddy fields in critical zones have been rehabilitated with planted mangroves • 12 villages have received their CF certificates, giving them long-term rights to the management and use of mangrove resources	• Collect seeds and establish five mangrove nurseries at the Forestry Department (FD) and in villages in year 1 • Form CF user groups (six in first year and two additional each year) and apply for CF certificate at FD • Map community lands with potential reforestation areas for each community forest • Collaboratively plant selected mangrove species in degraded forests and on abandoned fields during June and July • Support individual CF members to manage their plantation plots	• Develop a management plan for each community forest, and plantations are monitored annually by the FD • Additional households can apply yearly to CF user groups for new lands • Monitoring of plantation development is done continuously by CF user groups and NGOs • Mangroves replanted after Cyclone Nargis in 2008 • Functional value chains are in place to market products from the mangrove forests

Operational framework for FLR implementation

The operational framework adopted for these guidelines and presented in Table 4 considers the following four phases in applying FLR:

1) **visioning** (preparation)—relatively short-term (e.g. 1 year);

2) **conceptualization** (planning)—relatively short-term (e.g. 1 year);

3) **implementation** (acting)—mid-term (e.g. 3–10 years); and

4) **sustainability** (sustaining the achievement)—long-term (at least decades).

All six FLR principles and related 32 guiding elements are equally important at any phase of the FLR intervention. sets out recommended actions for each of the guiding elements under the six principles. Note that the operational framework presented therein is not designed to place all possible interventions perfectly into the four phases. The nature of project-cycle management means that feedback loops exist to enable adjustments to be made in light of experience and evidence. Readers should bear in mind that, as stated in Chapter 2, the guiding elements are not exhaustive and may not encompass all aspects of FLR in all situations.

Table 5: Recommended actions for FLR interventions aligned with FLR principles and guiding elements following the logic of the project-management cycle

Principles and guiding elements	FLR interventions in the project-management cycle			
	Visioning	***Conceptualizing***	***Acting***	***Sustaining***
Principle 1: FOCUS ON LANDSCAPES				
GE1: Undertake inclusive, gender-responsive landscape-level assessment and land-use planning	**Define the appropriate landscape** in a given biophysical, sociocultural, economic and political environment **Identify and engage stakeholders and their interests** by gender in the forest landscape through baseline surveys and the use of participatory rural appraisal or similar techniques	**Develop a technical baseline** through initial landscape mapping and resource inventory (including carbon) on which the state of the landscape is assessed and the intended FLR outcomes are formulated **Endorse the ecological and socioeconomic baseline through an adequate consultation process** and obtain agreement on it **Carry out a social landscape assessment** for use in restoration efforts to ensure the provision of multiple functions	**Develop and endorse a land-use plan** as a key instrument that contributes to responsible land governance. Ensure that the plan reconciles competing interests in the landscape and thereby minimizes land-use conflict If a decision is taken that a degraded forest landscape should remain or be established as part of the permanent forest estate, **develop an appropriate management strategy** in collaboration with all stakeholders	**Develop and operationalize socioeconomic and ecological criteria** for the evaluation of FLR scenarios **Define and legally implement, at the landscape scale, the permanent forest estate** as a key element for sustaining existing natural forests, restoring degraded forests and rehabilitating degraded forest land
	More information			
	A guide to the Restoration Opportunities Assessment Methodology (ROAM): assessing forest landscape restoration opportunities at the national or sub-national level (IUCN & WRI 2014)			
	Mapping social landscapes: a guide to identifying the networks, priorities, and values of restoration actors (Buckingham et al. 2018)			
	Baseline photography and participatory drawing in East Africa (Boedhihartono & Barrow 2008)			
	From addressing symptoms to tackling the illness: reversing forest loss and degradation (Mansourian & Parrotta 2019)			
	Ten principles for a landscape approach to reconciling agriculture, conservation, and other competing land uses (Sayer et al. 2013)			
	The Green Negotiated Territorial Development (GreeNTD): a people centred, process-oriented socio-ecological approach to territorial development (FAO 2016)			
	Toolkit for the application of the GreeNTD to promote a negotiated and agreed solution to a resource dispute, ranging from governments and companies to communities, dealers and non-governmental organizations (FAO 2017)			
	Understanding the landscape mosaic (Gilmour 2005a)			
GE2: Gain recognition that FLR must transcend sector policies	**Identify and analyze the current legal and policy framework** relevant to FLR **Formulate rules and procedures** that enable consistent and effective planning for FLR	**Analyze the potential impacts of sectoral laws and policies** on FLR. Identify and address discrepancies between sectoral policies **Endorse the ecological and socioeconomic baseline through an adequate consultation process**	**Develop appropriate intersectoral collaboration platforms** between governmental institutions to legitimize FLR **Promote actions to ensure that laws requiring FLR are broadly understood** by relevant actors and enforced in a	**Define socioeconomic and ecological criteria** on which **scenarios** for FLR will be evaluated **Define and use, at the landscape scale, the permanent forest estate** as a key element for sustaining existing natural forests, restoring degraded forests and

		and obtain agreement on it	visible, credible and fair manner	rehabilitating degraded forest lands **Ensure that legal frameworks are supported by adequate regulations**, including restrictions on the clearing or cutting of remaining natural forests and the establishment of clear links between tree and land ownership
	More information			
	Participatory integrated land-use planning: (i) community-based landscape planning and decision-making; (ii) effective intersectoral cooperation and coordination among government agencies at the national, subnational and local levels; (iii) the strengthening of local institutions to better manage conflicts over land use and tenure; and (iv) improved policies for integrated management (e.g. agroforestry) (FAO 2012a)			
	The restoration diagnostic: a method for developing forest landscape restoration strategies by rapidly assessing the status of key success factors (Hanson et al. 2015)			
	Forest landscape restoration in Asia-Pacific forests [Overview on FLR policies] (FAO & RECOFTC 2016)			
GE3: Conduct FLR at an appropriate scale	**Identify appropriate scales for landscape planning** based on, for example, jurisdictional area or biophysical or socioeconomic zones, or in light of customary practices	**Integrate FLR interventions** with relevant interventions **at higher and lower spatial scales** **Embed integrated land-use planning in higher-level spatial plans** to obtain an adequate balance between conservation, production and sustainable livelihood needs **Define categories of resource degradation** as targets for FLR **Integrate degraded and secondary forests, degraded forest land and forest mosaics into land-use planning** at the macro and micro scales	**Formalize integrated land-use plans at the jurisdictional level** as a basis for implementing FLR commitments at the programme and project scales	**Adapt land-use plans periodically**, as needed, to changing contexts
	More information			
	Understanding the landscape mosaic (Gilmour 2005a)			
	Discourses across scales on forest landscape restoration (Reinecke & Blum 2018)			
GE4: Address tenure and access rights	**Map the tenure situation,** including all claims, at an early stage of designing an FLR intervention	Where property and access rights are unclear, **establish a transparent mechanism for conflict resolution**, particularly in recently converted forest landscapes Through participatory land-use planning, **develop criteria for taking landholder preferences into**	**Set specific targets for addressing gender equity** in rights and access to land subject to FLR **Strengthen the rights of forest dwellers and indigenous peoples** for the gathering of products from forest lands for subsistence use and propose regulations for the	**Clarify and legitimize equitable tenure, access, use and other customary rights** in forest landscapes for local and national stakeholders and for foreign investors **Reform laws, including the recognition of customary and traditional rights**, to

		account in the selection of restoration areas	commercial use of such products	provide security of tenure as a necessary condition for SFM and FLR
	More information			
	Improving governance of forest tenure: a practical guide (Mayer et al. 2013)			
	The Sangha guidelines for the landscape approach (IUCN & Ecoagriculture Partners 2008)			
	Novel governance for forest landscape restoration in Fandriana-Marolambo, Madagascar (Mansourian et al. 2016)			
Principle 2: ENGAGE STAKEHOLDERS AND SUPPORT PARTICIPATORY GOVERNANCE				
GE5: Build adequate governance capacity for decentralized FLR	**Identify the appropriate authorities and institutions** and other stakeholders at the district or municipal level to lead FLR programmes and projects	**Inform and devolve responsibility and accountability to appropriate local management institutions** (e.g. provincial governments, municipalities and communities) to plan, implement and monitor FLR processes	**Support regular interinstitutional meetings** to provide strategic guidance and oversight on FLR **Formulate and apply locality-based social and environmental safeguards** to minimize any adverse consequences of FLR programmes and projects for social and natural systems	**Empower decentralized institutions** to develop the capacity and means to plan and implement programmes and projects that support FLR
	More information			
	Governance and forest landscape restoration: a framework to support decision-making (Mansourian 2017)			
	The politics of decentralization: forests, power and people (Colfer & Capistrano 2016)			
GE6: Obtain strong stakeholder engagement	**Develop a shared landscape vision** among stakeholders in a given area and context	**Assess existing landscape-level governance structures** and evaluate them for their suitability for carrying out FLR **Create stakeholder platforms** for developing and agreeing on restoration strategies, clearly define roles and responsibilities (including strategies to address unequal power relations), and identify areas of conflict and develop common approaches to deal with them	Through stakeholder platforms organized at the process level, **develop an understanding of the conditions and factors that influence the engagement of local people in FLR**	**Develop and maintain a diverse range of partnerships** to help ensure the ongoing success of FLR interventions
	More information			
	Stakeholders organized into platforms and empowered to promote SLM practices in the landscape (Eneko et al. 2013)			
	The restoration diagnostic: a method for developing forest landscape restoration strategies by rapidly assessing the status of key success factors (Hanson et al. 2015)			
	Applying a stakeholder approach in FLR (Kusumanto 2005)			

<table>
<tr><td></td><td colspan="4">Fostering stakeholder commitment in Western Flores, Indonesia: villages' organization in local conservation and development groups and the Mbeliling Community Forum (Widyanto et al. 2014)</td></tr>
<tr><td rowspan="3">GE7: Conduct joint stakeholder analysis of the drivers of degradation</td><td>Identify the external and local pressures that have caused degradation and determine whether they are still present. Assess the potential for reducing or eliminating them</td><td>Using participatory processes, determine the underlying causes of degradation pressures and the potential for addressing them</td><td>Reduce or remove degradation pressures and observe the natural responses of vegetation

If additional planting or other interventions become necessary, ensure that the area is protected from significant degradation pressures and that interventions are suitable for the site</td><td>Adopt strategies and responsibilities for the control of illegal activities, focusing on preventive actions</td></tr>
<tr><td colspan="4">More information</td></tr>
<tr><td colspan="4">Community-based forest resource conflict management: a training package (FAO 2012b) (see case study, "Supporting local mechanisms for conflict resolution in the Chiang Mai Highlands, Thailand" by V. Viriyasakultorn, pp. 303–312)

Global guidelines for the restoration of degraded forests and landscapes in drylands (FAO 2014)</td></tr>
<tr><td rowspan="3">GE8: Strive for social equity and benefit sharing</td><td>Create and communicate opportunities for the economic empowerment of all local stakeholders</td><td>Develop benefit-sharing plans through participatory processes</td><td>Within a given landscape and society, address inequalities based on gender and the marginalization of other groups by including all community members in benefit-sharing plans

Develop effective mechanisms for resolving conflicts among stakeholders on the sharing of costs and benefits</td><td>Monitor the distribution of the costs and benefits of forest management and restoration among stakeholders</td></tr>
<tr><td colspan="4">More information</td></tr>
<tr><td colspan="4">Forest restoration in Shinyanga, Tanzania (see Fisher et al. 2005; Barrow 2014; Duguma et al. 2015)

The Sangha guidelines for the landscape approach (IUCN & Ecoagriculture Partners 2008)</td></tr>
<tr><td rowspan="3">GE9: Conduct participatory FLR planning, decision-making and monitoring</td><td colspan="2">Create a broad participatory framework and (formal and informal) mechanisms for all interested groups, stakeholders, and the public at different levels for early, meaningful participation and effective decision-making

Build consensus among stakeholders on criteria and indicators for the monitoring and evaluation of FLR

Build up the elements that enable the community-based monitoring of FLR interventions</td><td>Implement monitoring and evaluation systems (i.e. data collection, analysis, reporting and communication) to enable adaptive management in the participatory process</td><td>Revise management strategies periodically and adapt management procedures as necessary

Ensure legal recognition of the monitoring system in the long term</td></tr>
<tr><td colspan="4">More information</td></tr>
<tr><td colspan="4">Integrated planning: policy and law tools for biodiversity conservation and climate change (Lausche 2019)

A diagnostic for collaborative monitoring in forest landscape restoration (Evans & Guariguata 2019)

The Sangha guidelines for the landscape approach (IUCN & Ecoagriculture Partners 2008)

Landscape restoration in Hojancha, Costa Rica (Salazar et al. 2005; 2007)</td></tr>
</table>

<table>
<tr><td rowspan="6">GE10: Build stakeholder capacity for sharing responsibility for FLR</td><td colspan="2">Assess knowledge about the physical, biological and human resources in the landscape and ensure the participation of all actors in the collection of gender-disaggregated data</td><td>Provide training and capacity building for all stakeholders in the basic skills required to restore and sustainably manage forests for goods and ecosystem services

Develop capacities in institutions to monitor the effectiveness of their programmes, manage their knowledge and adapt their programmes in light of evidence

Integrate capacity building and leadership training at the local level into a training-of-trainers model</td><td>Assess capacity-building activities and incorporate the results in the management cycle</td></tr>
<tr><td colspan="4">More information</td></tr>
<tr><td colspan="4">Implementing forest landscape restoration: a practitioner’s guide (Stanturf et al. 2017)</td></tr>
<tr><td colspan="4">The Sangha guidelines for the landscape approach (IUCN & Ecoagriculture Partners 2008)</td></tr>
<tr><td colspan="4">The Landscape Academy organizes regular courses on landscape leadership, landscape governance and landscape finance</td></tr>
<tr><td colspan="4">The Environmental Leadership Training Initiative, Yale School of Forestry and Environmental Studies (various online training courses—visit https://elti.yale.edu/online-training-program)</td></tr>
<tr><td rowspan="6">GE11: Address long-term financing for FLR initiatives</td><td>Develop an FLR financing strategy for each of the four FLR phases</td><td>Formulate FLR interventions in accordance with the procedures of agencies that provide financial incentives for FLR</td><td>Analyze the potential for, and develop schemes that allow, payments for ecosystem services at the landscape scale, such as those related to carbon, water, biodiversity and tourism</td><td>Consider domestic and international private finance or blended public–private finance for sustaining FLR interventions</td></tr>
<tr><td colspan="4">More information</td></tr>
<tr><td colspan="4">Sustainable financing for forest and landscape restoration (FAO & UNCCD 2015)</td></tr>
<tr><td colspan="4">Towards effective national forest funds (FAO 2015a)</td></tr>
<tr><td colspan="4">Integrating diverse social and ecological motivations to achieve landscape restoration (Jellinek et al. 2018)</td></tr>
<tr><td colspan="4">The economics of ecosystems and biodiversity (TEEB 2009)</td></tr>
<tr><td colspan="4">Payments for environmental services in Latin America as a tool for restoration and rural development (Montagnini & Finney 2011)</td></tr>
<tr><td rowspan="3">GE12: Establish a favourable investment environment for FLR</td><td>List potential FLR investors in a given landscape based on existing knowledge at the national level</td><td>Provide enabling conditions (e.g. legal, policy, institutional, fiscal and tenurial) to attract investments in FLR (including ensuring easy access to information)</td><td>Assess potential investor needs and concerns regarding the investment environment

Promote simple, inexpensive technologies that directly address investors’ needs</td><td>Develop conflict-resolution mechanisms to handle trade-offs arising from competing land-use interests, particularly in light of new land-use proposals (e.g. mining in restored forest areas)</td></tr>
<tr><td colspan="4">More information</td></tr>
<tr><td colspan="4">Sustainable financing for forest and landscape restoration: opportunities, challenges and the way forward (FAO & UNCCD 2015b)</td></tr>
</table>

	Global guidelines for the restoration of degraded forests and landscapes in drylands: building resilience and benefiting livelihoods (FAO 2015)			
	Coalition for Private Investment in Conservation blueprints (http://cpicfinance.com/blueprints)			
Principle 3: RESTORE MULTIPLE FUNCTIONS FOR MULTIPLE BENEFITS				
GE13: Generate multiple functions and benefits	**List known and readily available forest products, based on local knowledge** **Estimate past and potential products** and reflect on whether such potential can be restored	**Assess ecosystem services and trade-offs for different land uses** in the landscape **Evaluate prospects for the multiple use of forest products and, potentially, payments for ecosystem services** as strategies for creating multiple benefits	**Develop comprehensive knowledge of forest and tree resources** with the aim of boosting the value of forest goods and ecosystem services, and uphold usufruct rights	**Provide incentives for farmers to diversify their agricultural production systems** with multipurpose tree species, and examine the market potential of value-added products
	More information			
	Accelerating biodiversity commitments through forest landscape restoration (Beatty et al. 2018)			
	A cost-benefit framework for analysing forest landscape restoration decisions (Verdone 2015)			
	Synergies between climate mitigation and adaptation in forest landscape restoration (Rizvi et al. 2015)			
GE14: Conserve biodiversity and restore ecological functions	Wherever possible, and regardless of opportunity costs, **prioritize the restoration of a given degraded natural forest area over its replacement with another land use**	**Prioritize the restoration of ecological functions** such as water-catchment protection, soil conservation and pollination services in the design of FLR interventions	**Make use of relevant ecological knowledge on species** in the development of FLR initiatives **Improve conservation planning and impact monitoring in critical areas** such as the buffer zones of protected areas, areas for connectivity corridors, high-value conservation forests and areas that provide key ecosystem services for productive activities, biodiversity protection and sustainable use	**On agricultural lands, provide incentives for diversified land-use and management practices**, such as various types of agroforestry to allow multifunctionality and protect soils and water resources
	More information			
	Guidelines for the conservation and sustainable use of biodiversity in tropical timber production forests (ITTO & IUCN (2009)			
	International principles and standards for the practice of ecological restoration (Gann et al. 2019)			
	Biodiversity in forest landscape restoration assessment planning (in Beatty et al. 2018)			
	Restoring forest landscapes: important lessons learnt (Mansourian & Vallauri 2014)			
	Forest and water on a changing planet: vulnerability, adaptation and governance opportunities. A global assessment report (Creed & Noordwijk 2018)			
GE15: Improve livelihoods	Using participatory processes, **determine and prioritize interventions for improving**	**Plan targeted participatory assessment and monitoring of the socioeconomic situations of**	**Consider incentive mechanisms, capacity building and institutional development** (including producer	**Set rules to allow the continued use of traditional forest and tree products**, including

	livelihoods through FLR	**households and communities before, during and after FLR interventions** to evaluate the effectiveness of livelihood strategies and outcomes for local people In planning an FLR intervention, **ensure that restored forests and trees will generate an adequate supply of timber and woodfuel to meet community needs** within the landscape **Explore opportunities to diversify incomes** through tree-based products from restoration **Make available and provide guidance** to rural communities, smallholders and forest and agricultural business managers **on how to manage, produce, add value to and access markets for products arising from FLR**	associations) **to encourage the development of value-added products** based on FLR outcomes **Develop viable business plans** for FLR-related economic activities by locally based enterprises **Improve market information and provide communities and smallholder organizations with marketing support** for products derived from restored and managed landscapes	regulations to ensure sustainable harvesting **Implement the participatory monitoring of the socioeconomic situations** of households and communities **Build capacity for business development and marketing** **Encourage the engagement of communities and smallholder producer organizations in partnerships** with other civil-society groups, (local) governments and financing agencies to design and develop sustainable restoration models **Strengthen the capacity of second-order associations and federations** to deliver services to their members
	More information			
	Global guidelines for the restoration of degraded forests and landscapes in drylands: building resilience and benefiting livelihoods (FAO (2014)			
	Direct and indirect methods for improving forest ecosystem function and livelihoods, well-being, and resilience through FLR (Erbaugh & Oldekop 2018)			
	Small-scale forest enterprises in Latin America: unlocking their potential for sustainable livelihoods (Del Gatto et al. 2018)			
	Smallholder forest producer organizations in a changing climate (FAO 2017)			
	Enhancing food security through forest landscape restoration: lessons from Burkina Faso, Brazil, Guatemala, Viet Nam, Ghana, Ethiopia and Philippines (Kumar et al. 2015)			
	Improving ecosystem functionality and livelihoods: experiences in forest landscape restoration and management (Barrow et al. 2012)			
GE16: Make full use of locally based knowledge	**Develop FLR approaches that include local knowledge** relating to natural resources management, the use of NTFPs and wild meat, agriculture and other locally relevant development opportunities	**Develop approaches to the implementation of FLR that combine the body of knowledge held by local stakeholders**, including indigenous communities and farmers, **and technological advances** in land and forest use	**Document traditional land-use practices** that enable local communities to obtain multiple benefits from the landscape	**Make adequate provision in FLR interventions to ensure that local cultural values associated with natural resources are sustained and enhanced**
	More information			

	Community-led restoration of forest resources improves community cohesion and livelihoods (Ghosh et al. 2016)			
	Management and restoration practices in degraded landscapes of Eastern Africa and Southern Africa (Chirwa et al. 2015a, 2015b)			
PRINCIPLE 4: MAINTAIN AND ENHANCE NATURAL FOREST ECOSYSTEMS WITHIN LANDSCAPES				
GE17: Avoid the conversion of natural forests	Through cross-sectoral technical analysis and stakeholder assessment, **determine the direct and indirect causes of deforestation and forest degradation**		**Using a participatory process, define the permanent forest estate** (for protection and production functions) in a given jurisdictional area and demarcate its boundaries **Create incentives for stabilizing land use by local stakeholders in agricultural frontiers** in the vicinity of the designated permanent forest estate (e.g. in buffer zones)	**Define and agree on criteria for the conversion of degraded and secondary forests to other land uses.** Prioritize sustainable forest management above other, non-forestland uses
	More information			
	Technical guidelines for the restoration, management and rehabilitation of degraded and secondary tropical forests (ITTO (2002)			
	Guidelines for the conservation and sustainable use of biodiversity in tropical timber production forests (ITTO & IUCN 2009)			
	Voluntary guidelines for the sustainable management of natural tropical forests (ITTO 2015)			
	For examples of actions that could be taken to address deforestation drivers, see FAO's SFM Toolbox module "reducing deforestation" (www.fao.org/sustainable-forest-management/toolbox/modules/reducing-deforestation/basic-knowledge)			
	For examples of strategies and actions to prevent and halt forest degradation, see FAO's SFM Toolbox module, "reducing forest degradation" (www.fao.org/sustainable-forest-management/toolbox/modules/reducing-forest-degradation/basic-knowledge)			
GE18: Restore degraded forests and rehabilitate degraded forest land	**Decide on processes for identifying and prioritizing areas for FLR** interventions. In so doing, **assess current uses and take into account socioeconomic, ecological, legal, technical and financial aspects**, such as legal requirements, key ecosystem services, the risks associated with climate change, livelihood needs, and market opportunities	**Using participatory processes, define the objectives** of FLR interventions **Determine FLR interventions and techniques** suitable for achieving agreed objectives **Screen and select the most appropriate tree species**, based on ecological, market and socioeconomic criteria Where appropriate, **carry out cost–benefit analyses of promising FLR interventions**, as determined with the participation of stakeholders	**Develop FLR plans through participatory processes** **Address former and current pressures and drivers of forest and land degradation and their consequences and impacts**, including, where appropriate, through government concession/contractual agreements and agreements with local people on forest use	Where legally feasible, **encourage economic activities** such as intercropping **to increase the economic viability of FLR interventions**, especially early in the restoration process
	More information			

	Guidelines for the restoration, management and rehabilitation of degraded and secondary tropical forests (ITTO 2002)			
	Restoring forest landscapes: an introduction to the art and science of forest landscape restoration (ITTO & IUCN 2005)			
	Restoring tropical forests: a practical guide (Elliott et al. 2013)			
	Global guidelines for the restoration of degraded forests and landscapes in drylands (FAO 2015)			
	A guide to the Restoration Opportunities Assessment Methodology (ROAM): assessing forest landscape restoration opportunities at the national or sub-national level (IUCN & WRI 2014)			
	International standards for the practice of ecological restoration: including principles and key concepts (McDonald et al. 2016)			
	Implementing forest landscape restoration: a practitioner's guide (Stanturf et al. 2017)			
	Rainforest restoration: a guide to principles and practice (Mudappa & Raman 2010)			
GE19: Avoid forest fragmentation	**Assess the extent of forest fragmentation and formulate strategies to increase connectivity** with a view to facilitating genetic flows of native fauna and flora between and within landscapes **Mainstream connectivity principles into** (state- and private-funded) **restoration projects** **Prepare/update thematic maps for cross-sectoral landscape planning** (e.g. on land use/cover, topography, soil/land suitability, biodiversity/protected areas) **Identify restoration areas to act as connectivity corridors, using gender-balanced participatory processes** with defined roles and responsibilities		Where possible, **create corridors between fragmented forest stands and productive areas under degradation risk** to enable wildlife and tree seed dispersal **Develop and apply strategies for efficient, cost-effective agreements to support restoration and connectivity** and greater compliance and impact Where appropriate, **establish planted forests for multiple economic, social and environmental objectives,** including improving site conditions and biodiversity conservation in forest-poor areas	**Monitor the investments made**
	More information			
	Guidelines for the conservation and sustainable use of biodiversity in tropical timber production forests (ITTO & IUCN 2009)			
	Spatial planning and monitoring of landscape interventions: maps to link people with their landscapes (Willemen et al. 2014)			
	Forest fragmentation. In: *Restoring tropical forests: a practical guide*, pp. 93–98 (Elliott et al. 2014)			
	Targeted habitat restoration can reduce extinction rates in fragmented forests (Newark et al. 2017)			
GE20: Conserve natural grasslands, savannas and wetlands	Through participatory processes, **identify natural areas that should not be converted to planted forests or other land uses** and, rather, should be kept in a natural state	**Assess potential risk factors for the conversion of natural areas and formulate strategies to minimize those risks**	Through cross-sectoral collaboration, **undertake conservation and management measures** in savannas and wetlands	**Monitor the development** of natural grasslands and wetlands

	More information			
	Resilience and restoration of tropical and subtropical grasslands, savannas, and grassy woodland (Buisson et al. 2018)			
	Wetlands International (www.wetlands.org/?s=restoration)			
PRINCIPLE 5: TAILOR TO THE LOCAL CONTEXT USING A VARIETY OF APPROACHES				
GE21: Assess local context and restrictions	**Assess the local ecological, sociocultural, governance and economic conditions driving change in the landscape**		**Analyze potential opportunities and restrictions for implementing FLR**, given the local context Through a participatory process, **determine the types and aims of FLR interventions on specific sites**	**Locally adapt,** as needed, **to ongoing changes**, including those related to climate change
	More information			
	Understanding the landscape mosaic (Gilmour 2005b)			
	Restoring tropical forests: a practical guide (Elliott et al. 2013)			
	A guide to the Restoration Opportunities Assessment Methodology (ROAM): assessing forest landscape restoration opportunities at the national or sub-national level (IUCN & WRI 2014)			
	Implementing forest landscape restoration: a practitioner's guide (Stanturf et al. 2017)			
GE22: Allow for future changes in conditions	**Conduct a general assessment of national climate risk** as it relates to land use, land-use change and forestry in the country	**Analyze current conditions and projected sociocultural, political and climate-related trends** and assess the associated opportunities and risks **Review selected FLR interventions for their adaptability to future landscape-scale trends**	**Monitor trends and assess associated risks and potential opportunities** for FLR implementation **Introduce and apply emerging technologies** such as open-access remote sensing, geographic information systems and models, digital elevation models and software that facilitates the detection of landscape-scale patterns	**Diversify land uses, biota and livelihoods** to reduce risk and increase landscape resilience **Provide incentives for climate-smart technologies** in restoration and planting practices and for land uses adapted to projected climate change
	More information			
	Climate change guidelines for forest managers (FAO 2013)			
GE23: Tailor FLR interventions to the local context and generate local benefits	**Define a set of FLR interventions suited to the local context and develop a landscape vision** acceptable to all stakeholders	**Review selected interventions for their adaptability to future trends in the local context** **Assess locally important ecosystem services**, including regulating and cultural services, and ensure their continued supply	**Improve local income opportunities and prepare markets for locally developed products** from restored forest landscapes **Pay attention to local-level value-added production** from restored forests	**Fully involve local stakeholders in FLR design, implementation and evaluation**, and take into account the landscape history and people's expectations

		through FLR within a landscape	and mosaic landscapes	
	More information			
	Decision support tools for forest landscape restoration (Chazdon & Guariguata 2018)			
	A tool for planning community-based tree and forest product enterprises: Market Analysis & Development—MA&D (FAO 2011a)			
	A cost-benefit framework for analyzing forest landscape restoration decisions (Verdone 2015)			
	A decision framework for identifying models to estimate forest environmental services gains from restoration (Christin et al. 2016)			
	Identifying site-level options (Lamb 2005)			
GE24: Achieve the financial and economic viability of FLR investments	**Prepare cost–benefit analyses of the planned FLR programmes and projects**, including non-monetary benefits and their values	**Develop business cases for FLR investments and communicate these** to potential private investors	**Explore opportunities for market-based incentives** such as results-based carbon payments and transfer payment mechanisms for ecosystem services At the programme and project levels, **conduct economic analyses of pilot FLR initiatives** to help guide policy formulation in the use of incentives	**Determine how to gain added value for the goods and ecosystem services generated by FLR interventions,** such as through ecotourism, reducing waste and improving product quality
	More information			
	A cost-benefit framework for analyzing forest landscape restoration decisions (Verdone 2015)			
	Value for money: Guatemala's forest landscape restoration (Colomer et al. 2018)			
	Enhancing food security through forest landscape restoration: lessons from Burkina Faso, Brazil, Guatemala, Viet Nam, Ghana, Ethiopia and Philippines (Kumar et al. 2015)			
GE25: Identify opportunities to increase local incomes	**Strengthen forest producer organizations and locally based small and medium-sized enterprises** and support their market access **Consider local opportunities for alternative income sources for the rural poor** not based on land ownership and natural resource exploitation		**Promote the local-level and value-added production and processing** of agricultural, timber and NTFPs **Promote forest-related income opportunities and market access for women** as important determinants of the local acceptability of FLR implementation	**Develop opportunities to partner with communities, projects and institutions** (public and private) with processing and marketing experience to strengthen efforts to gain access to markets **Explore community-based forest management schemes** based on forest goods and ecosystem services and develop investment strategies
	More information			
	Community forestry and FLR: attracting sustainable investments for restoring degraded land in SE Asia (Gritten et al. 2018)			
	Forest landscape restoration for livelihoods and well-being (Erbaugh & Oldekop 2018)			
GE26: Develop sustainable supply chains	**Identify the potential to develop green supply chains** for products produced	**Build on existing sustainable supply-chain initiatives**, such as those associated with	**Develop instruments to support financial returns for sustainable forest**	**Scope out potential marketing opportunities and value chains** for tree species that are

	in restored forest landscapes	certification and timber legality, with the aim of making similar processes more accessible to local and indigenous communities and smallholder farmers **Develop public–private partnerships** for sharing the incremental costs and ensuring the viability of initiatives to create sustainable supply chains in restored forest landscapes **Assist local and indigenous communities and smallholder farmers to develop sustainable supply chains** for the goods they produce on restored forest lands	**land-use options**, including mechanisms to provide payments for ecosystem services in restored landscapes **Create enabling conditions**, including incentives, access to finance and fair taxes, and simplified regulations, **to develop sustainable supply chains for promising products** from restored forests and agroforestry	abundant in the landscape but relatively unknown in the market
	More information			
	The buzz on green supply chains (ITTO 2018)			
	Is community forestry open for business? (Greijmans & Gritten 2015)			
PRINCIPLE 6: MANAGE ADAPTIVELY FOR LONG-TERM RESILIENCE				
GE27: Take an adaptive management approach	From the initial stages of an FLR process, **ensure understanding among all stakeholders of the importance of adaptive management in improving FLR planning interventions** **Incorporate in the FLR monitoring system a component to enable the learning of lessons** on successes and failures and the improvement of future FLR interventions		**Periodically assess, review and document feedback on FLR interventions**, with the participation of relevant stakeholders **Promote applied and participatory research on determining factors for the adoption of FLR interventions** by local stakeholders and extend and communicate the resulting knowledge and experiences	**Annually review FLR interventions and adapt them** in light of learnings gained from monitoring and assessment
	More information			
	Multi-sectoral platforms for planning and implementation: how they might better serve forest and farm producers (FAO 2014)			
	Guidelines for the restoration, management and rehabilitation of degraded and secondary tropical forests (ITTO 2002)			
	International standards for the practice of ecological restoration, including principles and key concepts (McDonald et al. 2016)			
	Implementing forest landscape restoration: a practitioner's guide (Stanturf et al. 2017)			
	Co-creating conceptual and working forest and landscape restoration frameworks based on core principles (Gutierrez et al. 2018)			

<table>
<tr><td rowspan="3">GE28: Continually measure the biophysical dimensions of the landscape</td><td>Determine the specific physical and environmental risk and stress factors with the potential to affect FLR interventions</td><td>Document the baseline situation with ground-level and drone photographs and remote sensing

To the extent possible, document the site history that led to the need for FLR</td><td>Analyse outcomes and assess whether the effects of stress factors will allow a socially and economically feasible approach to FLR in the landscape and over time</td></tr>
<tr><td colspan="3">More information</td></tr>
<tr><td colspan="3">Climate change guidelines for forest managers (FAO 2013)

Synergies between climate mitigation and adaptation in forest landscape restoration (Rizvi et al. 2015)</td></tr>
<tr><td rowspan="3">GE29: Periodically assess vulnerability to climate change</td><td>Assess FLR interventions according to their ability to increase the long-term adaptive capacity of stakeholders

Take stock and encourage research to improve and apply ecological knowledge aimed at maintaining ecological processes such as pollination, seed dispersal and nutrient cycling</td><td>Assess ecological and social vulnerability and the drivers behind it

Assess the impacts of climate change and climate variability on the physical characteristics of the landscape and its productivity, ecological dynamics and ecosystem functions</td><td>For stress factors caused by climate change, explore the feasibility of undertaking FLR under adaptation and mitigation mechanisms within the United Nations Framework Convention on Climate Change, particularly as part of climate-change adaptation</td></tr>
<tr><td colspan="3">More information</td></tr>
<tr><td colspan="3">Climate change guidelines for forest managers (FAO 2013)

Accelerating biodiversity commitments through forest landscape restoration: evidence from assessments in 26 countries using the Restoration Opportunities Assessment Methodology (ROAM) (Beatty et al. 2018)</td></tr>
<tr><td rowspan="8">GE30: Develop participatory monitoring of FLR</td><td>Carry out diagnostics to assist the process of setting up participatory, collaborative FLR monitoring by systematically identifying factors that are already in place or need strengthening

Consider the local restoration context and identify the desired outcomes as a starting point for identifying indicators and shaping the monitoring system. Three recommended steps for identifying priorities and indicators for FLR monitoring are: 1) determine the goals, identify current and desired land-use patterns, and define the principal barriers to change; 2) filter the choices for indicators according to local constraints, priorities for change in the landscape and data availability; and 3) set up an indicator framework based on suitable metrics</td><td>Develop and implement a comprehensive set of process indicators and monitoring protocols that cover:
the livelihoods of communities, disaggregated by social group;
biodiversity values and ecological functions; and
the productivity of agricultural and natural resource systems</td><td>Monitor institutional arrangements for landscape governance, including laws, customs, regulations and norms of behaviour

Use FLR approaches that enhance ecosystem resilience and the adaptive capacity of local stakeholders</td></tr>
<tr><td colspan="3">More information</td></tr>
<tr><td colspan="3">Applying an adaptive management approach in FLR (Gilmour 2005b)</td></tr>
<tr><td colspan="3">Measuring the effectiveness of landscape approaches to conservation and development (Sayer et al. 2016)</td></tr>
<tr><td colspan="3">Implementing forest landscape restoration: a practitioner's guide (Stanturf et al. 2017)</td></tr>
<tr><td colspan="3">Success from the ground up: participatory monitoring and forest restoration (Evans & Guariguata 2016)</td></tr>
<tr><td colspan="3">A diagnostic for collaborative monitoring in forest landscape restoration (Evans & Guariguata 2019)</td></tr>
</table>

<table>
<tr><td></td><td colspan="3">A guide to identifying priorities and indicators for restoration monitoring (Buckingham et al. 2019)</td></tr>
<tr><td rowspan="7">GE31: Encourage open access to, and the sharing of, information and knowledge</td><td>Collate existing national-level data and information on FLR practices, and use this knowledge in developing FLR interventions

Build awareness of the characteristics and importance of FLR at the local, national and international levels</td><td>Develop and disseminate information for field use by agricultural extension services aimed at increasing understanding of FLR and its benefits, costs and techniques

Develop communication strategies on FLR targeted at key stakeholder groups</td><td>Foster national and local working groups involving all stakeholders and encourage other forms of networking for sharing experiences and developing ideas and actions for FLR

Devise or adapt communication tools to match the message, medium and target group, including translation into local languages, as necessary</td></tr>
<tr><td colspan="3">More information</td></tr>
<tr><td colspan="3">Implementing forest landscape restoration: a practitioner’s guide (Stanturf et al. 2017)</td></tr>
<tr><td colspan="3">Measuring the effectiveness of landscape approaches to conservation and development (Sayer et al. 2016)</td></tr>
<tr><td colspan="3">Restoring forest landscapes: important lessons learnt (Mansourian & Vallauri 2014)</td></tr>
<tr><td colspan="3">Learning from landscapes (IUCN ArborVitae Special 2008: www.iucn.org/downloads/a_avspecial_learning_from_landscapes_1.pdf)</td></tr>
<tr><td colspan="3">FAO’s Forest and Landscape Restoration Mechanism knowledge base (www.fao.org/in-action/forest-landscape-restoration-mechanism/knowledge-base)</td></tr>
<tr><td rowspan="8">GE32: Report on FLR outcomes</td><td colspan="2">Develop a social monitoring and evaluation plan in the early stages of an FLR process, including indicators for measuring progress</td><td>Monitor households and communities before, during and after the implementation of an FLR intervention to generate data on changes in livelihoods, wellbeing and resilience due to FLR</td><td>Ensure the continuation of monitoring over time on aspects such as carbon stocks, biodiversity, ecosystem services and the livelihoods of local stakeholders

Communicate monitoring findings to national and international FLR networks</td></tr>
<tr><td colspan="4">More information</td></tr>
<tr><td colspan="4">Implementing forest landscape restoration: a practitioner’s guide (Stanturf et al. 2017)</td></tr>
<tr><td colspan="4">IUCN overall monitoring framework</td></tr>
<tr><td colspan="4">Criteria and communication in the IUCN Bonn Challenge Barometer of Progress (https://infoflr.org/bonn-challenge/bonn-challenge-barometer)</td></tr>
<tr><td colspan="4">Forest and Landscape Restoration Mechanism FLR monitoring (www.fao.org/in-action/forest-landscape-restoration-mechanism/knowledge-base/monitoring-evaluation)</td></tr>
<tr><td colspan="4">Monitoring and evaluating site-level impacts (Gasana 2005)</td></tr>
<tr><td colspan="4">Participatory planning, monitoring and evaluation of multi-stakeholder platforms in integrated landscape initiatives (Salvemini & Remple 2014)</td></tr>
<tr><td colspan="4">Indicators for improved forest ecosystem function, livelihood and resilience (Erbaugh & Oldekop 2018)</td></tr>
</table>

4 The way forward

The first priority in the conservation and use of tropical forest landscapes should be sustainable management, because this will prevent degradation and thus render restoration unnecessary. If policies are sound and sustainability the goal of all stakeholders, the prospects for maintaining and enhancing forest landscapes are good. Wider issues such as population pressure, globalization and especially climate change, however, are putting increasing pressure on resources, and land degradation has become widespread. Thus, FLR is needed as a way of restoring the functionality of degraded landscapes, enabling local people to obtain decent livelihoods and improving environmental outcomes.

Restoring forest landscapes and sustainably managing and protecting existing forests are a cost-effective strategy for reaching the goals of the Paris Agreement on climate change, which aim to limit the global temperature rise to 1.5 °C. The SDGs and several other globally agreed policy instruments, including the UN Decade on Ecosystem Restoration (2021–2030), recognize FLR as an important tool for achieving the aspirations such instruments embody.

The ambition of this set of guidelines is to support the goals and aspirations of stakeholders in the implementation of FLR and to inform decision-makers and practitioners in the development of successful FLR interventions. A number of immediate actions can be taken to encourage the use of these guidelines at the national and local levels, including the following:

- Apply the guidelines as a reference and guiding document in the development of FLR interventions at the national and subnational levels.
- Use the guidelines as a vehicle for increasing capacity in tropical countries to undertake FLR, in combination with other specific guidelines, tools and approaches.
- Identify landscapes where FLR is necessary, feasible and a local priority and make a long-term commitment to its implementation, including by putting in place mechanisms for learning and exchanging information among stakeholders in such landscapes and at sites within them.
- Promote the guidelines among international organizations and interested stakeholders as an important contribution to the existing community of practice, and support strategies for influencing the development of FLR-conducive strategies at the national and subnational levels.
- Promote the dissemination and application of the guidelines by local actors and other stakeholders. This may involve the production of simplified versions adapted to local contexts and in local languages.
- Use the guidelines to advocate FLR in broader international conventions and processes.
- Monitor the impacts of these guidelines on changing practices in forest and landscape use throughout the tropics.

Glossary

Adaptive management[9]	A structured, iterative process of robust decision-making in the face of uncertainty with the aim of reducing uncertainty over time via system monitoring
Afforestation	The establishment of a planted forest on non-forested land
Agroforest	A complex of trees within an area broadly characterized as agricultural or an agroecosystem
Biodiversity	The variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems [From the Convention on Biological Diversity, 1992]
Degraded forest landscape	Forest conditions other than those found in primary or managed natural and planted forests. "Landscape" is defined in this context as a cluster of interacting ecosystem types of forest and other woodland vegetation
Degraded forest land	Former forest land severely damaged by the excessive harvesting of timber or non-timber forest products, poor management, repeated fire, grazing or other disturbances or land uses that damage soil and vegetation to a degree that inhibits or severely delays the re-establishment of forest after abandonment
Degraded (natural) forest	Forest that delivers a reduced supply of goods and services from a given site and maintains only limited biodiversity. It has lost the structure, function, species composition and/or productivity normally associated with the natural forest type expected at that site
Ecological restoration	The process of assisting the recovery of an ecosystem that has been degraded, damaged or destroyed, using the concept of a native reference ecosystem as a model for setting and evaluating restoration objectives. It is a process aimed at recovering ecosystem integrity and resilience while delivering ecosystem services and ensuring human wellbeing. The conservation and restoration of biodiversity is usually a primary goal
Ecosystem restoration	A term often used interchangeably with "ecological restoration", but ecological restoration always addresses biodiversity conservation, while some approaches to ecosystem restoration may focus solely on the delivery of ecosystem services
Ecosystem services (also called environmental services)	All benefits that people obtain from natural or semi-natural ecosystems, including provisioning, regulating, cultural and supporting services
Elastic capacity of a forest ecosystem	Dynamic forest processes within a range of changing vertical forest structure, species composition, biodiversity and productivity normally associated with the natural forest type expected at that site
Endemic species	A species native to, and restricted to, a particular geographical region
Enrichment planting	The planting of desired tree species in a modified natural forest or secondary forest or woodland with the objective of creating a forest dominated by desirable (i.e. local and/or high-value) species
Environmental services	See "ecosystem services"
Forest degradation	The reduction of the capacity of a forest to produce goods and services (in which "capacity" includes the maintenance of ecosystem structure and functions)

[9] The definitions given here are to assist readers and do not necessarily constitute official ITTO definitions. In some cases they are drawn from other ITTO documents and in others they are adapted from the literature.

Jurisdiction	An area in a country under the control of a subnational government entity which is different from that in neighbouring areas
Land-use planning	The systematic assessment of land potential and alternatives for optimal land uses and improved economic and social conditions through participatory processes that are multisectoral, multistakeholder and scale-dependent. The purpose of land-use planning is to support decision-makers and land users in selecting and putting into practice those land uses that will best meet the needs of people while safeguarding natural resources and ecosystem services for current and future generations
Native species	A species that occurs naturally in a region
Natural regeneration	Renewal of trees by self-sown seeds or natural vegetative means
Nutrient cycle	A natural process in which nutrients, mainly minerals, are taken up from the soil, used for plant growth and, once the plant dies, returned to the soil through decomposition processes
Permanent forest estate	Land, whether public or private, secured by law and kept under permanent forest cover. This includes land for the production of timber and other forest products, for the protection of soil and water, and for the conservation of biodiversity, as well as land intended to fulfil a combination of these functions
Planted forest	A forest stand that has been established by planting or seeding
Primary forest	Forest which has never been subject to human disturbance, or has been so little affected by hunting, gathering and tree-cutting that its natural structure, functions and dynamics have not undergone any changes that exceed the elastic capacity of the ecosystem
Reforestation	The re-establishment of trees and understorey plants at a site immediately after the removal of natural forest cover
Resilience	The capacity of an ecosystem to recover from perturbations (biotic and abiotic)
Secondary forest	Woody vegetation regrowing on land that was largely cleared of its original forest cover (e.g. carried less than 10% of the original forest cover). Secondary forests commonly develop naturally on land abandoned after shifting cultivation, settled agriculture, pasture, or failed tree plantations
Silviculture	The art and science of producing and tending forests by manipulating their establishment, species composition, structure and dynamics to fulfil given management objectives
Stakeholders	Any individuals or groups directly or indirectly affected by, or interested in, a given resource (in this case forest)
Shifting agriculture	Used here as a synonym for shifting or swidden cultivation. The burning and cleaning of forest vegetation and subsequent planting of agricultural crops for short periods (e.g. 1–5 years) followed by abandonment
Succession	Progressive change in species composition and forest structure caused by natural processes over time
Sustainable forest management	The process of managing forest to achieve one or more clearly specified objectives of management with regard to the production of a continuous flow of desired forest products and services without undue reduction of its inherent values and future productivity and without undesirable effects on the physical and social environments
Sustained yield	The production of forest products in perpetuity, ensuring that the harvesting rate does not exceed the rate of replacement (natural or artificial) in a given area over the long term
Tenure	Agreement(s) held by individuals or groups, recognized by legal statutes and/or customary practice, regarding the rights and duties of ownership, holding, access and/or usage of a particular land unit

	or the associated resources (such as individual trees, plant species, water or minerals) therein
User rights	The rights to the use of forest resources as defined by local custom or agreements or prescribed by other entities holding access rights. These rights may restrict the use of particular resources to specific harvesting levels or specific extraction techniques
Woodlot	Small forest stands up to several hectares in size that allow some productive and protective management

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Part II: Case studies in tropical forest landscape restoration

The need for FLR emerges as forests and wider landscapes become degraded as a result of one or more direct drivers. From this baseline, the design and implementation of FLR is context-specific and influenced by biophysical factors, socioeconomic conditions and governance at the landscape scale. The role of stakeholders is decisive in setting objectives for the FLR process and the sustainable use of the landscape into the future.

Context matters

"Different biophysical and social contexts affect the choice of technical approach necessary to meet restoration goals and objectives. Each situation will be unique and may require a particular mix of approaches, but some general principles apply" (Stanturf et al. 2017)

Part II presents 18 case studies of FLR interventions in the tropics that have been implemented in the past or are under implementation now. The experiences gained in these efforts inform the guidelines and help illustrate the range of FLR interventions given local biophysical, socioeconomic and governance contexts, stakeholder objectives and available resources. Most of the case studies presented here refer to projects designed and implemented to respond to context-specific situations affecting the functionality of a particular area at a given scale. These projects build on or incorporate participatory approaches and mechanisms that seek to engage stakeholders in the FLR process through awareness-raising, information, capacity development and the establishment of favourable conditions for implementation.

The context and influence of the landscape are important in the visioning, conceptualization and implementation processes in these case studies. On the other hand, the extent to which the landscape approach (involving its specific tools and interventions) is incorporated appears to depend on the quality of the participatory process, the commitment and capacity of the institutions in the relevant jurisdictions, and the awareness of the benefits that may accrue to households, communities, public and private investors, and society at large from putting in place sustainable landscape-scale practices.

The case studies are grouped here (Table 6) as follows:

- restoration of degraded forests for production;
- restoration of degraded forests for protection (e.g. of soil, water and biodiversity);
- rehabilitation of degraded forest land through planted forests;
- rehabilitation of degraded forest land through agroforestry or silvopastoral systems;
- restoration and management of secondary forests; and
- restoration or rehabilitation of mangroves.

The cases studies are described using a standard template covering various relevant characteristics (Box 4).

Box 4: Template for describing case studies of tropical FLR

- Proponent
- Country of implementation
- Location
- Implementation period
- Restoration option
- Case-study focus
- Target main objective
- Target groups or users
- Partners and collaborators
- Context (initial situation) and challenge (problem) being addressed
- Process and methodological approach, techniques and tools used
- Field-level practices implemented
- Innovative aspects
- Outcomes
- Conditions (institutional, economic, social, cultural, environmental) for successful replication in a similar context
- Main challenges faced
- Key messages and lessons learned
- Sources describing the case
- Contributors
- Photos

Of the 18 selected case studies, three are from tropical Africa (Ethiopia, Ghana and Madagascar), seven are from tropical Asia (Cambodia, Indonesia, Malaysia, Myanmar, the Philippines and Thailand) and eight are from Latin America (Brazil, Colombia, Ecuador, Guatemala and Peru) (Table 7).

Table 6: Selected case studies of FLR in the tropics

CASE STUDY	COUNTRY	RESTORATION INTERVENTION					
		Restoration of degraded forests for production	Restoration of degraded forests for protection	Rehabilitation of degraded forest land through planted forests	Rehabilitation of degraded forest land through agroforestry or silvopastoral systems	Restoration and management of secondary forests	Restoration or rehabilitation of mangroves
1) Sustaining timber yields in dipterocarp forests through the Indonesia selective logging and strip-planting technique	Indonesia	✔					
2) The rehabilitation of degraded forests by local communities in Ghana	Ghana	✔					
3) Facilitating biodiversity through the shelter effects of *Pinus patula* and *Alnus acuminata* in montane	Ecuador	✔	✔	✔			

CASE STUDY	COUNTRY	RESTORATION INTERVENTION					
		Restoration of degraded forests for production	Restoration of degraded forests for protection	Rehabilitation of degraded forest land through planted forests	Rehabilitation of degraded forest land through agroforestry or silvopastoral systems	Restoration and management of secondary forests	Restoration or rehabilitation of mangroves
ecosystems in southern Ecuador							
4) Assisted natural regeneration for watershed restoration	Philippines		✔		✔		
5) An early example of FLR in northern Thailand	Thailand		✔				
6) The restoration of degraded tropical forests—a performance-based payment approach	Ethiopia	✔	✔	✔			
7) The domestication of endangered, endemic and threatened plant species in disturbed terrestrial ecosystems in Malaysia and Thailand	Malaysia and Thailand		✔	✔			
8) Achieving landscape restoration at Prey Lang through community forestry	Cambodia		✔			✔	
9) Restoring cloud forest on private and communal land in the Ecuadorian Andes	Ecuador		✔			✔	
10) The Matas Legais project	Brazil		✔	✔		✔	
11) The Land-Use Dialogue—planning sustainable landscapes in the Atlantic rainforest	Brazil	✔	✔	✔	✔	✔	
12) The private restoration of degraded forest land with native tree species in the Peruvian Amazon	Peru			✔		✔	
13) From *Eucalyptus* monocultures to high-diversity mixed forests—bringing together wood production and tropical forest restoration	Brazil			✔			
14) Strengthening the cocoa value chain for upscaling FLR through agroforestry	Guatemala				✔		

CASE STUDY	COUNTRY	RESTORATION INTERVENTION					
		Restoration of degraded forests for production	Restoration of degraded forests for protection	Rehabilitation of degraded forest land through planted forests	Rehabilitation of degraded forest land through agroforestry or silvopastoral systems	Restoration and management of secondary forests	Restoration or rehabilitation of mangroves
15) The productive rehabilitation of tropical cattle-ranching lands	Colombia				✔		
16) The restoration of mangrove ecosystems through community forestry	Myanmar						✔
17) Empowering local communities for the restoration of a coastal landscape in the Ayeyarwady Delta	Myanmar						✔
18) The restoration and community management of mangroves on the west coast of Madagascar	Madagascar						✔

Note: Dark green indicates the primary purpose of the intervention; light green indicates secondary purposes.

Table 7: Case studies in the tropics illustrating the FLR principles and guiding elements in practice

PRINCIPLE	GUIDING ELEMENT	CASE STUDIES																	
		Indonesia	Ghana	Ecuador-1	Philippines	Thailand	Ethiopia	Malaysia & Thailand	Cambodia	Ecuador-2	Brazil-1	Brazil-2	Peru	Brazil-3	Guatemala	Colombia	Myanmar-1	Myanmar-2	Madagascar
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1 Focus on landscapes	1) Undertake inclusive, gender-responsive landscape-level assessment and land-use planning				X				X		X	**X**				X		**X**	X
	2) Gain recognition that FLR must transcend sector policies				X							**X**			X	**X**	**X**	X	X
	3) Conduct FLR at an appropriate scale	X			X								X			**X**			
	4) Address tenure and access rights						X		X	**X**							**X**	**X**	
2 Engage stakeholders and support participatory governance	5) Build adequate governance capacity for decentralized FLR				X				X	X		**X**				**X**		**X**	
	6) Obtain strong stakeholder engagement	**X**	X	X	**X**	X	**X**		**X**	**X**	**X**	**X**				X	**X**	**X**	**X**
	7) Conduct joint stakeholder analysis of the drivers of degradation		X		X		**X**			**X**	**X**	**X**						**X**	
	8) Strive for social equity and benefit sharing								**X**			**X**							
	9) Conduct participatory FLR planning, decision-making and monitoring		**X**		X		X		**X**	X	X	**X**					**X**	**X**	**X**
	10) Build stakeholder capacity for sharing responsibility for FLR	**X**	**X**	X	X	**X**	**X**		**X**	X	X	**X**			**X**	X	**X**	**X**	**X**
	11) Address long-term adequate financing for FLR initiatives	X			**X**		X		X	X	**X**	**X**	**X**	**X**	**X**	X			
	12) Establish a favourable investment environment for FLR	X							X	**X**	**X**	**X**	**X**		**X**				

3 Restore multiple functions for multiple benefits	13) Generate multiple functions and benefits			X	X		**X**	X		X		X				**X**	**X**	
	14) Conserve biodiversity and restore ecological functions			**X**	**X**	**X**	**X**	**X**	**X**	X		X	**X**		**X**	**X**		**X**
	15) Improve livelihoods		**X**		**X**		**X**		X					X	**X**	**X**	**X**	**X**
	16) Make full use of locally based knowledge		X		X			X	X		**X**	X						
4 Maintain and enhance natural forest ecosystems within landscapes	17) Avoid the conversion of natural forests	**X**							**X**	**X**				X				
	18) Restore degraded forest and rehabilitate degraded forest land	**X**	**X**	**X**	**X**	**X**	X	**X**	**X**	**X**		**X**	**X**	X				**X**
	19) Avoid forest fragmentation				X	**X**				**X**		**X**			**X**			
	20) Conserve natural grasslands, savannas and wetlands				X										X	X		X
5 Tailor to the local context using a variety of approaches	21) Assess local context and restrictions				X	X	**X**	X	**X**		**X**	X			X	**X**	X	**X**
	22) Allow for future changes in conditions					X		X	X		**X**	**X**	X					
	23) Tailor interventions to the local context and generate local benefits		**X**		X		X	**X**	**X**	X	**X**	X				**X**	**X**	**X**
	24) Achieve the financial and economic viability of FLR investments	**X**	**X**									**X**	**X**	**X**	**X**			
	25) Identify opportunities to increase local incomes	X	**X**		X		X		X			**X**		**X**		**X**	**X**	**X**
	26) Develop sustainable supply chains	X								**X**		X		**X**				
6 Manage adaptively for long-term resilience	27) Take an adaptive management approach				X						**X**		X			X		
	28) Continually measure the biophysical dimensions of the landscape	X		**X**	X	X		X		X		X	**X**			**X**		X
	29) Periodically assess vulnerability to climate change																X	
	30) Develop participatory monitoring of FLR						**X**								**X**			X
	31) Encourage open access to, and the sharing of, information and knowledge			**X**	X	X		X			**X**	X	**X**	X	**X**		X	X
	32) Report on FLR outcomes	X	**X**	**X**	X	**X**	**X**	**X**				X	**X**					

Note: Dark green indicates that the case study makes a strong contribution to the guiding element; light green indicates that the case study addresses makes a meaningful contribution to the guiding element.

Case study 1: Sustaining timber yields in dipterocarp forests through the Indonesia selective logging and strip-planting technique	
Proponent(s)	Sari Bumi Kusuma logging concession Ministry of Environment and Forestry, Indonesia
Country of implementation	Indonesia
Location	Sari Bumi Kusuma logging concession, Central Kalimantan Province, Indonesia (lowland dipterocarp forest)
Implementation period	1999–present
Restoration option	Restoration of degraded forests for production
Case-study focus	Process ☐ Planning ☐ Assessment/monitoring ✓ Intervention level ✓
Main objective	Sustainably manage production forests in Indonesia to supply timber to forest industries and provide conservation benefits such as biodiversity conservation as well as social and economic benefits to local people
Target groups or users	Forest managers, government decision-makers, impact investors and local people
Partners and collaborators	Faculty of Forestry, Tanjungpura University, West Kalimantan
Context (initial situation) and challenge (problem) addressed	Under the currently allowable logging intensities and cutting cycle of 30 years, timber yields are not sustainable in selectively logged dipterocarp forests in Indonesia. Timber harvest volumes decrease from more than 60 m^3 per ha for the harvesting of primary forests to 32–40 m^3 per ha in second harvests; an average yield of only 19 m^3 per ha is expected in the third harvest. Yields of less than 30 m^3 per ha are not financially remunerative, and forests without valuable timber are prone to conversion to more lucrative land uses. To sustain timber yields, The Indonesian Selective Cutting with Line Planting/Intensive Silviculture Technique (TPTJ/SILIN) was piloted in two logging concessions in 1999. This case study is from one of those logging concessions. TPTJ/SILIN involves strip planting with native fast-growing commercial timber species such as *Shorea leprosula* and *Shorea parvifolia*. Nursery-grown seedlings or wildlings are planted in twice-logged forest at 5 m intervals along cleared strips at a spacing of 20 m. Based on this case study (Ruslandi et al. 2017a), timber volumes from planted trees and naturally regenerated future crop trees in the inter-strip areas are expected to recover primary forest volumes (96 m^3 per ha) after 40 years. Carbon stocks recover to primary-forest levels in just 35 years
Process, methodological approach, techniques and tools used	– Application of best management practices for enrichment planting with fast-growing dipterocarps (e.g. tending of seedlings) while maintaining natural forest cover at operational scales in logging concessions (refined nursery practices, tree improvement, and species selection were integral to the success of this intervention) – Intensive tending of the seedlings in the first years after planting – Planting on fairly level terrain with easy access for planting and tending
Field-level practices implemented	– Implementation of reduced-impact logging – Large-scale nursery establishment – Adequate site preparation (i.e. strip clearing) – Careful planting of native fast-growing commercial species (e.g. large planting holes) – Tending (weeding and liberation of planted trees) – Tree improvement and species selection – Forest growth monitoring As contractors, local people are responsible for site preparation, planting and tending, and other activities are the responsibility of the concession's employees
Innovative aspects	– Planting native commercial fast-growing species at industrial scales (i.e. 4000 ha/year) – Maintaining natural forest cover between planted strips

	– Applied only on level terrain with easy access from maintained logging roads to minimize planting and monitoring costs – Employing local people as workers and planting contractors
Outcomes	– Line-planted area of 49 000 ha in the Sari Bumi Kusuma logging concession – More than 2000 workers from local communities employed in planting 4000 ha per year – Commercial timber growth of 5 m^3 per ha per year in the TPTJ/SILIN area compared with only 1 m^3 per ha per year in the selective-logging-only (TPTI) area – Scientific publications and training for local researchers and forest workers (the concession has standard operating procedures for each TPTJ activity because the concession has been Forest Stewardship Council-certified)
Conditions (institutional, economic, social, cultural, environmental) for successful replication in a similar context	– Reasonably level terrain that will remain accessible for at least 5–10 years – Skilled and dedicated staff members who take pride in their work – Company owner commitment, including financial support. The upfront cost of applying TPTJ is about USD 429 per ha; the net present value is USD 628 per ha for the timber-only revenue and USD 1056 per ha for timber and carbon payment revenues, assuming a cutting cycle of 25 years as specified by government and a discount rate of 6% per year – Government support, including incentives such as reducing timber royalty
Main challenges faced	– Financial viability, in terms of low financial returns and high upfront costs – Ownership of planted trees and long-term land security. There should be a clear rule that the planted trees will be owned by the concession and there is a guarantee from the government that the concession licence will be extended to enable the concessionaire to harvest the planted trees – Development of a harvesting method to minimize the impacts of future harvests of large volumes
Key messages and lessons learned	– Silvicultural knowledge about the planted species is crucial – Dedicated and well-trained concession staff is essential to ensure that all procedures are implemented properly and innovatively – Strong commitment is required from concession owners, including financial support – Government support, including incentives, is needed for wider adoption – Local community members should be employed
Source(s) describing the case study	Ruslandi et al. (2017a); Ruslandi et al. (2017b)
Contributors	Ruslandi (Yayasan Konservasi Alam Nusantara, an affiliate of The Nature Conservancy, Jakarta Indonesia); and Francis E. Putz (Department of Biology, University of Florida)
Photos	

Site preparation for strip-planting at the Sari Bumi Kusuma concession with annual targets of 3000–4000 ha. Photo: © Ruslandi

A 16-year-old plantation in a TPTI/SILIN area of the Sari Bumi Kusuma concession. Photo: © Sari Bumi Kusuma

Case study 2: The rehabilitation of degraded forests by local communities in Ghana	
Proponent	ITTO Forestry Research Institute of Ghana
Country of implementation	Ghana
Location	Pamu-Berekum Forest Reserve (dry semi-deciduous forest ecological zone) Afrensu-Brohoma Forest Reserve (dry semi-deciduous fire zone) Southern Scarp Forest Reserve (moist semi-deciduous southeast)
Implementation period	2012–2017
Restoration option	Restoration of degraded forests for production
Case-study focus	Process ☐ Planning ☐ Assessment/monitoring ✓ Intervention level ☐
Main objective	Forests established by local communities through the rehabilitation of degraded reserved forest areas are collaboratively and sustainably managed together with the communities and serve as a major source of livelihoods
Target groups or users	Local communities living in and around the reserved forest areas in three districts
Partners and collaborators	Local communities, Forest Service Division of the Forestry Commission, traditional authorities and district assemblies
Context (initial situation) and challenge (problem) addressed	The overexploitation of forest resources, agricultural expansion into forest areas, wildfires and mining have significantly reduced forest cover and degraded most reserved forest areas in Ghana. This negatively affects biodiversity, soils and ultimately agricultural productivity. After an initial focus on the rehabilitation of degraded reserved forest areas through the establishment of community plantations and agroforestry, it became clear that long-term success required the development of a sustainable management and monitoring system, including capacity building and governance
Process and methodological approach, techniques and tools used	The project was guided by a participatory process. Local communities were the main actors in plantation establishment. They were also included in land-use surveys, focus-group discussions and capacity building, together with the Forest Service Division. Capacity building on plantation management, timber and carbon valuation, monitoring and governance were central aspects of the approach
Field-level practices implemented	– Seed propagation and nursery establishment – Establishment of tree plantations with various indigenous species (e.g. *Albizia adianthifolia*, *Altsonia boonei*, *Ceiba pentandra*, *Ficus exasperate*, *Milicia excelsa*, *Sterculia tragacantha* and *Terminalia* spp.) and one exotic tree species (*Cedrela odorata*) – Enrichment planting of the plantations with five species that produce important NTFPs – Methodology for communities to calculate timber financial values – Estimation of carbon stocks and carbon-dioxide reduction through restoration – Plantation registration and development of management plans
Innovative aspects	– Planting distance: the project used wider planting distances than suggested by the Forestry Commission for the *taungya* system, with farmers preferring 8 m 3 m or 6 m × 6 m to provide more light for growing crops – Registration: the project supported farmers to register established plantations to ensure they obtained a share of the benefits at the time of harvest – NTFPs: The inclusion of NTFPs in the *taungya* system has not been done before in Ghana
Outcomes	– 225 ha of plantation with 48 tree species established in four years → the increased forest cover is contributing to improved water supply and carbon sequestration – Plantation plots registered with the government by more than 180 farmers

	– Five species of NTFPs integrated with established plantations in one project site – Several technical reports and publications produced to support researchers and practitioners in community-based forest restoration
Conditions (institutional, economic, social, cultural, environmental) for successful replication in a similar context	– Local institutional arrangements to govern and manage established plantations in the long term – Use of local knowledge – Collaboration and clear distribution of roles between government-affiliated stakeholders and local communities – Green firebreaks around established plantations to prevent wildfires
Main challenges faced	– Restricted tree tenure and complicated plantation registration procedure – Continued wildfires, unsustainable farming practices and illegal logging – Conflicts with nomadic livestock herders
Key messages and lessons learned	– Strong commitment from forest resource managers (communities) needed – Opportunity costs for not converting degraded forest areas into agricultural lands need to be accounted for (e.g. through payment schemes for ecosystem services, carbon credits, alternative livelihoods)
Source(s) describing the case	ITTO & FORIG (2017)
Contributors	Mélanie Feurer (Bern University of Applied Sciences, Switzerland); and Lawrence Damnyag (CSIR-Forestry Research Institute Ghana)
Photos	

An ITTO rehabilitation project community plantation featuring *Khaya senegalensis*, *Terminalia superba* and *Terminalia ivorensis* in the Olantan community, Begoro Forest district site. Photo: © Alex Aglebe

Collecting biodata from farmers for a benefit-sharing document for a plantation in the Nsugunsua community, Offinso district. Photo: © Emmanuel Antwi Bawuah

Case study 3: Facilitating biodiversity through the shelter effects of *Pinus patula* and *Alnus acuminata* in montane ecosystems in southern Ecuador	
Proponents	Universidad de Cuenca, Centro de Agroforestería y Manejo de Paisaje, Facultad de Ciencias Agropecuarias; Technical University of Munich School of Life Sciences Weihenstephan, Chair of Silviculture; and Thünen Institute of International Forestry and Forest Economics
Country of implementation	Ecuador
Location	Loja Canton, Loja Province, southern Ecuador. Six study sites in the provinces of Loja and Zamora-Chinchipe (*Estación Científica San Francisco* site), including five plantations *of Pinus patula* and three naturally regenerated forests of *Alnus acuminata,* and representing large parts of the humid Andean ecosystem at an altitude of 1935–2450 m above sea level
Implementation period	2011–2016
Restoration options	Restoration of degraded forests for production Restoration of degraded forests for protection
Case-study focus	Process ☐ Planning ☐ Assessment / Monitoring ✓ Intervention level ✓
Main objective	The reforestation of degraded areas is a promising strategy for sustainable land use and the conservation of biodiversity in the tropical mountain forest ecosystems of Ecuador. Native tree species have been largely neglected to date, however, and introduced species have been favoured, resulting in monocultures of *Pinus* spp. and *Eucalyptus* spp., with well-known ecological disadvantages. Nevertheless, these plantations are able to produce timber on former forest land (which has been converted to pasture and subsequently degraded to bracken fern fields), and they are suitable for the provision of shelter for native tree species that can be introduced by enrichment planting. This is particularly important because experimental trials have shown that many native species require shelter for successful establishment. With the aim of creating mixed forests, this concept can be used for the restoration of degraded areas and the conversion of existing monocultures, and it has been tested within the scope of a technology-transfer project called *Nuevos Bosques para Ecuador*. The project focused on scientific research and technology transfer using a participatory approach: the central work package enabled the installation of experimental plots and the carrying out of thinning treatments and enrichment plantings. This, in turn, enabled the evaluation of *A. acuminata* and *P. patula* stands as shelter tree species and the ecological and economic effects of these silvicultural treatments. Technology transfer included both the broad implementation of the silvicultural concept and the communication of suitable techniques and instruments for the continuation of the pilot project
Target groups or users	Private landowners, the national environmental agency, local government agencies and NGOs
Partners and collaborators	Technical University of Munich, Universidad Técnica Particular de Loja, Naturaleza y Cultura Internacional, Westfälische Wilhelms-Universität Münster, Thünen Institute of International Forestry and Forest Economics, Georg-August-Universität Göttingen, Freie Universität Berlin, Universidad Nacional de Loja, Ecuadorian Ministry of Environment, Provincial Government of Loja, Municipality of Loja, Municipality of Zamora, and local landowners
Context (initial situation) and challenge (problem) addressed	Reforestation with native species and mixed forests with higher ecological and economic stability are not yet considered in restoration practices in Ecuador, notwithstanding positive experiences in Central America and other regions. The aim of this pilot project was to foster the establishment of mixed forests with native species and

	test enrichment plantings with native tree species in naturally regenerated stands of *Alnus acuminata* and plantations of *Pinus patula*
Process and methodological approach, techniques and tools used	In total, 50 experimental plots were installed—33 in plantations of *P. patula* and 17 in *A. acuminata* stands. Each experimental plot was divided into 16 subplots in which nine native tree species were randomly distributed. The study areas were visited by local staff from various institutions to learn *in situ* of the different activities of enrichment planting as a restoration strategy. Moreover, planting-stock propagation techniques have been shared with local institutions. Additionally, several training courses in tree climbing and seed collection have been carried out to facilitate the propagation of autochthonous material
Field-level practices implemented	Enrichment planting was carried out in the experimental plots and surrounding demonstration areas in the rainy season in March and April 2015, immediately after thinning operations of differing intensities. Some 3267 seedlings were planted in pine plantations and 1683 seedlings in alder stands. The project compared both shelter tree species and evaluated the environmental factors facilitating or impeding the establishment of native species. Thinning operations of various intensities have been implemented in both pine plantations and alder stands. In addition, the impact of thinning operations on natural regeneration and their ecological and economic consequences were assessed. Training courses (tree climbing, silvicultural techniques) were carried out in the field under realistic and practice-oriented conditions
Innovative aspects	Institutional objectives and technology transfer focused on training local staff in environmental sciences and technical issues (including tree-climbing courses, seed management practices, nursery techniques, silvicultural treatments, and the monitoring of nutrient cycling and biodiversity), and the improvement of interinstitutional cooperation on environmental issues and the upscaling of technical experiences. Another innovative aspect was combining productive and protective functions into restoration concepts
Outcomes	Forest plantations with exotic species in southern Ecuador have mostly been characterized as having negative externalities in both ecological and economic terms. After ten years of research in mountain forests in southern Ecuador on restoration and reforestation, several native tree species with good growth responses (e.g. *Handroanthus chrysanthus*, *Cedrela montana* and *Juglans neotropica*) have been identified in open field conditions. Some species (e.g. *Podocarpus oleifolius* and *P. sprucei*) were able to grow under the shelter provided by *Pinus* and *Alnus* trees
Conditions (institutional, economic, social, cultural, environmental) for successful replication in a similar context	A participatory approach through the active and well-balanced joint cooperation of national, provincial and municipal agencies with NGOs and research organizations (Ecuadorian and German universities), conducted according to the objectives of local landowners and implementing fact-based corporate social responsibility
Main challenges faced	– Creating a platform for effective and harmonious interaction of the various stakeholders – Clear leadership and administration – Creating options for mid-term run-time and funding periods with a minimum of up to ten years
Key messages and lessons	– Applied science with a long-term perspective contributes to better decisions – The major obstacle to the use of native species for large-scale restoration is a lack of adequate knowledge about their biological characteristics and silvicultural traits. Information about appropriate seed storage, propagation methods and silvicultural treatment options must be adequately retrieved, compiled and applied, and the knowledge communicated – Both shelter tree species demonstrated potential for enrichment planting with native species. Thinning operations resulted in clearer effects for enrichment plantings in pine plantations, and the seedlings of all species showed consistently higher growth rates with increased thinning intensity

	– Forest site classification can support forest management planning: for example, investments could be directed to stands in the highest site-productivity class, whereas the conversion of monocultural stands to mixed forests might be more appropriate in stands with lower productivity. The classification system should be expanded to other native tree species – Because many soils in tropical areas are heavily degraded, investigations should be carried out on how soil biodiversity in tropical ecosystems can be facilitated by the conversion of monocultures (e.g. on bracken sites) into mixed forests. In this case, oribatid mites acted as indicators and model organisms for soil fauna – Arbuscular mycorrhizal fungi (AMF) represent the dominant mycorrhizal form in tropical (native) trees, improving the nutrient uptake, water balance and pathogen tolerance of their host plants. However, the forestry sites used in this project for afforestation with native tree species potentially provide a poor AMF inoculum: *Pinus patula* only forms associations with ectomycorrhizae, whereas roots of *Alnus acuminata* are associated with ectomycorrhizae, AMF and the nitrogen-fixing actinomycete *Frankia*
Source(s) describing the case study	Data are published in the database of the Platform for Biodiversity and Ecosystem Monitoring and Research in South Ecuador (http://tropicalmountainforest.org), and they are also available from the project partners on request
Contributors	Ximena Palomeque (Universidad de Cuenca, Centro de Agroforestería y Manejo de Paisaje, Facultad de Ciencias Agropecuarias); Bernd Stimm (Chair of Silviculture, School of Life Sciences Weihenstephan, Technical University of Munich); and Sven Günter (Thünen Institute of International Forestry and Forest Economics)

Photos

Dense *Pinus patula* plantation in southern Ecuador. Photo: © Baltazar Calvas

Regeneration after thinning in a pine plantation. Photo: © Bernd Stimm

Case study 4: Assisted natural regeneration for watershed restoration	
Proponents	Department of Environment and Natural Resources Forest Management Bureau; Balagunan Integrated Social Forestry Farmers Association, Inc.; and Municipality of Danao, Bohol The project was supported by FAO, which also contracted the Bagong Pagasa Foundation to facilitate some activities for the project and provide technical support to field implementation
Country of implementation	Philippines
Location	San Miguel, Danao Municipality, Bohol
Implementation period	2006–2009
Restoration option	Restoration of degraded forests for protection Rehabilitation of degraded forest land through agroforestry and/or silvopastoral systems
Case-study focus	Process ✓ Planning ☐ Assessment/monitoring ✓ Intervention level ✓
Main objective	To promote assisted natural regeneration (ANR) as a cost-effective restoration method for recovering biodiversity, enhancing resilience and supplying multiple forest products and ecosystem services
Target groups or users	Policymakers, government planners and technical staff, local government officers, peoples' organizations, NGOs and local communities
Partners and collaborators	NGOs, local communities and government extension agents. Additional funds were provided by the Japan Fund for Global Environment
Context (initial situation) and challenge (problem) addressed	The once-forested watersheds in the locality had been deforested and severely degraded through unsustainable land-use practices. Fire-prone grasses had become dominant, which prevented natural forest recovery. Tree planting was believed to be the only available approach to restoration, although there were few incentives or funds to implement and sustain such planting efforts. Previous reforestation efforts involving conventional tree planting were largely unsuccessful due to a lack of support from local people. ANR was introduced as a low-cost approach to restoration, with attractive benefits for local people and clear advantages in enhancing biodiversity and watershed protection
Process and methodological approach, techniques and tools used	ANR was used as the restoration approach with the engagement of local stakeholders, including communities, government officials and extension agents. The process started with the demonstration and explanation of ANR so that all concerned would understand the approach. Visual inspections, surveys and mapping of the area were made to identify the boundaries of the project area and the jurisdiction of the local government unit. After this, field work involved locating and staking wildlings (naturally regenerating forest tree seedlings and saplings) and nurturing their growth by reducing competition from weeds and grasses and protecting against fire through weeding, the pressing ("lodging") of fire-prone grasses (e.g. *Imperata cylindrica*) around the wildlings, and building and maintaining firebreaks. Local farmers were encouraged to plant food crops on firebreaks to provide economic benefits for local people, as well as NTFPs such as rattan, bamboo and nito (*Lygodium circinnatum*), in the restoration area to develop a sustainable supply of raw materials for handicraft production. The approach also helped control unplanned grazing and woodfuel gathering. As the local community began to appreciate the potential of ANR for restoring degraded forest lands, the municipality organized civic groups (e.g. associations of teachers and police), who voluntarily participated in the maintenance and protection of the ANR project site against forest fire. Some groups also "adopted" additional areas of nearby land for protection and the expansion of restoration efforts
Field-level practices implemented	Firebreak establishment; the planting of food crops in firebreaks; preventing recurrence of fire through community patrols; lodging of grasses and other weedy vegetation; regular patrols; community meetings and discussions

Innovative aspects	Active nurturing of natural regeneration (i.e. "assisted") is itself innovative in most areas where tree planting is the conventional approach to reforestation. The project's ability to convince interested sectors that natural regeneration can play a major role in forest restoration was a significant success. Multisectoral collaboration was key. The provision of meaningful incentives to local people served to gain their commitment and support
Outcomes	– The case demonstrated the potential of ANR as a cost-effective approach for restoring an ecologically diverse forest capable of providing multiple benefits. Desired outputs arising from the use of ANR as a restoration approach included the issuance of a technical guidance document on FLR application for the use of field implementers; the application of FLR as a restoration technology in several forestry projects (such as the Integrated Natural Resources and Environment Management Programme, the Forestland Management Programme, and other forestry-related projects); and the Municipality of Danao passed a resolution declaring itself the first "ANR municipality" in the Philippines – Monitoring data collected during the project confirmed that the cost of ANR-based restoration is approximately half that of conventional reforestation – The Danao site became a "showcase" for demonstrating the potential and feasibility of ANR to a multitude of forest restoration enthusiasts – Several local and international workshops have been conducted at the site, in addition to workshops and training conducted by the Forest Management Bureau and FAO – ANR is featured in the World Overview of Conservation Approaches and Technologies as a sustainable land management approach in the Philippines – Largely attributable to the pioneering work at Danao, ANR has increasingly been recognized and recommended for ecologically sound forest restoration by Philippine government agencies, NGOs and international donors (e.g. the Asian Development Bank and USAID)
Conditions (institutional, economic, social, cultural, environmental) for the successful replication in a similar context	– Patient and steady community organizing – Targeted and consistent information campaigns that generate interest in ANR based on cost savings, the development of biologically diverse forest cover and the need to understand that forest restoration cannot be achieved solely by planting – Enlisting the cooperation of local NGOs and educational institutions – There appears to be a range of population density that favours ANR—where population pressure on the land is not so intense that all available land is cultivated, and not so sparse that labour is unavailable to implement ANR field practices – Recognition by local people of the direct and indirect benefits of forest restoration is essential for securing commitment and support for the effort
Main challenges faced	– Most of the areas suitable for the ANR approach are in far-flung areas that are challenging to access – Wildlings nurtured in ANR sites demonstrate slow growth compared with seedlings planted through reforestation – The widely held misperception that forest restoration can be achieved only via extensive tree planting
Key messages and lessons learned	– ANR is an effective, low-cost approach to restoration that can achieve impressive results by working with nature – The engagement of local stakeholders and the provision of incentives to local communities were the key factors in convincing them that ANR can be used to restore forests for the protection of watersheds as a shared objective – Careful monitoring and documentation of results can verify the cost-effectiveness of ANR and help convince observers of its feasibility
Source(s) describing the case	*DENR-FMB Technical Bulletin No 27: Procedures and costings in the application of assisted natural regeneration (ANR)*; WOCAT SLM Database (2017); FAO (2019); FAO 2011b)

Contributors	Patrick Dugan (Bagong Pagasa Foundation); Kenichi Shono (Forestry Officer, Forest Management, FAO); Patrick Durst (forestry and natural resources consultant and former Senior Forestry Officer, FAO); and Emma N. Castillo (Senior Forest Management Specialist, Forest Management Bureau, Philippines)

Photos

Forest restored through ANR. Photo: © Patrick Durst

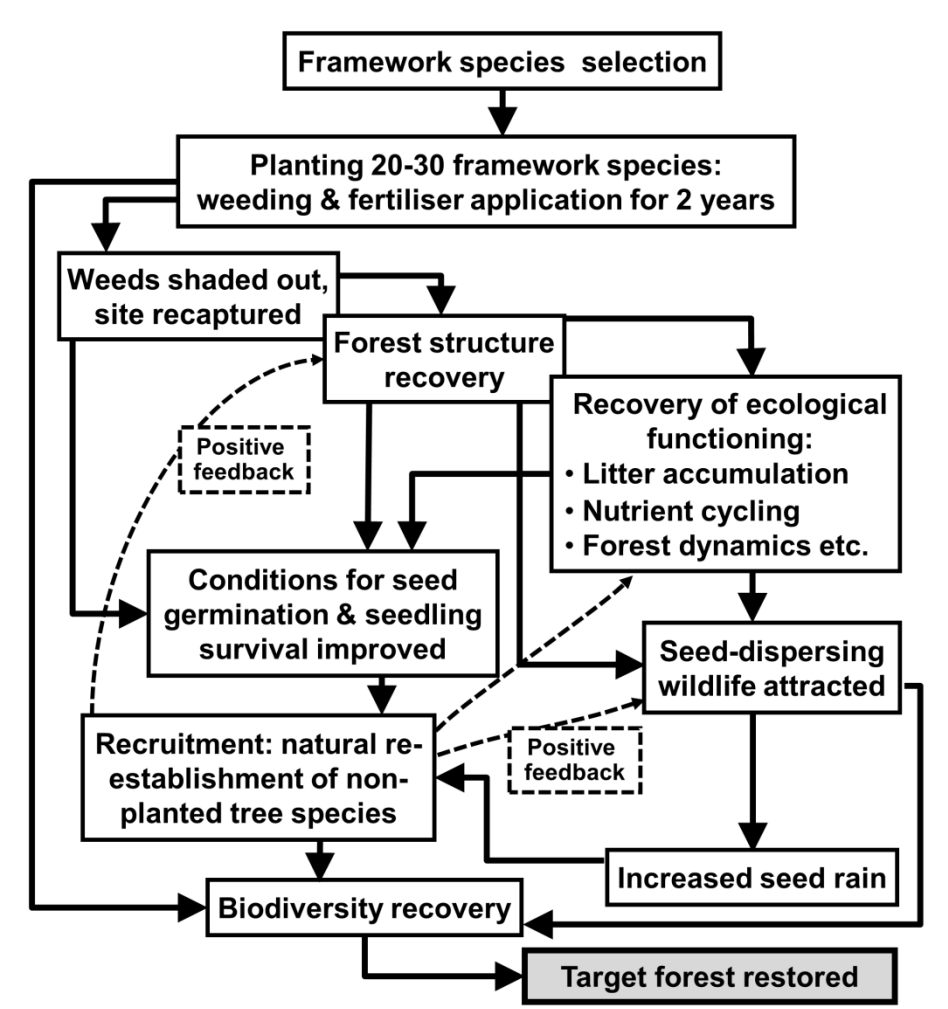
Forest restored through ANR. Photo: © Patrick Durst

a. Locating of wildlings b. Staking of wildling c. Ring weeding d. Pressing or lodging of grasses

Technical preparation of an ANR site. Photos: © XXXXXXXX

Landscape area of a newly lodged ANR site and forest restored through ANR. Photo: © XXXXXXXX

Case study 5: An early example of FLR in northern Thailand	
Proponent	Forest Restoration Research Unit (FORRU), Biology Department, Science Faculty, Chiang Mai University
Country of implementation	Thailand
Location	Upper Mae Sa Valley, Chiang Mai Province, northern Thailand
Implementation period	1996 to present
Restoration option	Restoration of degraded forests for protection
Case-study focus	Process ✓ Planning ☐ Assessment / Monitoring ☐ Intervention level ☐
Main objectives	To develop effective techniques to restore upland evergreen tropical forest; and to stabilize watershed services and restore biodiversity to degraded forest sites in a national park
Target groups or users	Villagers living in a national park, national park officers, students and practitioners of forest restoration, and NGOs
Partners and collaborators	FORRU, the communities of Ban Mae Sa Mai and Ban Mae Sa Noi, and the Doi Suthep Pui National Park Authority
Context (initial situation) and challenge (problem) addressed	The community of Ban Mae Sa Mai was founded in 1922 at an altitude of about 1400 m, but the village moved to its present location (at 1081 m) in the early 1960s after deforestation caused the water supply to run dry. In 1981, the village was included in the Doi Suthep-Pui National Park and the villagers faced eviction because they had no land titles. Consequently, a few villagers formed the Ban Mae Sa Mai Natural Resources Conservation Group in the early 1990s to demonstrate that they were responsible custodians of the forest. In 1996, the villagers decided to contribute to a national reforestation project to celebrate His Majesty King Bhumibol Adulyadej's Golden Jubilee, agreeing to reforest 50 ha of agricultural land in the upper watershed while intensifying agriculture on the more fertile land in the lower valley by installing an irrigation system. When FORRU approached the villagers in 1996 to discuss planting framework-species trial plots, they readily agreed, recognizing an opportunity to improve their reforestation efforts
Process and methodological approach, techniques and tools used	Field trials of the framework-species method of forest restoration were conducted, combining tree planting with assisted natural regeneration and the protection of remnant trees. Framework tree species are selected from the indigenous tree flora characteristic of the target forest ecosystem for their ability to survive and grow well in deforested sites; shade out weeds (with dense spreading crowns); and produce resources such as fleshy fruit and nectar-rich flowers early in life to attract seed-dispersing animals and consequently promote biodiversity recovery. FORRU guided the experimental design while villagers worked voluntarily to plant the trees and received payments for monitoring and maintenance, including fertilizer application, weeding and fire

	prevention 
Field-level practices implemented	– Planting stock raised from locally collected seeds – Planting 20–30 framework tree species to increase stocking density to 3100 trees per ha – Site clearance with glyphosate – Weeding and fertilizer application three times in each of the first and second rainy seasons – Fire prevention in the dry season – Monitoring two weeks after planting and at the end of the first and second rainy seasons – Comparison among species and silvicultural treatments using performance indices derived from survival and growth rates
Innovative aspects	First-time testing of the framework-species method of forest restoration outside Australia (where it originated)
Outcomes	– A reliable set of science-based forest restoration techniques—tried and tested – 33 ha of forest added to a highly overcrowded landscape with rapid biodiversity recovery and carbon accumulation – Reduced conflict between villagers and the national park authority – Perceived improvement in watershed services – A forest restoration model widely used for workshops, conferences and publications to foster best practices for FLR
Conditions (institutional, economic, social,	– Communities that recognize the benefits of forest restoration in terms of both ecosystem services and political clout

cultural, environmental) for successful replication in a similar context	– Cooperative park authority – University with access to fundraising mechanisms – Students to undertake scientific aspects of the work for their projects
Main challenges faced	– Need for continuous fundraising – National park regulations prohibit the sale of products/services from the restored areas, so the project could never become financially self-supporting – Constantly shifting socio-politico-economic conditions – Annual fires in the dry season
Key messages and lessons learned	No matter how much technical and financial support is provided, and no matter how many village meetings are run, the sustainability of FLR can never be guaranteed if the benefits of restoration are not immediately evident and while rural communities continue to grow and aspirations rise
Source(s) describing the case	Elliott et al. (2019)
Contributor	Stephen Elliott (FORRU, Biology Department, Chiang Mai University, Thailand)
Photos	

Forest restoration using the framework-species method has transformed the landscape of the upper Mae Sa Valley. (A) May 1998 before restoration. (B) Same site, left of the track, restored forest, 15 years old, planted 2001; right, 9-year-old restored forest, planted 2007 (photo September 2016). (C) Inside nearby restored forest, 18½ years old, a dense understory develops comprising seedlings and saplings of more than 70 recruit tree species. Photo: © FORRU-Chiang Mai University

Case study 6: The restoration of degraded tropical forests—a performance-based payment approach	
Proponent	Thünen Institute of International Forestry and Forest Economics (case study implemented by Gesellschaft für Internationale Zusammenarbeit Biodiversity and Forestry Program—GIZ-BFP—Ethiopia)
Country of implementation	Ethiopia
Location	Geiza tropical mountainous high forest located in Zazie Kebele (village), Geresse Woreda [District], Arba-Minch, Gamo Gofa zone in Southern Nations Nationalities and Peoples Region
Implementation period	Since 2017
Restoration option	Restoration of degraded forests for production Restoration of degraded forests for protection Rehabilitation of degraded forest land through planted forests
Case-study focus	Process ☐ Planning ☐ Assessment / Monitoring ✓ Intervention level ✓
Main objective	– Restoration of tropical degraded forest sites from a landscape perspective – Creation of forests beyond tree planting—e.g. a combination of natural forests and plantations with mixed ages and diverse tree species in buffer zones – Improved SFM and biodiversity conservation – Increased forest protection and productivity within area enclosures – Supply of ecosystem services such as provisioning (e.g. timber, woodfuel); regulating (e.g. erosion control, carbon sequestration); supporting (e.g. biodiversity conservation); and cultural (e.g. recreation) – Enhanced livelihood opportunities and long-term resource security
Target groups or users	Local communities around highly degraded forest landscapes and protected sites
Partners and collaborators	Universities, private partners, state and regional administrations, community-based organizations, farmers and farmer groups
Context (initial situation) and challenge (problem) addressed	– Geiza forest was degraded and highly depleted due to overexploitation (timber and NTFPs, especially woodfuel) and encroachment for farming by the surrounding communities – Some parts of the forest were closed, with local people excluded from access and use (grazing and farming). This measure was aimed at allowing natural regeneration and the recovery of pastures and trees. Due to inadequate management, however, more than five years after the establishment of the closed areas, productivity was still low and consequently so was the supply of forest products. This called for alternative interventions, particularly enrichment planting and the establishment of mixed-species woodlots – Lack of sufficient supply of good-quality seedlings – Lack of capacity (knowledge and financial) in the local communities in tree nursery and plantation management
Process and methodological approach, techniques and tools used	– Engagement of various stakeholders, especially local communities, at all stages of tree establishment and monitoring through participation, negotiation and signed agreements on restoration goals (referred to as tree-planting modality agreements) – Tree-planters must fulfil the terms and conditions of the tree-planting modality agreements. These clarify the duties of the various stakeholders, specifically the proponent (GIZ-BFP) and farmers and farmer groups. The key duties of farmers and farmer groups are to acquire and legalize land for forest establishment (certificates of land-use rights), provide boundary maps, baseline information and concept notes that describe planned forest activities, provide guarantees for silvicultural activities (e.g. weeding, beating up and guarding the plantations), and establishing mixed-forest

	stands with diverse species and an uneven age distribution. GIZ-BFP is responsible for providing partial financing for the purchase of seedlings and also for technical advice, support and tools. The programme provides a onetime payment for healthy trees (15–18 months after tree planting). Before the payments are made, GIZ-BFP, partner organizations and farmers jointly conduct tree monitoring and survival assessments. This is done to ensure transparency, trust and acceptance of the results obtained from the assessments. In situations where forest sites are owned by a group, payments are made directly to the whole group rather than to individual members – Performance-based payments/incentives for tree nurseries and forest establishment activities depending on agreed indicators (e.g. the survival of at least 1600 trees per ha at the time of monitoring, 15–18 months after tree planting) – Monitoring and follow-up of newly established afforestation sites – Capacity building for individual farmers, farmer groups and communities in all forestry-related silvicultural activities, such as nursery and stand establishment, maintenance, tending and harvesting
Field-level practices implemented	– Assessment and documentation of baseline information (biophysical and economic) – Enrichment planting using at least 25% indigenous tree species with not less than a ten-year rotation and 75% of short-rotation tree species (e.g. *Eucalyptus* spp.) to ensure the restoration of multiple functions, benefits and long-term resilience – Field participatory monitoring through survival-rate assessments – Advice and technical support for tree nursery and plantation establishment and maintenance, capacity building and training on silvicultural practices, and development of a management plan, including sustainable harvesting and the utilization of tree resources
Innovative aspects	Performance-based payments/incentives through contractual agreements between individuals, groups, small enterprises, and the biodiversity and forestry programme of GIZ-Ethiopia
Outcomes	– Increased tenure and access rights to forest land for local communities – Increased establishment of good-quality tree nurseries as a sustainable business model for forest user groups – Increased survival rates of established tree plantations – Establishment of mixed-species plantations embedded in a community/individual-based land-use plan in the buffer zone of a protected forest reserve. This creates a forest landscape mosaic within and around the protected forest reserve – Increased benefits for the communities through direct cash payments for forestry activities, increased forest protection, and increased productivity and potential for the supply of forest products and services
Conditions (institutional, economic, social, cultural, and environmental) for the successful replication in a similar context	– Land-tenure regulations and assurance of land and tree-harvesting rights (provision of land certificates for at least 30 years and beyond) – Availability of voluntary agreements between the main stakeholders and tree-growers – Benefit-sharing mechanisms (bylaws) – The state's willingness to support tree planting – People's understanding of the value of trees – Market assurance for different tree products encouraged by stakeholders – Availability of human labour
Main challenges faced	– Unclear land and tree-tenure rights – Assuring other stakeholders of the approach's sustainability because it takes time to provide convincing results
Key messages and lessons learned	– Stakeholder engagement, especially among the local communities, plays a big role in the success of forest restoration projects

	– Signing flexible contracts/agreements and directly involving communities is very important – Allowing local communities to participate in forest activities and use forest products from planted areas helps them believe and develop a sense of ownership towards the surrounding forests. This not only enhances forest production but also forest conservation in enclosure areas – FLR should be implemented in a form of sustainable economic/livelihood provision model, and tree planting should be supplemented with proper monitoring and management (e.g. by applying appropriate silvicultural techniques) – Enabling conditions need more research
Source(s) describing the case	Julian Schmid (GIZ-Development Advisor for Forestry), and Alemayehu Asefa and Shibire Bekele (GIZ)
Contributors	Vianny Ahimbisibwe, Jobst-Michael Schröder and Sven Günter (Thünen Institute of International Forestry and Forest Economics). Acknowledgement goes to Karin Christina Allgoewer (GIZ-BFP programme manager) for logistical support

Photos

Site preparation and pitting for the next tree-planting activity carried out by a group of farmers in a formerly degraded enclosure. Photo: © Vianny Ahimbisibwe

A reforested site with several tree species (e.g. *Cypress*, *Grevillea* and *Eucalyptus*) using a performance-based incentive approach. Photo: © Vianny Ahimbisibwe

Case study 7: The domestication of endangered, endemic and threatened plant species in disturbed terrestrial ecosystems in Malaysia and Thailand	
Proponent	AFoCO, Forest Research Institute, Malaysia, and Royal Forest Department, Thailand
Country of implementation	Malaysia and Thailand
Location	Malaysia: Ex-tin mine in Tin Tailing Afforestation Center, Bidor, Perak Thailand: Mae Moh mountain, Lampang Province, and Takua Pa Experimental Site, Phang Nga Province
Implementation period	2016–2022
Restoration option	Restoration of degraded forests for protection Rehabilitation of degraded forest land through planted forests
Case-study focus	Process ✓ Planning ☐ Assessment / Monitoring ✓ Intervention level ✓
Main objectives	To establish domestication models for the use of indigenous species in the rehabilitation of degraded ecosystems, particularly post-mining landscapes To promote technology transfer between Malaysia and Thailand as well as in the region on scientifically proven rehabilitation methods
Target groups or users	Researchers, mining companies, urban/rural/state land development authorities and local communities
Partners and collaborators	Forestry agencies, mining companies, universities, research institutions and local communities
Context (initial situation) and challenge (problem) addressed	Abandoned mining areas, although commonly known for their harsh microclimates and infertile soils, have potential to be used for biodiversity conservation and as seed production sites. Malaysia and Thailand have put considerable effort into rehabilitating abandoned minesites with indigenous species currently in the IUCN Red List (and national lists), collectively referred as "endangered, endemic and threatened plant species" (EETS). By planting these species, the sites have more value-added as a depository of EETS
Process and methodological approach, techniques and tools used	The project has three main components: 1) domesticating EETS in both countries through the establishment of demonstration sites; 2) strengthening cooperation between Malaysia and Thailand on the *ex situ* conservation of EETS, domestication techniques and technology transfer; and 3) exchanging knowledge and lessons learned on best practices for minesite rehabilitation and the domestication of EETS
Field-level practices implemented	– Identification of potential EETS based on market analysis and field observations – Establishment of demonstration plots in former lignite and tin mining areas and maintenance of them through micromanagement using appropriate technologies – Exchange visits to gain experience in the identification of EETS and plantation practices in Thailand and Malaysia – Analysis of the impact of plantations on the basis of soil analysis and physiological assessment of planted trees – Capacity development and technology-transfer activities, including workshops, seminars, exchange visits and publications
Innovative aspects	– Generating a broader scope of EETS to include not only existing IUCN Red List species but also those likely to be listed in the future based on each country's science-based analysis – Selecting abandoned ex-mining sites as biodiversity conservation areas because of their high land security, permanent land tenure, and reduced possibility of conversion to other land uses

	– Application of sustainable post-mining landscape restoration practices by introducing diverse native tree species in the mid-to-latter stages of rehabilitation – Expanding the greening concept of ex-mining sites to include EETS to function as ecologically sound forest stands in the region
Outcomes	– Identification of 25 EETS, including nationally and internationally threatened species in Malaysia and Thailand – Demonstration plots covering 16.3 ha in both countries, with a total of 8726 saplings of EETS planted – A technically sound FLR mechanism for abandoned mining areas – Strengthened knowledge on the domestication of EETS through annual workshops hosted alternatively by Malaysia and Thailand with the participation of Association of South East Asian Nations member countries to share domestication techniques for ex-mining sites
Conditions (institutional, economic, social, cultural, environmental) for successful replication in a similar context	– Institutional commitments to sustainably manage the plantations – Close collaboration between forestry agencies and mining companies – Adoption of scientifically sound analytical processes to assess the stand quality of plantations – Effective knowledge-sharing networking for training, workshops, etc.
Main challenges faced	– High establishment costs for converting infertile sites to productive forest stands – Technical difficulties in implementation (e.g. collecting seedlings, ensuring high survival rates after plantation) – Lack of understanding on the concept of domestication of EETS among stakeholders (e.g. forestry officials, mining company) – Low public awareness of the importance of EETS domestication
Key messages and lessons learned	– EETS can be grown on abandoned ex-mining sites, with appropriate planting technologies – Ex-mining sites can be used for the *ex situ* conservation of EETS – In selecting EETS, careful consideration should be made of market availability in line with species currently on the IUCN Red List; thus, species selection for similar projects in the future should be flexible – Mechanisms are needed for closely monitoring the planting and tending of EETS to address the lack of knowledge on domestication techniques in post-mining areas – Following-up activities on the effectiveness of technology-transfer workshops among participating countries should be considered in project activities – A cost–benefit analysis may be required to persuade donors and stakeholders of the merits of minesite restoration using EETS
Source(s) describing the case	AFoCO et al. (2017); FRIM (2017)
Contributors	Soozin Ryang (AFoCO); Ang Lai Hoe and Ho Wai Mun (Forest Research Institute Malaysia); and Phuangphan Yongrattana (Royal Forest Department, Thailand)
Photos	

An EETS plantation site established in 2019 at an abandoned lignite mine in Mae Mot, Lampang Province, Thailand. Photo: © AFoCO Secretariat

An EETS plantation site established in 2019 at a former tin mine in Bidou, Perak, Malaysia. Photo: © AFoCO Secretariat

Case study 8: Achieving landscape restoration at Prey Lang through community forestry	
Proponent	RECOFTC
Country of implementation	Cambodia
Location	The Prey Lang Landscape, which comprises the Prey Lang Forest, a nature reserve in Kampong Thom, and Preah Vihear, Kratie and Stung Treng provinces
Implementation period	Since 2006
Restoration option	Restoration of degraded forests for protection Management of secondary forests
Case-study focus	Process ✓ Planning Assessment / Monitoring Intervention level
Main objectives	1. Formalizing local communities' rights to manage forests 2. Fostering multistakeholder participation in establishing zones and guidelines for sustainable management of forests 3. Supporting the development of inclusive forest-based business opportunities The aim of the landscape programme is to strengthen the capacity of community forestry (CF) stakeholders in the Prey Lang Landscape. This includes local communities, Cambodia's Forest Administration, NGO partners and local government officials to sustainably manage the network of community forests
Target groups or users	Communities living and using forest resources in the Prey Lang Landscape, particularly ethnic Kuy people, who comprise 30% of the population
Partners and collaborators	– The Forest Administration at the national, cantonment, division and triage level – Local NGO partners: Action for Development; Cambodian Community Development; Save Cambodian Wildlife; Buddhism For Development Kampong Thom; the Environment Protection and Development Organisation; Ponlork Khmer; the Wildlife Conservation Society; and WWF – Provincial CF programme coordination committees, formal platforms/networks for CF development partners
Context (initial situation) and challenge (problem) addressed	Prey Lang is a biodiversity hotspot, covering 900 000 hectares of lowland evergreen forests, deciduous forests, flooded forests, grasslands, marshes and freshwater mangroves. The landscape hosts endangered species and indigenous communities threatened by deforestation, illegal logging and forest degradation. Since the early 2000s, CF schemes have played a key role in reducing forest loss and poverty in the area. Cambodia's National Forest Programme (NFP, 2010–2029) aims to create 1000 sites over an area of 2 million hectares as a platform for investment and forest restoration. The NFP also views CF as a means to combat climate change and strengthen ecosystems
Process and methodological approach, techniques and tools used	RECOFTC places local people at the centre of FLR and envisions a future in which people in the Asia-Pacific region live equitably and sustainably with thriving forests and landscapes. RECOFTC's approach is closely linked to the NFP, the CF sub-decree and the CF *prakas*, which define the fundamental guidelines for establishing CF sites and agreements between forest communities and the Forest Administration. There are 12 steps: Step 0: Identification of potential CF areas Step 1: CF establishment Step 2: Information gathering Step 3: Establishment of CF management committee (CFMC) structure Step 4: Preparation of internal bylaws of CFMC Step 5: Demarcation of CF boundaries and mapping Step 6: Preparation of CF regulations Step 7: Preparation and approval of the CF agreement Step 8: Preparation of the community forest management plan Step 9: Enterprise development

	Step 10: Implementation of the community forest management plan Step 11: Monitoring and evaluation. Following these steps, RECOFTC Cambodia developed a CF capacity-development programme for CF stakeholders. This was followed by capacity-development training with forest-dependent villages, the Forest Administration, NGO partners and local authorities to explore collaborative forms of forest stewardship. Initiatives in Prey Lang focus on: researching and training on CF management planning and strengthening institutions; piloting CF partnerships that implement forest management; supporting multiple stakeholder processes to link national and grassroot initiatives developing CF; and developing initiatives to increase the equitable benefits from sustainable forest management
Field-level practices implemented	The main practices in the implementation of the CF steps are highlighted below. **Field training and coaching.** Capacity development involved CF stakeholders tailoring specific CF training modules to provide communities, local government officials, the Forest Administration and NGO participants with practical management skills for assessing, zoning, planning and managing forest resources. **Forest management planning.** CF land is surveyed, mapped and divided into zones for restoration, conservation and fuelwood and pole extraction, each requiring a plan of action. CF management is participatory and integrates community initiatives with scientific forest management techniques. The facilitator must ensure that the interests and concerns of local community members are reflected in the management plans. Community members carry out forest patrolling and restoration activities in degraded forest areas by the artificial regeneration (interplanting) of trees. CF nurseries maintained with Forest Administration support produce seedlings each year, including *Afzelia xylocarpa*, *Sindora cochinchinensis*, *Hopea odorata*, *Acacia* hybrids, *Dipterocarpus alatus*, *Anisoptera costata* and bamboo species. Fencing and firebreaks protect tree plantings while CFMCs and CF members carry out weeding and pruning. **CF establishment.** Early in the CF application process, the villagers must learn how to self-organize and agree on CF objectives. CF interest and membership varies depending on the level of consensus reached and the quality of the CF areas. This variation has implications for participation, decision-making, benefit-sharing and organizing CF work. Communities must learn about and consider the implications of CF investments before they can make informed decisions; the development of CF procedures and the documentation of CF membership application can start thereafter. Once CFMCs are established, CFs demarcate and map CF boundaries, which allows them to develop CF regulations for resource use within the area. When these steps have been completed, CF communities sign formal agreements with the Forest Administration to formalize their rights to manage the community forest. **Multistakeholder processes.** Coordination among CF stakeholders is crucial throughout the CF application process. RECOFTC works with the Forest Administration at the district level to ensure that CF initiatives support the government's five-year work plans. Multistakeholder consultations and participatory operational planning at the local level help identify priorities. Activities are then planned according to available resources and service providers. By using existing CF platforms and planning systems, it is possible to promote activities with direct government support alongside other contributions. Local CF networks can also identify and resolve issues encountered through regular meetings. **CF development funds.** To financially support CFMCs, communities must establish CF development funds. These can be allocated to implement activities during the stages of CF formalization and development and may help strengthen institutions. CFMCs get a "hands-on" opportunity to apply knowledge and skills gained from the CFMC financial management training, including recordkeeping, financial management and coaching
Innovative aspects	Running a CF credit scheme in areas that are resource-deficient is important because they can help kick-start businesses. A core budget of USD 1000, which comes from a project or a CF development fund, is made available for CFs and placed under the control of the CFMC. A certain amount is allocated to CF members to invest in small businesses (often agriculture-based), which is then paid back within 3–6 months at a low interest rate, enabling the fund to grow. In a 2015 assessment, 11 established community forests were

	managing funds of USD 1000–5000. USD 10–40 per month was used to support basic CF management activities, such as regular patrolling, constructing firebreaks, restoring degraded forest areas and meeting with members to resolve conflicts. After achieving a certain level of financial stability, the community forests use the credit fund as a means to reduce their dependence on outside funders, like businessmen who charge high interest rates. The scheme has resulted in a notable increase in participation among CF members, especially women, in both business development and community forest management. Women are motivated by the CF credit schemes and now hold 24% of the committee positions
Outcomes	In the Prey Lang Landscape, 4594 people have been trained on various topics. This has resulted in 164 operational community forests with 15-year agreements. Community forests now cover more than 200 000 ha and involve 29 654 households in operational forest management plans
Conditions (institutional, economic, social, cultural, environmental) for successful replication in a similar context	**Legal recognition of CF.** The government has committed to expanding CF to 1000 sites over an area of 2 million ha and to formalizing CF tenure and management rights for a period of 15 years after the CF steps are completed. **Sufficient quality forest resources to establish CF** is essential. However, 20–70% of the community forests granted so far are degraded, which is likely to prevent communities from gaining short-term benefits and therefore reduce management efforts. **Community incentives/interest.** The implementation of CF should help secure tenure rights for villages so that local communities can legally prevent destructive forest conversion. Communities are also incentivized to develop commercial benefits from their investments and practice their cultural and spiritual beliefs. **Strong CF institutions/leadership.** When leadership complies with the CF *prakas,* CF agreements and CF management plans and develops its capacity, CFMCs can effectively govern their members; put in place transparency metrics for financial management and decision-making processes; and partner with local authorities, the Forest Administration and NGOs to combat illegal logging and land encroachment. An example is documented on the RECOFTC website (www.recoftc.org/en/cambodia/stories/local-leader-innovates-ways-protect-forests-and-improve-livelihoods-his-community). **Institutional capacity development for CF.** Capacity development for all CF stakeholders ensures the long-term sustainability of CF and institutional management. Extension services and curricula require strong institutionalization within the Forest Administration, while CF networks and platforms for learning and information sharing require local-level Forest Administration support
Main challenges faced	**Quality CF processes.** There is a tendency to implement the CF establishment and formalization process too quickly without ensuring that expected outcomes in each of the CF steps are adequately met. For example, CFMCs are sometimes formed but not fully functioning (step 2), or CFMC bylaws (step 4) and CF regulations (step 5) are prepared and approved but not yet well understood and implemented. Moving quickly to reach step 6 (signing CF agreements) without following up with important activities in earlier CF steps might endanger local understanding and ownership. **Commercial CF incentives.** Step 9 of the CF process, enterprise development, is not yet fully achieved and few community enterprises are operational. While there are initiatives to achieve economic models of CF that enable villagers to benefit commercially, few concrete and viable examples exist. Some community forests have business plans but, without the resources, capacities and support to implement these, they are not operationalized. Through collaboration among community forests, they might be able to accumulate sufficient volumes of forest products to attract business partners. Developing effective partnerships among CF organizations and the private sector, for example the trading of cashew or acacia, may pose another challenge for Forest Administration officials who often lack the skills to facilitate partnerships. **Planning ahead: CF as legal source of timber?** CF management plans that incorporate timber harvesting will potentially be one of the few sources of legal timber in Cambodia, but this link is not yet developed. However, with the increase in CF sites across the country and community forests maturing to enable the harvesting of timber, attention is needed to

	improve forest governance and strengthen forest law enforcement where communities and smallholders are involved
Key messages and lessons learned	**Tenure rights.** CF is an important land-tenure mechanism through which local communities can gain formal rights to access, manage and restore forests that they can use to build their livelihoods. Participation and endorsement of local authorities helps to avoid land-use conflicts and adds legitimacy to ownership claims. **Multistakeholder approaches.** Stakeholder engagement assists the process of establishing community forests and helps in laying the groundwork of effective partnerships among government, CF groups and networks, and the private sector. Involving staff from different sectors and organizations builds relationships, which can ensure a shared understanding of what CF development requires and an appreciation of the strengths and constraints of each other's institutional arrangements. **Training for action.** Participatory approaches have proven effective in capacity building where training is linked to the implementation of CF activities. The logical sequencing of training courses is linked to the different steps of CF establishment and formalization, thereby ensuring government buy-in. **Realistic prospects.** Clear guidance in CF processes is important for communities and stakeholders to keep the momentum of resource management in newly established community forests. CF requires ongoing motivation, especially when multiple objectives are pursued, such as the protection of biodiversity and natural resources, restoring forest functions, and the production of forest products. One way to provide motivation is through modest financial support for CFMCs through the establishment of CF development funds; other means include maintaining close relations, providing institutional support, and ensuring effective communication between the Forest Administration and CFMCs. It is highly recommended that the Forest Administration play a role in attracting private-sector partnerships in this context to develop a realistic outlook for FLR and help develop market access
Source(s) describing the case	Bampton et al. (2009); RECOFTC (2017); (RECOFTC 2017/2018); RECOFTC (undated); Equator Initiative (2015); Gritten et al. (2015); Prey Lang Community Network (https://preylang.net)
Contributors	Lok Mani Sapkota and Martin Greijmans (RECOFTC)

Community members of Phnom Dek Chambok Hos patrol their community forest near the Prey Lang Sanctuary. Photo: © RECOFTC

RECOFTC facilitates a group discussion with CF members, Borie Ousvay Community Forest. Photo: © RECOFTC

Case study 9: Restoring cloud forest on private and communal land in the Ecuadorian Andes	
Proponent	Defensa y Conservación Ecológica de Intag (DECOIN)
Country of implementation	Ecuador
Location	Intag Valley, Imbabura Province
Implementation period	2001–2012 (including site maintenance)
Restoration option	Restoration of degraded forests for protection Rehabilitation of degraded forest land through agroforestry and/or silvopastoral systems
Case-study focus	Process ✓ Planning ✓ Assessment / Monitoring ☐ Intervention level ☐
Main objectives	To restore water to local communities undertaking restoration (local objective); to conserve biodiversity in a highly deforested, megabiodiverse region (international funders); and to provide local communities with land sovereignty in the face of mining interests in the region
Target groups or users	Implementers, donors, local and regional NGOs and government agencies. The target groups of "users" of the restoration included local communities to restore much-needed water to their communities; downstream communities for water benefits; and the international community for biodiversity conservation
Partners and collaborators	DECOIN (a local NGO and implementer); local communities; international private donors (United States of America); and Rainforest Concern, Ecuador (an international NGO with national chapter)
Context (initial situation) and challenge (problem) addressed	The Intag Valley is a rural Andean farming region in Imbabura, Ecuador. Mountainous, steep and remote, the region ranges from 650 m above sea level to nearly 4000 m, with annual rainfall of 1500–3300 mm. Intag is in the centre of the tropical Andes biodiversity hotspot, and its cloud forests are exceptionally diverse (with 80–120+ tree species in one-tenth of a hectare). Clearing patterns are typical of many places in the Andes—following centuries of sparse habitation and dense forests, deforestation rates increased precipitously after the Ecuadorian land reform laws in the 1960s through to the 1990s, mainly for cattle ranching and small-scale farming. Today, upwards of 60% of the cloud forests has been cleared. Intag's population (~1600 people) is primarily rural and *mestizo*, with minority populations of *Otavaleños* (indigenous people from the Central Valley) and Afro-Ecuadorians, dispersed across 76 communities. Farming is largely unmechanized, with most of it occurring on 10–35° slopes. This case study is based on work with residents in four small communities (23–45 households, average farm size of 13 ha) in northeast Intag that participated in forest restoration projects supported by DECOIN. Cloud forests play a vital role in the hydrological cycle, capturing clouds and mist as precipitation. Following deforestation in watershed catchments, in the late 1990s and early 2000s communities in Intag reported increasing problems with droughts and erratic water supply in the dry season. Summer drought conditions were so severe that, combined with declining soil fertility and the underperformance of "green revolution" farming technologies, these traditionally agrarian communities were uncertain whether they would be able to continue farming. The community was in crisis
Process and methodological approach, techniques and tools used	In response to these water shortages, DECOIN helped more than 40 communities establish small-scale, community-based reforestation projects in watersheds. Founded in 1995, DECOIN worked through local schools to increase environmental awareness about the value of forests and promote forest stewardship. Rather than reaching smallholders through existing farmer organizations focused on private farms, DECOIN's focus was

	exclusively on creating and managing communal reserves. Funded through private donations and partnerships with international environmental NGOs, the goals of the watershed reforestation projects were to: improve the quality of water resources in communities (particularly to maintain summer stream flows); restore and conserve forest biodiversity in the region; and provide local sovereignty over land development in strategic locations throughout the region. DECOIN purchased land in watersheds from local farmers and signed the titles over to communities for the purpose of conservation and restoration, with use restrictions in the title—no burning, cattle, cultivation, or harvesting for sale. The DECOIN intervention: – worked at the communal level to purchase land and create community watershed reserves – sought international funds for projects (for biodiversity conservation) – worked through elementary schools to provide environmental education – trained local people to collect seeds and seedlings from native forests and grow, plant and maintain them – engaged trusted local leaders/managers in each community – ensured that trees were properly maintained
Field-level practices implemented	– Training and materials for establishing tree nurseries – Creating restoration associations/cooperatives within communities – Training for collecting and propagating native species and to plant trees and maintain restored areas – Education on unsustainable land-use practices (e.g. burning, cattle on marginal lands) – Maintaining planted areas with weeding 3–4 times per year for 2–3 years after initial planting Planting involved using commercial seed for a quick-growing, nitrogen-fixing exotic species (*Alnus nepalensis*), which local people favoured. Technicians also provided training for residents to collect and propagate seeds from native trees in nearby forests and to plant and maintain these seedlings in combination with limited numbers of *A. nepalensis*. Seedlings were planted 2.5 m apart and there was a total of 50 species, with 12–26 in each reserve. All reserves were managed similarly. Community members cleared pasture grass around seedlings by hand every 3–4 months, and prohibited grazing animals, harvesting wood for sale, clearing, and burning within reserves. In each reserve, there are planted areas and areas that, because of limited funds, were not planted but left to regenerate naturally
Innovative aspects	– Introducing communal land into an area where private land was the norm created a new, safe space for people to become familiar with, experiment with, and participate in restoration. This was a creative way to engage many stakeholders at the local level—even those who did not have land. It also allowed landholders to collectively achieve benefits that would have been challenging for individual farmers, restoring large tracts in strategic watershed regions – Working with schools to provide environmental education on the importance of trees for water and farming, encouraging a way of thinking as environmental stewards – Hiring local leaders as implementers—another key step towards engaging stakeholders meaningfully – Allowing local people to plant the species they wanted but within a given framework (i.e. allowing some exotics and a choice of natives) helped make the project locally relevant and accepted
Outcomes	Restoring forests on communal land produced a number of social and environmental benefits, and, according to interviews with both landholders and local NGOs, was widely considered a success.

	High participation. In total, about 60% of households (69 people) restored over 70 ha of land in four microwatersheds, planting over 75 000 trees. Most people reported planting trees to restore water resources, and 4–7 years after the inception of the projects, more than half reported an increase in water quality or quantity, or both. **Landscape-level impacts.** Strikingly, after inception, even more households began planting on private land—an activity that was not directly supported by DECOIN but tended to arise organically when people saw the benefits of planting trees. They also started to allow natural regeneration around waterways, fences and roadways. **Jump-starting succession.** Areas were restored with "useful" species with which people were familiar. Although different in composition from primary forests in the region, these sites were recruiting native species at much faster rates (both in terms of species richness and numbers) than unrestored, abandoned pastures nearby. **Communal governance around shared benefits.** Compared with private lands, restoring on land owned and governed by the community was a relatively low-risk investment. Smallholders could restore forests without giving up farmland, making the opportunity costs of restoring on communal land lower than on private land, where restoration may compete with agricultural production. Restoring forests in watershed areas may not have been possible (or attractive) if the burden had been placed on the few households who owned land in watersheds (2–6 in each community), but was both attractive and accessible when community resources (of labour, knowledge and motivation) were pooled. This allowed a broader range of community members, from the land-rich to the land-poor and landless, to participate in and benefit from restoration
Conditions (institutional, economic, social, cultural, environmental) for successful replication in a similar context	Communities were experiencing the effects of forest degradation, and the NGO helped them make the link between a resource they needed and forest restoration. A desire to remain on the land and identification with a land-based livelihood, as well as some degree of cohesion within communities, were also key enabling conditions. People chose to restore forests in Intag because they faced a dire situation: their future as farmers was uncertain because of environmental change. By framing forest restoration as a way to alleviate urgent environmental problems, DECOIN initiated restoration projects with exceptionally high participation rates. Households planted trees in communal reserves and on farms to obtain various ecosystem services, but the ultimate goal was the same—to restore and provide products and services that would help maintain and sustain farming livelihoods, which were threatened by a perceived decline in environmental conditions. This "crisis restoration"—in which people reforest to combat changing environmental conditions that threaten their livelihoods and communities—required that people look backward to move forward. Recalling a past when forests provided vital ecosystem services, people in Intag worked to build a future in which they could sustain farming practices and rural livelihoods. After clearing forests for decades, trees and forests were re-envisioned as a means to help farming. Ultimately, this restoration was an endogenous shift from exploiting forest to protecting them
Main challenges faced	– Lack of resources for maintenance and monitoring (donors do not want to support these activities) – Threats from mining, and from administrations that support mining over forest conservation activities – Lax enforcement of communal land rules (like allowing animals in reserves); however, because people generally believe in the ability of forests to restore water, these are minimal and have minimal impacts on forest regeneration
Key messages and lessons learned	**Restoring communal lands allowed for more inclusive participation, enabled larger restored areas, and facilitated knowledge sharing and acquisition**. It was well suited, therefore, to achieving the goals of both ecological forest restoration (focus on restoring intact ecosystems) and FLR (focus on the spatial allocation of restored/reforested sites to benefit a range of stakeholders). This case study suggests the following **key lessons for maximizing the benefits of such projects**:

	– Communal restoration should focus restoration around shared, communal services or goods with widespread appeal in the community – Restoration can be used strategically to achieve goals that may be out of reach to individuals but possible as a group. Restoring forests thus fits a typology of extensive land uses, such as pastures and wild woodlands, that have traditionally been managed communally, even in places where agricultural plots are managed privately – In communal arrangements, it can be beneficial to allow people the space and flexibility to learn from each other, share knowledge, and experiment with different species and methods – Projects should engage locally trusted, respected and visionary leaders. The case study also suggests that the **perceptions of environmental crisis due to forest loss can strongly influence people's motivation to plant trees,** on farms and off. In Intag, people engaged in restoration because they identified strongly as farmers, experienced land degradation that threatened their ability to farm, and came to see forests and tree planting as integral to creating viable farming systems in these new conditions. **Reframing tree planting and reforestation as a forward-looking solution to current and tangible environmental problems can make projects relevant, useful and desired by local communities.** The Intag example shows that communities experiencing an environmental crisis may be willing to plant trees if they believe it will improve conditions and that local agencies and NGOs can play a powerful role in making this link. Focusing tree-planting efforts on those communities and households who stand to benefit most from restoration has the potential to produce high participation rates and high levels of community and on-farm engagement with projects, and it can foster new and innovate ways of using trees in rural farming systems. **From a landscape perspective, communal management meant that large areas of land could be restored in strategic locations to restore a given ecosystem service.** Rather than restoring small patches on private landholdings distributed across a landscape, communities planted trees in contiguous patches of land around streams. Restoring the same crucial area of forest on private lands would have been challenging because all landholders would have had to agree to participate; agree to restore that particular area of land; and monitor and maintain sites individually. Communal restoration also meant that those who were most interested and invested in restoring forests were able to participate, even if they did not own land in target areas. A significant benefit of communal restoration was that **restoring on communal land seemed to provoke people to increase forests on private land**. After restoring forests on communal land, nearly 80% of the participants planted trees on private farms, and households that had not participated in the projects also began planting on-farm trees at that time (before the communal projects, only 9% households had planted on private land). In addition, secondary-forest cover in the region increased dramatically as people intentionally allowed forests to regenerate naturally on private land along roads and waterways
Source(s) describing the case	Wilson et al. (in press); Wilson & Coomes (2019); Wilson & Rhemtulla (2018); Wilson (2016); Wilson & Remtulla (2016)
Contributors	Sarah Jane Wilson (Department of Geography, McGill University, Canada)
Photos	

The Intag Valley, Imbabura Province, northwest Andean Ecuador. Photo: © Sarah Wilson

Restoring pastures in watersheds—clearing grass from around recently planted trees. Photo: © Sarah Wilson

Case study 10: the Matas Legais project	
Proponent	Environmental and Life Preservation Association (Associação de Preservação do Meio Ambiente e da Vida—Apremavi) and Klabin (the biggest producer and exporter of papers for packaging in Brazil and a leader in the production of paper packaging)
Country of implementation	Brazil
Location	States of Paraná and Santa Catarina
Implementation period	Since 2005
Restoration option	Restoration of degraded forests for protection Rehabilitation of degraded forest land through planted forest Management of secondary forests
Case-study focus	Process ✓ Planning ✓ Assessment/monitoring ✓ Intervention level ☐
Main objectives	Develop actions in conservation, environmental education and forest promotion that help preserve and restore the remnants of native forests, improve quality of life and forest development based on planning at the landscape and rural properties level
Target groups or users	Rural owners, outgrowers of Klabin
Partners and collaborators	The *Matas Legais* project is a partnership between Apremavi and Klabin
Context (initial situation) and challenge (problem) addressed	The project emerged from the need to ensure that Klabin's outgrowers met governmental environmental regulations
Process and methodological approach, techniques and tools used	Landowners, particularly those supplying raw materials to Klabin, are approached by project staff through environmental education activities in schools, visits and seminars. In agreement with the landowner, it is decided which areas can be planted with commercial forests, which areas need to be conserved, which areas must be restored (such as water springs and riparian forest) and which areas of secondary forests can be enriched. Planning takes place at the properties, which are mapped out and the data inserted into Apremavi's Environmental Portal, a platform of geographic data that helps monitor activities. With this virtual platform it is possible to access information on, for example, the areas involved and the restoration methodology and seedlings used; maps and sketches of the properties; and photos of the various stages of implementation
Field-level practices implemented	Activities start with field visits to the properties to analyze the situation. Conversations take place about the environmental improvements that need to be made. After agreeing on the needed actions, reforestation and restoration areas are demarcated. The project offers seedlings as well as materials for the construction of fences, where needed, and the owner plants and maintains the trees. Monitoring visits are scheduled after the trees are planted

Innovative aspects	**The partnership between an NGO and a private company.** In establishing the partnership, several meetings between the parties were held to design a project that was of interest to both and also important to the community. The success of this type of partnership can be measured by the number of years it has been in development—15 years, as of 2020. **The environmental portal.** This virtual platform provides the project with transparency, which is fundamental for its credibility and also promotes a sense of belonging for all who participate in the project
Outcomes	As of July 2019, the project had worked in 1019 areas to plant 391 ha with native trees and establish 2566 ha of natural regeneration and conservation. More than 1.4 million seedlings were donated and planted in the states of Paraná and Santa Catarina
Conditions (institutional, economic, social, cultural, environmental) for successful replication in a similar context	This model of partnership between a cellulose and paper company and an environmental NGO can be replicated in other partnerships between companies and civil-society organizations. It is a partnership built on dialogue using the assets of each partner organization in complementary ways, seeking a common and important goal for each that also benefits society as a whole. There are countless opportunities to build this kind of partnership between companies and civil-society organizations; it requires a dialogue to be established and certain conditions, such as trust, commitment, non-exclusion, integration, respect for diversity, proactivity and transparency. Partnerships built in this way are meant to last
Main challenges faced	The process of learning and coexisting among the various sectors, in this case involving a company and an environmental NGO working with rural owners and communities. It is a continuous learning experience that requires constant evaluation and adaptation, without diverging from the main purpose
Key messages and lessons learned	The main message is the importance that dialogue processes have in building long-term partnerships
Source(s) describing the case	Apremavi (2008); Brazilian Forests Dialogue (2013); Apremavi's environmental database platform (http://apremavi.cargeo.com.br/publico/mapa); Klabin website (www.klabin.com.br)
Contributors	Miriam Prochnow (steering committee member, The Forest Dialogue/Apremavi); and Leandro da Rosa Casanova and Maurício Batista Reis (technical coordinators of the *Matas Legais* project)
Photos	

An area of newly planted *Eucalyptus* seedlings and demarcated restoration area on the Valmor Catafesta property, 2007. Photo: © Leandro Casanova

Valmor Catafesta's property, 2019. Photo: © Leandro Casanova

Case study 11: The Land-Use Dialogue—planning sustainable landscapes in the Atlantic rainforest	
Proponent	Apremavi
Country of implementation	Brazil
Location	Alto Vale do Itajaí region, Santa Catarina
Implementation period	Since 2016
Restoration option	Restoration of degraded forests for production Restoration of degraded forests for protection Rehabilitation of degraded forest land through planted forests Rehabilitation of degraded forest land through agroforestry and/or silvopastoral systems Management of secondary forests
Case-study focus	Process ✓ Planning ✓ Assessment / Monitoring ☐ Intervention level ☐
Main objectives	The goal of the Land-Use Dialogue (LUD) initiative is to support a stakeholder-driven landscape platform for learning about collaborative, adaptive land management in selected landscapes around the world. The multistakeholder landscape platform builds shared understanding between local stakeholders and global partners engaging in LUD processes. Together, landscape stakeholders foster a common landscape vision of how various priorities and challenges across sectors and land uses connect. The LUD model is designed to identify locally prioritized actions across multiple pathways for change. These often include: – generating recommendations for policy guidelines or implementation – resolving conflicts and confusion around land rights and boundaries – developing partnerships between the community and the private sector – testing sustainable land-use practices – establishing information-sharing and learning networks, locally and internationally
Target groups or users	NGOs, communities, private companies, academia and governments
Partners and collaborators	The Forests Dialogue, Brazilian Forests Dialogue, Apremavi and IUCN
Context (initial situation) and challenge (problem) addressed	In Brazil, the LUD initiative was launched in April 2016 in Atalanta, Santa Catarina, focusing on planning and implementing sustainable landscapes in the Alto Vale do Itajaí (Upper Itajaí Valley). The Alto Vale do Itajaí was chosen as the pilot because the region's land use already fulfils many of the characteristics of sustainable landscapes. It is an opportunity to exchange ideas and experiences that can help improve land use in the region and also advertise the project to other regions. The valley was colonized at the beginning of the twentieth century; within less than 100 years of "economic growth", 80% of the forests in the region had been destroyed. Floods occurred more frequently, and the Alto Vale do Itajaí is now highly affected by climate change. With fewer forests to exploit, particularly after 1970, companies and small rural owners started planting exotic tree species to supply the market. Deforestation slowed in the 1980s with the commencement of native forest restoration projects and the introduction of environmental laws specific to rainforest protection (since 1990)
Process and methodological approach, techniques and tools used	The LUD process began with a seminar to gather information and integrate the regional actors that exert influence in the landscape. Two days of field visits and debates were held among specialists about the importance of a new participatory perspective on land use, directed at the Itajaí river basin and involving 31 municipalities in Santa Catarina. Forty-nine entities—NGOs, agricultural, public and private companies, government,

	universities, cooperatives and rural producers' associations—participated in this first historic meeting, at which objectives for extending the dialogue with practical actions were defined. A working group was formed to develop the next steps. The next step in the process was a second LUD seminar held in March 2017. Consisting of 90 participants, the initiative used databases and geoprocessing images—the knowledge of local actors—to develop the first map of priority areas envisioning sustainable landscapes in the Alto Vale do Itajaí
Field-level practices implemented	Several field visits were undertaken during the first seminar to better understand realities in the region. A database was created, which produced a pilot map of the region's social/environmental situation. The database supported a debate on scenarios for 2030 and 2050, held at the second seminar. Research on perceptions was conducted, asking, "What is your opinion on the scenarios for 2030/2050 in the Alto Vale do Itajaí?" The research covered eight main topics: 1) forests and biodiversity; 2) water resources; 3) protected areas; 4) farming; 5) silviculture/reforestation; 6) rural roads; 7) landslide and flood risk areas; and 8) rural × urban areas
Innovative aspects	For the first time in the Alto Vale do Itajaí, different sectors sat at the same table to look beyond their backyards and propose priorities and actions aimed at following the law and also transcending it with additional measures, focusing on improving the overall quality of life. Involvement in the mapping process helped identify production practices not specified by law that could bring together production and environmental conservation in more effective ways in the long run. Some organizations that participated in the process incorporated the results in their strategic planning
Outcomes	The first map of priority areas for sustainable landscapes in the Alto Vale do Itajaí; recommendations for the prevention and mitigation of environmental risks; and a list of priority actions to guide public policy, investment in conservation, and private-sector initiatives. About 150 areas were demarcated as follows: – Areas that have the potential to, or that already, support sustainable production, such as agroecological production and agroforestry systems – Priority areas for water resources and biodiversity conservation, such as water springs and basins, and places with endangered fauna and flora – forest restoration areas, such as permanent preservation areas and legal reserves – Areas with environmental impacts that need to be resolved – Areas with potential for ecological enrichment with native trees – Priority areas for the formation of biodiversity corridors and integrated landscape management – Areas with a higher risk of landslides and floods. Under the restoration theme, the Restaura Alto Vale project started in 2018 and has engaged with 368 rural owners in 27 municipalities. Some 64 000 native tree seedlings have been distributed covering 91 ha of restoration area
Conditions (institutional, economic, social, cultural, environmental) for successful replication in a similar context	**Stakeholder mapping.** A key priority in LUD platforms has been to gather the existing knowledge on the landscape and identify key actors in the landscape that influence land-use decision-making. **Communication pathways.** An information-sharing mechanism is needed so that participants know who is doing what in the landscape. **Clear dialogue structure and objectives.** A central tenet in a landscape approach is that the end goal is not predefined but determined by stakeholders through a process of visioning and balancing trade-offs. **Leadership.** It is clear that the success of a multistakeholder platform requires a key group of actors in the landscape who champion the identified priority actions and continue the flow of information beyond platform meetings

Main challenges faced	**The question of inclusivity.** To achieve the goal of inclusive decision-making, the platform must be viewed by all actors as a legitimate mechanism for influencing change, including those not traditionally involved. **Overcoming power imbalances for participatory decision-making.** Participants in LUD platforms include those who would be considered current decision-makers and those affected by landscape decisions. **Policy as an entry point.** Focusing on land-use policy allows the dialogue to be action oriented, but it also has its challenges. For example, it can cause discussions to centre on the overlap or lack of synergy among the policies of different sectors
Key messages and lessons learned	**Attending to scale**. Landscape approaches are designed to function at multiple scales, from influencing sustainable land-use decisions by individuals to reforming federal and regional land-use planning policy and guidelines. **Dialogue capacity building.** For the dialogue platform to be truly inclusive, it must not only make space for the participation of different stakeholders but also enable actors to present and negotiate their priorities
Source(s) describing the case	Brazilian Forest Dialogue & Apremavi (2019)
Contributors	Miriam Prochnow (steering committee member, The Forest Dialogue/Apremavi); and Wigold Bertoldo Schaffer (Technical coordinator of the LUD project for the Alto Vale do Itajaí Region)

Photos

The Alto Vale do Itajaí region. Photo: © Wigold Schaffer

A field visit during the first LUD seminar in April 2016. Photo: © Wigold Schaffer

Case study 12: The private restoration of degraded forest land with native tree species in the Peruvian Amazon	
Proponent	Bosques Amazónicos SAC (BAM) through its Campo Verde project[10]
Country of implementation	Peru
Location	Campo Verde, Ucayali (Peruvian Amazon)
Implementation period	Ongoing since 2008
Restoration option	Rehabilitation of degraded forest land through planted forests
Case-study focus	Process ☐ Planning ✓ Assessment/monitoring ✓ Intervention level ✓
Main objectives	Reforestation of degraded pasture lands, rehabilitation of degraded forest areas and supporting biodiversity by connecting forest fragments and recreating habitats for wildlife (the Campo Verde project reforests with native tree species on degraded lands for timber and carbon purposes)
Target groups or users	Reforestation companies, rural communities and extensionists
Partners and collaborators	Asociación para la Investigación y Desarrollo Integral; the National Institute for Agrarian Innovation; and the regional government of Ucayali
Context (initial situation) and challenge (problem) addressed	The company's property in the central Peruvian Amazon of around 18 000 ha comprises degraded pastureland, wetlands, grasslands and primary and secondary forests; it has been subject to a pattern of unsustainable logging and farming since the 1960s. The property was cleared in stages in the 1980s for cattle ranching, and active production on the land ceased in the mid-1990s. Repeated fires originating in neighbouring smallholder plots and soil degradation resulting from overgrazing and inherent soil fragility precluded the natural regeneration of the original forest cover. In 2007, an area of 2040 ha of degraded pastures was targeted for restoration under the Campo Verde project
Process and methodological approach, techniques and tools used	The design and planning of the Campo Verde project involved a sequence of assessments, studies and activities: – **Biophysical assessment** to characterize the herbaceous, shrub and arboreal vegetation, soils and fauna (with emphasis on entomological fauna) – **Socioeconomic assessment** of the zone of influence to gain knowledge and enhance understanding of the core characteristics and aspirations of villages and other settlements near the project area – **Design of the technical proposal**, including the preparation of the main components of the proposal (e.g. species selection, soil preparation, plant species, planting design, spacing and management regimes) based on infield biophysical surveys and analyses, literature reviews and expert opinion – **Establishment of a central nursery** with a production capacity of 1 million plants per year grown from seed – **Establishment of the forest plantation** using four native timber species combining fast-growing (marupa, *Simarouba amara*), moderate-growing (shihuahuaco, *Dypterix ferrea*) and slow-growing (tahuarí, *Tabebuia serratifolia* and mahogany, *Swietenia macrophylla*) species. In addition, the nitrogen-fixing species guaba (*Inga edulis*) was planted to help ameliorate the soil, suppress weed growth and provide shade and protection for the timber species. The timber species were planted in various combinations or stand models – **Maintenance and silvicultural practices**, designed to reduce seedling mortality, maximize growth and yield and mitigate the risk of pests and diseases

[10] BAM is a Peruvian private company founded in 2004 specializing in the conservation, protection, restoration and sustainable management of tropical forests. Its Campo Verde project has been operating since 2008 (www.bosques-amazonicos.com/en).

	– **Research**, carried out directly by BAM or through partnerships with acknowledged research organizations – **Monitoring**, both for carbon marketing purposes (carbon stocks, leakage, emissions) and to meet the company's management needs for the timely assessment of fundamental indicators such as survival, growth rates and unit costs. The monitoring also included environmental and social impacts of the project based on a set of key indicators – **Social issues**, including the promotion of productive projects with neighbouring communities and the replication of the plantation model (and other crops) among groups of rural families
Field-level practices implemented	**Biophysical diagnosis** to assess the drivers and level of degradation and to assist in the design of the intervention (e.g. species selection, soil preparation and seedling quality). **Site preparation and establishment**, including: – area stratification and delimitation of management units to facilitate management and monitoring – land classification and evaluation – weed management (carried out using tractor-mounted sprayers and glyphosate for control) – soil cultivation (using an offset-disc plough to form contours or "fish spine" furrows) – plant nutrition (application of 1 kg of chicken manure and 100 g of dolomite lime per tree) – planting (in various regimes for the reforestation of pasture areas and the enrichment planting of secondary forests) – maintenance. Pruning, phytosanitary control in the nursery and the plantation area, forest protection (following environmental strategies for the prevention and control of pests and diseases, compliance with legal and technical regulations on industrial safety and hygiene, and involvement of the neighbouring communities) and fire protection (20–30 m wide firebreaks, construction of water points for fire tenders, etc.) **Community development programme** with neighbouring villagers to prevent encroachment and contribute to local livelihoods
Innovative aspects	– The project management and business model involves a strategic planning process with baseline diagnostic studies and silvicultural operations to deliver the final products, community development activities, and strategic alliances to improve or develop production protocols (such as phytosanitary control) for basic studies of plant production (e.g. cloning), monitoring and research as well as product processing and commercialization. For example, the management regime for site preparation and the establishment of pasture areas includes the stratification and delimitation of management units to facilitate management and monitoring, land classification (according to various soil types, slope classes, terrain features and levels of weed competition) and evaluation (based on the classification, sites were evaluated to optimize silvicultural regimes in terms of soil preparation, weed management, soil nutrition and species choice) – Plant protection is done using an integrated pest management approach. Native viruses are multiplied in the laboratory for larvae control. Entomopathogenic fungi and bacteria are used as agents for the biological control of insects attacking the planted timber species – Implementation of eco-businesses with carbon credits from greenhouse-gas emission reductions through reforestation with native tree species on land that has been degraded by cattle ranching, as well as through natural regeneration. In 2008, the Campo Verde project became a Verified Carbon Standard Afforestation/Reforestation Project under the Climate, Community and Biodiversity Alliance
Outcomes	The project restoration interventions have:

	– Contributed to the valorization of 2040 ha of degraded land through forest plantations and ANR. By 2018, around 870 ha had been reforested with almost 2 million valuable native trees (an average plantation rate of 270 ha/year). Additionally, 124 ha are being restored through protection measures and ANR – Achieved greenhouse-gas emission reductions generating 169 000 carbon credits in the carbon market by 2016 (the price for the first sale of carbon was USD 8/tonne) – Fundamentally contributed to reversing the pattern of habitat loss, soil degradation and biodiversity impacts with a management regime that recovers soil physical, chemical and biological characteristics and regenerates forest habitats and enhances biological corridors, thus improving the overall biodiversity conditions of the region. Moreover, the project intends to establish mahogany, which is under serious risk of extinction because of its overexploitation for many years. An additional benefit is the improvement of water quality and quantity in the Agua Blanca River and other tributaries in the local water system. The project is generating interest in ecotourism, as evidenced by the many visitors to the area (over 2000 people annually), including professionals, producers (small- and medium-sized landholders), interns and students from national and foreign universities. The project is considered a reference for other companies and landholders interested in the business of planting native tree species on deforested/degraded forest land in the country's Amazon region. BAM has received awards for its Campo Verde project, including gold-level certification by the Climate, Community and Biodiversity Alliance in recognition of its effectiveness in mitigating climate change and promoting biodiversity and sustainable development; and the 2010 National Renewable Natural Resources Eco-Efficiency Business Award by Peru's Ministry for the Environment and *Universidad Científica del Sur*
Conditions (institutional, economic, social, cultural, environmental) for successful replication in a similar context	– Private-investor decisions to finance a high-risk project – Careful planning involving specialization by activity to facilitate understanding and the adoption of a work schedule geared to improving the technology, reducing costs and adapting to the changing situation during project implementation – Continuous improvement of the technology for soil preparation, plant production and plantation management based on strategic alliances – Use of local knowledge about soils, species interactions and the appropriateness of species selection as well as institutional alliances to improve silvicultural technology – On-site training by specialists and permanent updating according to activities carried out during project implementation – Maintaining constructive relations with local communities – Establishing an effective monitoring and evaluation system
Main challenges faced	**Financial constraints.** The initial objective of the Campo Verde project (to produce wood and commercialize carbon) was later changed to focus on the production of wood with fast- and slow-growing native species. The sale of carbon was discontinued due to the heavy burden of prerequisites that was not compensated by income received. **High operational costs.** The reforestation of degraded pastures in local conditions is an expensive business, amounting to around USD 7000 per ha (including all direct and indirect costs). The challenge is to scale up operations and integrate with the management of the area's residual logged-over and secondary forests. **Weak government support.** The regional and national governments have not shown much interest in the initiative and its potential as a model that could be adapted to smallholders settlements. **Information gaps.** The use of native tree species at scale brings a number of challenges, particularly with regards to information gaps on taxonomy, silviculture and technological properties of several tree species
Key messages and lessons learned	– The choice of species should be made on the base of a biophysical diagnosis

	– The use of *Inga edulis* to recover degraded areas has proved successful in the plantation model – Soil cover with legumes has proved an efficient way to biologically control weeds, notably with *Desmodium ovalifolium* (low-cost establishment, persistent, non-aggressive, supports shade of plantations, lignified stem and high contribution of biomass) to be introduced to the system in the third year – Complementing the planted timber species with natural regrowth and regeneration on a site is crucial. The cutting of lianas and other creeping plants is essential – Knowing the origin of the planting material and ensuring its traceability is essential for ensuring high-quality final products from the forest plantations – The best method of pest control in a mixed-native-species forest plantation is biological control with the use of entomopathogens – The establishment of biological corridors that provide alternative hosts and shelters for parasitoids is a good option for quelling harmful insect populations – Local participation should be promoted at two levels: internally, to maintain well-trained and motivated human resources; and externally, as part of a community development programme to approach and raise awareness among neighbouring villagers and communities
Source(s) describing the case	Chavez & Sabogal (2019); BAM (w.ww.bosques-amazonicos.com/en/our-projects/reforestation-of-native-species-in-campo-verde-ucayali)
Contributors	Jorge Chávez Rodríguez (Bosques Amazónicos SAC); and César Sabogal (independent consultant and former Forestry Officer, FAO)

Photos

Degraded pasture with remaining high forest before the start of the Campo Verde project showing the delineation of the restoration-area management units. Photo: © BAM

Planting Inga edulis *and timber species. Photo: © BAM*

View of the Campo Verde reforestation area on degraded pastures, seven years after planting. Photo: © BAM

Case study 13: From *Eucalyptus* monocultures to high-diversity mixed forests—bringing together wood production and tropical forest restoration	
Proponent	"Luiz de Queiroz" College of Agriculture, Laboratório de Ecologia e Restauração Florestal, University of São Paulo; Laboratório de Silvicultura Tropical
Country of implementation	Brazil
Location	Aracruz, Espírito Santo; Mucuri and Igrapiúna, Bahia
Implementation period	2011–2012
Restoration option	Restoration of degraded forests for production
Case-study focus	Process ☐ Planning ☐ Assessment/monitoring ☐ Intervention level ✓
Main objective	Temporary mixed plantations of *Eucalyptus* and a high diversity of native trees to produce wood and offset part of the cost of planting and maintaining tropical forest restoration
Target groups or users	Small to large farmers who need to restore degraded sites in marginal areas of production
Partners and collaborators	The University of São Paulo, The Atlantic Forest Restoration PACT, pulp and paper companies and the NGO *Organização de Conservação da Terra*
Context (initial situation) and challenge (problem) addressed	The areas had been used previously for cattle grazing (degraded pastures), followed by several rotations of *Eucalyptus* planted in monocultural plantations, which were then converted to a mixed forest composed of *Eucalyptus* and a high diversity of native trees to offset the cost of tropical forest restoration
Process and methodological approach, techniques and tools used	Use of active restoration by planting tree seedlings to establish a high-diversity mixed forest following the best available commercial silvicultural techniques for growing and harvesting trees
Field-level practices implemented	Up to 30 native tree species were intercropped with *Eucalyptus* at 2 × 3 and 3 × 3 m spacing. Common silvicultural practices (e.g. soil fertilization and weed and ant control) were carried out for all seedlings, either native or *Eucalyptus*. The native trees were in rows according to three main ecological groupings to facilitate future harvesting. Two types of native seedling rows were used: ten species of intermediate growth rates; and ten late-successional species alternated with ten fast-growers. These native species rows were alternated with rows of clonal *Eucalyptus* at a ratio of 1:1
Innovative aspects	This was the first time *Eucalyptus* had been intercropped with a high diversity of tropical tree species. Controlled conditions were used to test this silvicultural solution at a large scale at three sites. As part of the same experiment, the high-diversity mixed forests were also compared with traditional restoration plots and pure *Eucalyptus* plots to serve as controls
Outcomes	The survival rates of all species in the high-diversity mixed stands was generally the same as in *Eucalyptus* monocultures and at traditional restoration sites. Competition with *Eucalyptus* slowed the growth of the fastest-growing native trees but did not affect the slow-growers. So far, two of the three sites have been harvested using both chainsaw and animal traction at one site and harvesters and forwarders at the other site. The volume of wood produced in the first rotation of *Eucalyptus* and the damage caused by harvesting operations to native trees was assessed. *Eucalyptus* grew larger in mixtures and yielded approximately 75% of the basal area produced by monocultural stands, even considering that they accounted for only 50% of the trees in mixed stands. *Eucalyptus* may be used for additional rotations either permanently or until the desired financial return has been achieved. Depending on the landscape context, when there are nearby sources of seeds and other propagules, natural regeneration potential may be high, and recruited seedlings can occupy the space left by the harvest of *Eucalyptus*. Most of the

	mixing effects observed (increased growth of *Eucalyptus* and slowed growth of native trees) were attributed to competition for water. Thus, the fastest-growing native species should be planted after the final harvest of *Eucalyptus* (if already not present as a result of natural regeneration)
Conditions (institutional, economic, social, cultural, environmental) for successful replication in a similar context	This solution applies to small-to-large-scale forestry and can easily be replicated in other tropical regions if seedlings of *Eucalyptus* and 10–30+ native species are available. Even when the volume produced is insufficient for commercial operations, it can be used within the property on which it grew for fencing and other construction, woodfuel and other uses
Main challenges faced	The high costs of restoring tropical forests and the need to develop economically viable ecological restoration projects with economic returns were the motivating factors for developing these high-diversity mixed forests. Now that the approach has been tested successfully, landowners can adapt it to their regions at the scale they need in a way to achieve the highest conservation values and the maximum economic returns
Key messages and lessons learned	– The system is a viable option for FLR – Tree survival is high: the growth of individual *Eucalyptus* trees is higher in the mixed plantations, but the growth of some native trees decreases (especially naturally fast-growing species) – The natural regeneration in the understorey can be abundant and depends on the matrix in which the plantation is embedded – The harvesting of *Eucalyptus* can damage neighbouring planted native trees and seedlings that have established through natural regeneration, but the damage may be compensated by their growth after *Eucalyptus* removal
Source(s) describing the case	Amazonas et al. (2018a); Amazonas et al. (2018b); Amazonas (2018); Brancalion et al. (2019); Silva (2018)
Contributors	Nino Tavares Amazonas, Carina Camargo Silva and Pedro H.S. Brancalion (Forest Sciences Department, “Luiz de Queiroz” College of Agriculture, University of São Paulo); and Ricardo Ribeiro Rodrigues (Biology Department, “Luiz de Queiroz” College of Agriculture, University of São Paulo)
Photos	

Growth of a mixed forest composed of *Eucalyptus* intercropped with a high diversity of native trees in an experimental site in Igrapiúna, Bahia, Brazil. Photos were taken one week, 30 months, and 44 months after planting. Photos: © Carina Camargo

A mixed plantation of *Eucalyptus* and a high diversity of native trees (on the left), and a traditional forest restoration plot (on the right). Both forests were planted on the same day in Aracruz, Espírito Santo, Brazil, and the photo was taken 51 months later. Note that the mixed plantation was composed of double rows of native trees intercropped with double rows of *Eucalyptus*, which grew taller but did not close the canopy over native trees, which could still access full sunlight. Photo: © Nino Amazonas

Case study 14: Strengthening the cocoa value chain for upscaling FLR through agroforestry	
Proponent	IUCN
Country of implementation	Guatemala
Location	Franja Transversal del Norte,[11] Guatemala
Implementation period	2011–2019
Restoration option	Rehabilitation of degraded forest land through agroforestry and/or silvopastoral systems
Case-study focus	Process ✓ Planning ✓ Assessment / Monitoring ☐ Intervention level ✓
Main objectives	To promote agroforestry restoration in the biological corridors of the Lachuá ecoregion and to improve people's livelihoods by strengthening cocoa production and supply chains and ensuring an adequate source of funding from both public and private investors
Target groups or users	Cocoa producers, field technicians and government officers
Partners and collaborators	Fundalachuá (Fundación Lachuá)
Context (initial situation) and challenge (problem) addressed	The world cacao market has an unmet demand of about 150 000 tonnes of fermented dry cacao beans. In Guatemala, as in other Latin American countries with cacao production, this situation is perceived as a window of opportunity to make the crop a source of income and employment for small, medium-sized and large producers who live in areas that can grow it. Guatemala contributes only 0.26% of global cacao production on an area of about 5000 ha. The goal of the Strategic Plan of the Cacao Agro-chain of Guatemala[12] (2016–2025) is to increase this area to 15 000 ha in the next ten years. Cacao agroforestry systems have high conservation value, and their adoption could help restore landscapes that have been degraded due to the advance of the agricultural frontier and the unsustainable use of crops and livestock, among other factors. In the last 20 years, Guatemala has invested about USD 173 million in the forest sector through PINFOR and PINPEP.[13] PINPEP is still in place but, in September 2015, a new programme, PROBOSQUE,[14] replaced PINFOR to continue this effort for a further 30 years with the aim of contributing to the government target of restoring 1.2 million ha of degraded forest land. The National Restoration Strategy of Guatemala was designed and approved in 2015. PROBOSQUE is its main economic support, complemented by PINPEP. The National Restoration Strategy has been supported by IUCN through the implementation of the Restoration Opportunities Assessment Methodology (ROAM) and the facilitation and strengthening, since 2014, of the National Forest Landscape Restoration Roundtable. The restoration strategy aims to generate income and improve livelihoods by addressing poverty and natural resource degradation. It seeks to establish public–private partnerships and attract investment, strengthen value chains and promote the demand for sustainable products arising from restoration. IUCN—in coordination with INAB (the National Forestry Institute), CONAP (the National Council of Protected Areas), MAGA (the Ministry of Agriculture, Livestock and Food), local governments and Fundalachuá—has been promoting the conservation of the Lachuá ecoregion since 1997 through governance

[11] The Northern Transversal Strip is a region of Guatemala limited, to the north, by an imaginary line between the Vértice de Santiago in Huehuetenango and Puerto Modesto Méndez in Izabal and, to the south, by La Mesilla in Huehuetenango and Lake Izabal. It comprises, from west to east, parts of the departments of Huehuetenango, Quiché, Alta Verapaz and Izabal.
[12] The document of the strategy is available in Spanish at www.maga.gob.gt/download/enac16-25.pdf.
13 PINFOR is the Forest Incentives Programme. PINPEP is an incentive programme for holders of small areas of forest or agroforestry land.
[14] PROBOSQUES is an incentive programme for the establishment, recovery, management, production and protection of forests in Guatemala.

	strengthening; natural ecosystem management and promotion of sustainable forest management; and sustainable productive economic options, such as agroforestry. From 2016, IUCN and Fundalachuá shifted their action towards the development of business models focusing on the supply of and demand for added-value products and building alliances within and between the public and private sectors to scale up the experience, including by increasing access to technologies and markets. Within this framework, IUCN and Fundalachuá are promoting the establishment of new areas of agroforestry systems (cocoa + forest species), seeking financial leveraging with government incentives, impact investments and formal banking. Based on the Lachuá experience and in the framework of the National Cocoa Strategy, an expansion of cocoa production is planned in other areas, particularly in Verapaz (Lachuá, Cahabón and Polochic) and the southern part of the Petén
Process and methodological approach, techniques and tools used	The methodological approach defined the intervention as an innovation model operating in five dimensions: 1) production technology; 2) commercialization; 3) organization; 4) governance; and 5) finance. – **Production technology.** Creating conditions and capacities for the production of high-quality cocoa with the potential for commercialization in high-value specialized markets – **Commercialization.** Creating conditions and capacities for the implementation of associative models for small producers, in which they add value to their production through centres for collection and processing, guarantee quality and quantity, and increase their power to negotiate directly with international buyers – **Organization.** Creating the conditions whereby producer associations have the capacity to absorb all the production of their associates, pay in advance through revolving funds or credits, and invest in the infrastructure required to ensure an adequate supply (of suitable quality and quantity) for buyers of grains – **Governance.** Developing multistakeholder platforms for the management of production chains, with strong public support in cooperation with the private sector – **Finance.** Providing opportunities and prospects for private investors, as well as promoting public investment
Field-level practices implemented	Field activities mostly involved technical support and capacity building for the establishment of cocoa agroforestry systems, including the identification, selection and reproduction of high-value genetic material through the cloning of superior trees. This generated 85 000 cloned plants in the Lachuá ecoregion, which are expected to produce 1000 kg per ha per year with proper management
Innovative aspects	The innovative aspect is the strong focus on strengthening the value and production chains of a specific commodity (cacao) in order to produce the conditions and enabling environment (political, institutional and economic) for upscaling FLR through agroforestry models based on this commodity. Project results have motivated the government to prioritize the promotion of cocoa production and the creation and integration of policies and government programmes such as the Zero Hunger programme, forestry and agroforestry incentive programmes, the Rural Outreach Programme, and the National Fund for Agricultural Development. By integrating human, technical and financial resources and using the experience generated in Lachuá, these programmes will become an economic engine with a broad institutional base capable of generating employment and increasing income in marginalized areas with considerable potential for the cultivation of cocoa in agroforestry systems in the Franja Transversal del Norte Region of Guatemala
Outcomes	The project generated a change in the cocoa value chain, from production to commercialization, as well as in the services supporting it—such as organization, governance and finance. It showed that it is possible for organized groups of small-scale producers to manage a profitable production model without degrading the landscape's natural resources. Specifically, the results included the following: – 500 producers involved and 776 ha of cocoa agroforestry implemented

	– Increase in cocoa yields from 180 kg per ha to 500 kg per ha (70 kg per ha to 192 kg per ha dry grain) – Increase in average annual income estimated at USD 1411 per producer – Creation of 315 new full-time jobs – Positioning in and access to the international cacao bean market through trade agreements, enabling 236 small, organized private producers in Alta Verapaz to sell their products and generate an annual revenue of USD 197 400 – "Bean to bar" market: commercial alliances with 36 chocolate enterprises from the United States of America, Europe and Asia, achieving a price increase from USD 2.28 per kg to USD 4.50 per kg (USD 4500 per tonne) – Improved consistency of dry-fermented grain in terms of quality and volume, with fermentation rates of 70–90% and grain moisture of 7–7.5% – A financial programme relying on an operational plan for production and the creation of a revolving fund, guaranteeing that the material needed for production will be of sufficient quality and quantity – More than USD 1 million invested by government in supporting agroforestry models – The establishment of three collection and processing centres located strategically in producing areas in Cahabón and the Lachuá ecoregion, especially with the opening of the Cacao Verapaz Company, which links producers directly with chocolate companies
Conditions (institutional, economic, social, cultural, environmental) for successful replication in a similar context	Necessary institutional conditions include the coordination of policies and government programmes that integrate human, technical and financial resources. Moreover, the impact of field activities must include higher incomes and employment in marginalized areas. Thus, although public investments can create the conditions for the management of natural assets to deliver societal benefits, private finance and business models at different levels are also crucial
Main challenges faced	The main challenges mostly relate to the strengthening of value chains and unlocking private finance at the necessary scale, including: – matching quantity and quality (different groups) to respond to increased demand – diversifying buyers – providing evidence of impacts on farming systems, livelihoods and ecosystem services – the need for a substantial increase in the pipeline of investable projects – the need for a systematic de-risking of projects that the conventional finance sector often perceives as unfamiliar and risky – the construction of investment vehicles of an appropriate size and familiarity to interest institutional investors
Key messages and lessons learned	– Nature conservation hasn't always been regarded as a route to development, but it has become so in Guatemala, where farmers are sustainably growing cocoa while conserving forests. Sustainable cocoa products enable Guatemalan farmers to earn up to USD 1000 per ha, compared to USD 60 per ha from subsistence agriculture – Strengthening the cacao producer organizations and improving supply-chain performance motivates producers to continue establishing cacao agroforestry production systems – More actors in government, private companies and non-governmental support agencies are becoming interested in making investments to promote cacao cultivation, trying to take advantage of market opportunities and an improved business environment. All this generates a virtuous cycle that allows the upscaling of FLR
Source(s) describing the case	https://i-m-magazine.com/?p=1053; www.uncommoncacao.com/lachua-guatemala; www.iucn.org/node/31940
Contributors	Silvio Simonit, Orsibal Ramírez and Leander Raes (IUCN)

Photos

IUCN has strengthened the livelihoods of rural communities in Guatemala by improving the value chain of cocoa production. Photo: © IUCN ORMACC/Erick Ac

Local producers in the Alta Verapaz region participate in a cocoa field school on pre-production, production, value added and marketing. Photo: © IUCN ORMACC/Erick Ac

Case study 15: The productive rehabilitation of tropical cattle-ranching lands	
Proponent	Colombian Sustainable Cattle Ranching Project (Proyecto Ganadería Colombiana Sostenible)
Country of implementation	Colombia
Location	The Colombian Sustainable Cattle Ranching Project is under implementation in 87 municipalities in 12 departments grouped in five ecoregions in which cattle ranching exists close to protected areas: 1) Lower Magdalena; 2) Cesar River Valley; 3) Coffee (Quindío, Risaralda, Caldas, Tolima and Valle del Cauca); 4) Oak Corridor (Boyacá and Santander); and 5) Andean Foothills (Meta)
Implementation period	2012–2020
Restoration option	Rehabilitation of degraded forest land through agroforestry and/or silvopastoral systems
Case-study focus	Process ☐ Planning ☐ Assessment / Monitoring ☐ Intervention level ✓
Main objectives	To promote the adoption of environmentally friendly silvopastoral systems in Colombian livestock farms in order to enhance natural resource management, ecosystem services (biodiversity, soil and water conservation, and carbon sequestration) and productivity. The project focused on overcoming the main barriers to the adoption of land-use practices that benefit both farmers and the environment by: improving productivity in participating farms through silvopastoral systems (called SPS here); enhancing connectivity and reducing land degradation through various payment schemes for ecosystem services; and enabling the wider adoption of SPS by building the capacities of farmers and extensionists and strengthening institutions in the livestock subsector
Target groups or users	Cattle ranchers in five Colombian ecoregions (> 85% of participating farms were small or medium-sized)
Partners and collaborators	Federación Colombiana de Ganaderos (lead executing agency); Fundación Centro para la Investigación en Sistemas Sostenibles de Producción Agropecuaria (CIPAV), Fondo Acción[15] and The Nature Conservancy (allies and co-implementers); Global Environment Facility and the Government of the United Kingdom (funding agencies); and The World Bank (implementing agency)
Context (initial situation) and challenge (problem) addressed	Cattle ranching contributes 1.4% of Colombia's gross domestic product and 21.8% of its agricultural product and generates 810 000 direct jobs, representing 6% of national employment and 19% of employment in the agriculture sector. Cattle grazing occupies approximately 39.2 million ha, which is 34% of the Colombian territory and supports a bovine population of 23.5 million animals. Most conventional livestock systems rely heavily on grassland monocultures in which external inputs are used to compensate for the loss of essential ecological processes such as nutrient cycling and biological pest control. The main negative environmental impacts of these unsustainable livestock systems are the destruction and fragmentation of natural ecosystems, soil erosion and degradation, biodiversity loss, water pollution, the loss of hydrological regulation and high greenhouse-gas emissions
Process and methodological approach, techniques and tools used	**Technical assistance.** Project beneficiaries received free technical advice for participatory farm planning, establishing and managing SPS, enhancing animal welfare and restoring strategic ecosystems on their farms. **Payment for ecosystem services.** Two payment schemes for ecosystem services were applied. One rewarded biodiversity conservation resulting from forest and wetland

[15] Fondo Acción is a Colombian non-profit organization of the private regime working on themes such as sustainable rural development, conservation, climate change, and the protection and development of children and adolescents, with an emphasis on early childhood (https://fondoaccion.org).

	protection or the implementation of SPS; and the other promoted intensive silvopastures for their contributions to carbon sequestration. **Demonstration farms.** These small to medium-sized farms were part of the project's strategy for technology transfer and were intended to support cultural change among conventional farmers. They were used to evaluate silvopastoral innovations; generate information on the established SPS; train ranchers, students, technicians and professionals; serve as a model for cultural change towards sustainable livestock production, which includes the transmission of values and intergenerational exchange; and showcase behaviours respectful of nature. **Research, innovation and monitoring.** Research done in the project provided a better understanding of the effects of SPS on productive, economic, environmental and social indicators at the farm and landscape scales. Continuous monitoring for more than six years confirmed the productive and environmental benefits of SPS. Project innovations include new silvopastoral arrangements for different ecoregions, the identification of species well adapted to each productive context, and strategies for implementing and managing SPS. **Focal species.** The project identified native tree and palm species of global conservation concern, which were planted or managed in SPS and riparian forests to enhance connectivity and the conservation value of livestock-dominated landscapes
Field-level practices implemented	**Fenced forests.** Forest fragments and riparian corridors were fenced to prevent trampling and browsing from livestock and enhance their connectivity and conservation value. **Scattered trees in pastures.** 30–50 trees per ha were planted or protected in paddocks. **Intensive silvopastoral systems.** Implemented between 0 and 2000 m above sea level, intensive SPS involves more than 5000 fodder shrubs per ha and up to 500 trees per ha. The most common shrub species are *Leucaena leucocephala, Tithonia diversifolia* and *Guazuma ulmifolia*, combined with fruit trees, timber trees and palms. Above 2000 m, intensive SPS uses 100 native trees per ha, interspersed with 2000 forage shrubs planted in strips of four rows every 40 m. **Fodder hedges.** Strips of fodder shrubs planted at high density. They include a line of trees at the centre, planted 3 m apart. **Mixed fodder bank.** Crops of fodder shrubs (rich in protein, minerals and vitamins) combined with herbaceous plants such as legumes, sugar cane and tall grasses (rich in soluble sugars and fibre), designed to maximize biomass production and provide cut-and-carry fodder throughout the year. **Live fences.** Lines of native and/or timber trees that separate paddocks. They provide shade, act as biological corridors for certain species and provide complementary resources for the farm, such as fodder, fruits and wood
Innovative aspects	– Technical assistance for sustainable ranching implemented on an unprecedented scale, requiring a huge capacity-building effort – External demonstration farms with explicit commitments to help meet public policies to reduce deforestation and manage strategic ecosystems – Method demonstrations for farmers through field days on participating farms – Payment scheme for carbon sequestration in participating farms – An interinstitutional public policy committee (two ministries and the national planning department) that articulated the project's activities to international goals – An interinstitutional arrangement whereby the livestock sector accepted the challenge of leading silvopastoral training based on agroecological principles
Outcomes	– Four open calls and 44 100 farmers approved for participation, 79.3% of whom (3250) were still active at the end of the project – 8060 people trained in field days; 221 technicians and external professionals trained in sustainable cattle ranching; and 2807 beneficiaries of technology brigades – Personalized support for participating farmers interested in establishing silvopastoral systems (5978 technical visits for plantings in one semester)

	– A total of 30 080 ha of silvopastoral systems and 4572 ha of intensive silvopastures established; 3329 ha of enrichment planting in natural forests (up to June 2019) – 15 538 ha of scattered trees in paddocks, established through natural regeneration
Conditions (institutional, economic, social, cultural, environmental) for successful replication in a similar context	– Funding to cover implementation costs and to provide incentives for farmers – A large-scale training and technology-transfer programme – Infrastructure to provide small farmers with technical assistance – Financial and technical resources for adaptive monitoring and research – Technical knowledge about tree species adapted to the needs of livestock systems (tolerant to drought and cattle browsing)
Main challenges faced	– High mortality of planted trees and shrubs during implementation phase associated with climatic uncertainty (three El Niño–Southern Oscillation episodes during eight years of implementation, with extreme and unpredictable weather, prolonged drought periods and atypical heatwaves) – Geographic dispersion of participating farms – Imperfect land tenure
Key messages and lessons learned	– Farms should be concentrated in watersheds. The proximity and spatial aggregation of participating farms is crucial for the efficient use of resources in a large-scale project such as this – Land-use planning and farmer training are required for successful implementation and should have sufficient funding – Technical assistants and extension workers must receive special training to develop a holistic vision of cattle ranching and the application of agroecological principles
Source(s) describing the case	Giraldo et al. (2018); Federación Colombiana de Ganaderos (2006); Federación Colombiana de Ganaderos (2018)
Contributors	Zoraida Calle (Coordinator, Ecological Restoration Area, CIPAV and of the Colombian Programme, Environmental Leadership & Training Initiative, Yale School of Forestry and Environmental Studies); and Enrique Murgueitio (CIPAV Executive Director)
Photos	

The silvopastoral system as practised on a farm in Cascajal, Piojó, Atlántico. Photo: © Carlos Alfaro

The silvopastoral system, as practised on a farm in Palmarito, El Retorno, Guaviare. Photo: © Adolfo Galindo/Walter Galindo

Case study 16: The restoration of mangrove ecosystems through community forestry	
Proponent	Forest Resource Environment Development and Conservation Association; Action for Mangrove Reforestation
Country of implementation	Myanmar
Location	Pyindaye Reserved Forest (Pyapon Tsp, Ayeyarwady region)
Implementation period	Ongoing since 1999 (phase V: 2019–2024)
Restoration option	Restoration or rehabilitation of mangroves
Case-study focus	Process ☐ Planning ☐ Assessment / Monitoring ☐ Intervention level ✓
Main objectives	Restoration of degraded mangrove forests and rehabilitation of abandoned paddy fields through mangrove reforestation with a community forestry approach
Target groups or users	Communities living in the Pyindaye Reserved Forest
Partners and collaborators	Forest Department of Myanmar Community forest user groups (CFUGs) consisting of household heads, including villagers of all wealth classes, the landless, young adults and women Tokio Marine & Nichido Fire Insurance Co. Ltd
Context (initial situation) and challenge (problem) addressed	The mangroves in the Ayeyarwady region have experienced severe degradation and deforestation in recent decades, and mangroves in the Ayeyarwady Delta have been particularly overexploited for woodfuel and timber since the 1970s. Many degraded areas were later converted to rice fields and shrimp ponds; by 2000, only 46% of the original (1978) 2623 km^2 of mangroves remained. In the project area, rice productivity declined strongly after about ten years and many fields were abandoned. Ultimately, the depletion of the previously mangrove-dominated landscape left local communities with limited livelihood options and highly vulnerability to tropical storms (e.g. Cyclone Nargis in 2008)
Process and methodological approach, techniques and tools used	The project made use of the Community Forestry Instruction (1995, revised in 2016 and 2019) to restore mangrove forests, in partnership with local CFUGs. Using a collaborative approach involving the Forestry Department, local communities, NGOs and researchers, the strategy was to find locally adapted solutions for restoring degraded mangrove areas and to jointly develop community forestry management plans for long-term success. The methodology included field trials and research, capacity building and training
Field-level practices implemented	– Nursery establishment at various sites for 12 mangrove species – Mangrove planting on abandoned paddy fields – Enrichment planting and regeneration improvement felling in degraded mangrove forests – Livelihood development for communities, including a revolving fund for aquaculture and crab farming – Ecotourism trial – Capacity building and environmental education for local communities
Innovative aspects	Additional activities to improve community livelihoods included crab farming in existing degraded mangrove areas and various types of aquaculture and agro-sylvo-fisheries on villagers' land
Outcomes	– 2 639 ha of mangrove reforested (as of March 2019) – 4 279 households from 26 villages have forest user rights under the Community Forestry Instruction (phases I–IV)

	– Improved livelihoods for both CFUG and non-CFUG people (from NTFP production) – Increased awareness of the importance and sustainable use of mangroves in the wider project area – Reduced disaster risk for local communities
Conditions (institutional, economic, social, cultural, environmental) for successful replication in a similar context	– Knowledge of characteristics of specific ecosystems, local mangrove species and climatic and hydrological conditions – Collaboration between the Forest Department, local communities and regional NGOs as mediators – Local community awareness of the benefits of mangroves and a willingness to contribute to their restoration
Main challenges faced	**Previously:** – Severe soil degradation made successful planting difficult – Encroachment of shrimp-pond agriculture and salt production areas – Cyclone Nargis destroyed 25 000 ha of mangrove plantations in 2008 **Now:** – Commercialization rights for CFUGs – Limited funding (roughly USD 650 per ha needed)
Key messages and lessons learned	Community-based mangrove restoration has great potential but needs long-term planning
Source(s)	FREDA & ACTMANG (2012); Springate-Baginski et al. (2011); Webb et al. (2014)
Contributors	Mélanie Feurer (Bern University of Applied Sciences, Switzerland); and Koichi Tsuruda (ACTMANG, Japan)
Photos	

Mangrove nursery managed by staff from surrounding communities, Pyindaye Reserved Forest. Photo: © Mélanie Feurer

CFUG members in front of an 11-year old *Bruguiera sexangula* plantation, Pyindaye Reserved Forest. Photo: © Mélanie Feurer

Case study 17: Empowering local communities for the restoration of a coastal landscape in the Ayeyarwady Delta	
Proponent	RECOFTC
Country of implementation	Myanmar
Location	Pyar Pon Township of Ayeyarwady region, located in the low-lying Ayeyarwady Delta
Implementation period	2015–2018
Restoration option	Management of secondary forests Restoration or rehabilitation of mangroves
Case-study focus	Process ✓ Planning ☐ Assessment / Monitoring ☐ Intervention level ☐
Main objectives	To empower local communities to restore, conserve and legally manage degraded coastal landscapes by partnering with relevant stakeholders. The aim was to secure fair benefits and ensure the sustainable livelihoods of local communities in Pyar Pon Township
Target groups or users	1083 households or families in 22 community forestry user groups (CFUGs)
Partners collaborators	RECOFTC and the Forest Resource Environment Development and Conservation Association, with support from the Myanmar Forest Department, implemented under the Norwegian Embassy in Yangon-funded Scaling Up Community Forestry project
Context (initial situation) and challenge (problem) addressed	Local communities living on the coast in Pyar Pon Township are vulnerable to climate-induced socio-economic shocks. The forests and rice paddies of the low-lying Ayeyarwady Delta are the sources of community livelihoods. But 49% of the paddy fields have become unproductive due to salt intrusions. This increased local pressure on the forest, the area of which decreased at a rate of 1.9% per year between 1990 and 2015. The forests also face threats from illegal logging, unsustainable shrimp farming and salt production. These threats were evident in the severe reduction and fragmentation of surrounding mangrove forests. Mangrove forests are instrumental in protecting the settlements and agricultural lands from cyclones. Although their income relies on forests, local people were unable to play a meaningful role in restoring and conserving the landscape because the area was classified as reserved forest. Local communities lacked legal recognition of their rights and responsibilities. Instead, they were viewed as illicit collectors of woodfuel, crabs and other forest products
Process and methodological approach, techniques and tools used	Community forestry (CF) places local communities at the heart of natural resource management. It was promoted in the Ayeyarwady Delta to support the legal recognition of local communities and assist them in restoring and conserving the landscape. It was done through the following process: **Needs and interests were identified.** A situational analysis was followed by a capacity-development needs assessment. Participatory methods were used to jointly assess the availability of forest land for the programme, the interests and needs of local communities to participate in the programme, and gaps in the capacity of stakeholders. A climate vulnerability assessment was also conducted to identify the sources of vulnerability and how they could be addressed through the programme. **Training was designed and delivered.** A landscape workshop was organized at the township level to discuss collaboration among stakeholders, including government, civil-society organizations and local communities. It was followed by general training at the national, township and local levels on developing community forestry management plans, enhancing livelihoods and markets, strengthening community forestry institutions and managing forest conflicts. The approach was cascading, whereby participants would immediately apply their new knowledge and skills in their local context. Those trained at the national level—i.e. Forest Department officials and staff of civil-society organizations—

	would then train stakeholders at the township level. Community forest management committee (CFMC) members would then train their respective CFUG members. **Support was provided for CF formalization and management.** RECOFTC supported local communities to follow the nine-step formalization process outlined in the Community Forestry Instruction (1995, revised in 2016 and 2019). This process coincided with additional training. Communication products, including posters, booklets and newsletters, were produced to increase awareness among stakeholders and increase their participation. Once communities had CF certificates, they were provided with further training and financial resources for restoration practices. Each local community received USD 5000–8000 to establish nurseries and plantations, including mangroves. **Policy issues were addressed at the national level.** The challenges in establishing community forests were documented and shared at the national level through policy forums and networks. RECOFTC helped establish a local network of CFUGs, which provided opportunities for local CFUGs to collaborate in addressing the common issues facing the landscape. This network was connected to national processes through the Community Forestry National Working Group, a national multistakeholder platform that discusses issues related to community forestry
Field-level practices implemented	With this support, participants from 22 CFUGs formed CFMCs, developed community forest management plans and agreed on internal regulations and benefit-sharing mechanisms. They also worked to formalize their rights and secure their tenure, which mitigated conflict with private companies. When empowered with these rights, the communities effectively dealt with the problems facing their landscapes and coordinated with the Forest Department to restore and conserve the area. CFUGs set up rules and regulations to control the harvesting of forest products. They planted 585 000 mangrove seedlings on 1500 ha in 2017 and 225 000 mangrove seedlings on 600 ha in 2018. These actions have reduced forest degradation and contributed to reforestation efforts within the community forests. To encourage people to protect the forests, CFUGs have focused on livelihood enhancement through agroforestry. Members grow forest and seasonal crops while culturing crabs in the mangrove forests. Fences have been erected for protection. With these interventions, local communities have reported higher incomes from the mangrove seeds, fish, crabs and prawns
Innovative aspects	By focusing on formalizing rights and enhancing livelihoods, the project provided local communities with the support and resources needed for them to protect and reforest their degraded landscapes. By empowering people to make decisions on forest management, this approach ensures ownership of action and financial viability. This is necessary to sustain participation following a project's completion
Outcomes	– Local communities now have greater control over the natural resources they use for their livelihoods, including 4159 ha of forest – The CFUGs have concrete plans to restore the forest through mangrove plantations. This will protect their agricultural land and increase the supply of forest products – In 2018, 90% of CFMC members interviewed reported better forest health and reduced degradation. This was 10% higher than in 2016 – Of those interviewed, 60% also said that forests play a large role in their livelihoods (compared with 20% in 2016)
Conditions (institutional, economic, social, cultural, environmental) for successful replication in a similar context	– Landscape beneficiaries must be the primary focus of restoration practices. Institutional frameworks are necessary to support local initiatives but are insufficient by themselves – Projects must incorporate community needs and interests and provide capacity development when necessary. This often also requires supporting multiple stakeholders who may face capacity issues when engaging with local communities – Communities working to reduce deforestation and implement reforestation policies need strong rights and secured tenure based on customary practices. This ensures effective participation from local stakeholders and guarantees fair benefits

Main challenges faced	Local communities rightfully expect restoration practices to increase their livelihoods through forest products. But improving the condition of degraded forests is a slow process that does not allow for a rapid increase in the supply of forest products. Local communities may be forced to look for alternative livelihood options, which can potentially redirect interest in FLR
Key messages and lessons learned	The equitable participation of local people is a precondition for the success of FLR. The formalization of rights and tenure, the enhancement of livelihoods and the development of key capacities are important for encouraging local communities to engage in restoration and address forest degradation. If these are not secure, FLR will not succeed
Source(s)	Feurer (2017); RECOFTC (2018)
Contributors	Aung Kyaw Naing, Lok Mani Sapkota, Jeffrey Williamson, Anna Roebuck and Martin Greijmans (RECOFTC)

Photos

Participants examine agroforestry designs, including crab culturing and the conservation of natural mangroves. Photo: © RECOFTC

A mangrove nursery in Pyar Pon Township. Photo: © RECOFTC

Case study 18: The restoration and community management of mangroves on the west coast of Madagascar	
Proponent	WWF Madagascar
Country of implementation	Madagascar
Location(s)	West coast of Madagascar
Implementation period	Since 2010
Restoration option	Restoration or rehabilitation of mangroves
Case-study focus	Process ☐ Planning ☐ Assessment / Monitoring ☐ Intervention level ✓
Main objectives	Improving the resilience of the mangroves to ensure the maintenance of their ecological functions and improving the wellbeing of communities to alleviate pressure on mangrove ecosystems due to overexploitation
Target groups or users	Members of local basic communities (COBAs), fisher cooperative members, federations of COBAs and members of civil-society organizations
Partners and collaborators	– Region, districts and municipalities – Decentralized technical services, especially the Regional Directorate of Agriculture, Livestock and Fisheries and the Regional Directorate for Environment and Sustainable Development – Civil-society organization members – National and international NGOs and programmes
Context (initial situation) and challenge (problem) addressed	Madagascar has the second-largest expanse of mangroves in the Western Indian Ocean, with relatively high mangrove diversity (eight species). The overuse of this resource, and the massive influx of migrants (mostly from southern Madagascar), threaten this ecosystem. Migrants are in search of a means of survival, potential resources and markets, and their practice of converting mangrove areas into cultivated land is causing widespread mangrove loss. The local governance of natural resources is weak, and climate change is having an increasing impact. It is estimated that 38.9% of the total mangrove area in the Manambolo-Tsiribihina Delta was lost between 1990 and 2000. To address this, WWF identified priority sites for restoration and defined strategies for reducing pressure on the ecosystem
Process and methodological approach, techniques and tools used	**Community-based approach.** A participatory and inclusive approach was taken to involving local communities in the restoration process. This empowers them as actors and beneficiaries in the process of improving their quality of life. **Multilevel and multistakeholder holistic approach.** The legal framework alone does not conserve natural resources; therefore, collaboration among all actors is required. In its intervention, WWF and its partners demonstrated how the positive impacts of conservation can improve the quality of life of communities. The intervention is based on a "community management transfer system", which is a tool set up to empower local communities in Madagascar. Under this system, WWF strengthens the capacity of communities to manage natural resources by providing technical and organizational support for community-based organizations. WWF also supports communities by promoting income-generating activities to diversify community sources of income and thereby reduce the pressure to overexploit the mangroves. The presence of the field team is essential for building trust and ensuring the implementation of activities
Field-level practices implemented	– Support for the implementation of the sustainable management plan – Sensitization and mobilization sessions for COBA members and the community, and promoting their empowerment

	– Taking into account social and cultural aspects of the region (e.g. community meals during the restoration campaign, festive driving campaign) when implementing all restoration activities – A monitoring system involving community members (patrols led by *polisin'ala*)
Innovative aspects	Support provided through the establishment of a direct fund to enable local partner associations to carry out their activities. This strengthens the technical and institutional skills of these structures, better enabling them to carry out their missions
Outcomes	– 1600 households in the 12 communities empowered in the sustainable management of 47 000 ha of mangroves – 560 ha of degraded mangrove areas planted – Maintenance of mangrove ecosystem goods and services (e.g. recurrence of mangrove crabs at restored sites), which benefits the local communities and subsequently improves food security and incomes (e.g. through beekeeping and tourism) – Reduction of mangrove deforestation in areas managed by communities – Communities aware of the link between mangrove restoration and the availability of marine resources (e.g. crabs and shrimps)
Conditions (institutional, economic, social, cultural, environmental) for successful replication in a similar context	– A spatial, technical and scientific framework for the restoration process that allows all stakeholders to harmonize their approach – The presence of a structure or space for consultation among the various actors – Building relationships and trust – Local communities are aware and convinced of the economic and social importance of conserving the mangrove ecosystem – Combining approaches with local culture (e.g. traditional dance) and village festivals (e.g. football matches and poem contests) – The integration of activities in a regional-scale plan (e.g. fisheries management plan, regional development plan)
Main challenges faced	– Difficulty in accessing certain sites – Securing the restoration area – Insufficient support among local and regional policymakers – Integrating migrants (especially seasonal migrants) in existing structures (COBAs)
Key messages and lessons learned	– Active restoration is a way of engaging communities and showing them they are part of the solution for conserving the environment – Local communities are the core of the mangrove management mechanism – It is important to take into account local social, economic and cultural dynamics, especially in alternative income-generation activities – The durability of results, achievements and impacts is best ensured by integrating them into a stable structure such as municipalities (e.g. integrate restoration activities and the protection of restored areas into municipal decisions) – Always think about assisting local communities to diversify their sources of income – Periodic appraisal, involving community members, is important
Source(s) describing the case	Shapiro et al. (2019); Jones et al. (2016); Projet Eco-Régional REDD+ (2015); Edmond et al. (2012)
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Women lead mangrove restoration in Benjavilo village, Manambolo Delta, western Madagascar. Photo: © Tony Rakoto/WWF

Women from Manombo village, western Madagascar, spend an afternoon sorting mangrove propagules before planting them. Photo: © Pauline Dame/WWF Madagascar

Lessons from the case studies

Addressing the FLR principles and guiding elements

Most of the case studies illustrate the application of three or more FLR principles, especially principles 2 (*engage stakeholders and support participatory governance*), and 3 (*restore multiple functions for multiple benefits*). Efforts to address principle 1 (*focus on landscape*) are least represented. Of the guiding elements, the most deployed among the case studies are *obtain strong stakeholder engagement* (GE6), *build stakeholder capacity for sharing responsibility for FLR* (GE10), *improve livelihoods* (GE15), *restore degraded forests and rehabilitate degraded forest land* (GE18), *identify opportunities to increase local incomes* (GE25), *conduct participatory FLR planning, decision-making and monitoring* (GE9), and *conserve biodiversity and restore ecological functions* (GE14).

Key conditions and lessons

The case studies show a number of important conditions for successful FLR. Some of the lessons learned are described below as they apply to the principles and guiding elements.

Landscape/land-use planning [P1—GE1, GE3; P2—GE9]

- Landscape approaches are designed to function at multiple scales, from influencing sustainable land-use decisions by individuals to reforming national and regional land-use planning policies and guidelines (Case study 11, Brazil).

- Long-term land-use planning is required for the successful implementation of FLR. It needs to be done with good knowledge of the landscape and the identification of the key actors influencing land-use decision-making (Case study 11, Brazil).

- Planning should link and integrate activities at larger jurisdictional scales (Case study 18, Madagascar), and sufficient funding should be allocated (Case study 15, Colombia).

Land tenure and rights [P1—GE4; P2—GE5, GE6, GE12]

- Community forestry is an important land-tenure mechanism through which local communities can gain formal rights to access, manage and restore forests, which, in turn, they can use to improve their livelihoods (Case study 8, Cambodia).

- To ensure the effective participation of local stakeholders and guarantee fair benefits, communities need to have strong rights and secured tenure based on customary practices (Myanmar).

Stakeholder engagement and commitment—addressing community needs and interests [P2—GE6]

- Stakeholder engagement, especially among local communities, plays a big role in the success of FLR (Case study 6, Ethiopia). It helps in laying the groundwork for effective partnerships among government, community forestry groups, and the private sector (Case study 8, Cambodia).

- FLR should focus on shared services and goods with widespread appeal in the community (Case study 3, Ecuador).

- Active restoration is a way of engaging communities and showing them they are part of the solution for environmental conservation (Case study 18, Madagascar).

- The engagement of local stakeholders and the provision of incentives for local communities are key factors in convincing concerned parties that ANR can be used to restore forests for the protection of watersheds as a shared objective (Case study 4, Philippines).

- Enabling local communities to participate in forest activities and use forest products produced in planted areas helps them develop a sense of ownership of surrounding forests. This improves not only forest production but also forest conservation (Case study 6, Ethiopia).

Awareness and recognition of benefits [P2—GE6, GE12]

- Strong awareness among local people and communities of the direct and indirect (economic and social) benefits of FLR is essential for obtaining their commitment and support (Case study 4, Philippines; Case study 18, Madagascar).

- No matter how much technical and financial support is provided, and no matter how many village meetings are run, the sustainability of FLR can never be guaranteed if the benefits of restoration are not immediately evident and while rural populations continue to grow and aspirations rise (Case study 5, Thailand).

- Perceptions of an environmental crisis due to forest loss can strongly influence people's motivation to plant trees, on farms and off (Case study 3, Ecuador).

Institutional coordination and supporting arrangements [P2—GE5]

- Institutional conditions that need to be in place to support FLR include the coordination of policies and government programmes to integrate human, technical and financial resources (Case study 14, Guatemala).

- Institutional frameworks are necessary to support local initiatives at the landscape scale (Case study 17, Myanmar).

- The durability of FLR interventions can be enhanced by integrating them into stable structures such as municipalities (e.g. by integrating restoration activities and the protection of the restored areas into municipal decisions) (Case study 18, Madagascar).

Collaboration and cooperation [P2—GE6, GE9, GE10]

- Collaboration and cooperation among stakeholders contribute to the success of FLR (case study 4, the Philippines; case study 16, Myanmar). Among other things, this requires building relationships and trust (Case study 18, Madagascar), and the clear distribution of roles (Case study 2, Ghana).

Participation and participatory approaches [P2—GE6, GE9]

- The equitable participation of local people is a precondition for successful FLR (Case study 17, Myanmar).

- Participatory approaches have proven to be effective in capacity building where training is linked to the implementation of community forestry activities (Case study 8, Cambodia).

- Participatory approaches conducive to the success of FLR involve the active, balanced cooperation of national, provincial and municipal agencies with NGOs and research organizations, according to the objectives of local landowners and implementing factual corporate social responsibility (Case study 3, Ecuador).

Leadership [P2—GE9, GE10]

- Projects should engage locally trusted, respected and visionary leaders (case study 3, Ecuador).

- The success of multistakeholder platforms will be enhanced when key groups of actors in the landscape champion the identified priority actions and ensure the ongoing flow of information beyond platform meetings (Case study 11, Brazil).

Dialogue process [P2—GE6, GE9, GE7, GE12]

- Dialogue processes are important for building long-term partnerships (Case study 10, Brazil). For a dialogue platform to be truly inclusive, it should make space so that different stakeholders can participate and enable actors to present and negotiate their priorities (Case study 10, Brazil).

- A central tenet of a landscape approach is that the end goal is not predefined but determined by stakeholders through a process of visioning and balancing trade-offs, and this requires clear dialogue structure and objectives (Case study 11, Brazil).

Capacity development [P2—GE10, GE5, GE9]

- The development of key capacities is important for encouraging local communities to engage in restoration and address forest degradation (Case study 16, Myanmar).

Investments and business plans [P2—GE12; P5—GE24]

- Although public investments can create the conditions for natural assets to be managed for the delivery of a range of societal benefits, private finance and business models at different levels are crucial components of FLR (Case study 14, Guatemala).

Use of local knowledge [P3—GE16]

- In communal arrangements, it can be beneficial to allow people the space and flexibility to learn from each other, share knowledge, and experiment with different species and methods (Case study 3, Ecuador).

- Important success factors include the use of local knowledge about soils, species interactions and the appropriateness of species selection, and institutional alliances to improve silvicultural technology (Case study 12, Peru).

- A condition for success is combining approaches with aspects of local culture (e.g. traditional dance, village festivals, football matches and poem contests) (Case study 18, Madagascar).

Livelihood provision, alternative income-generation activities and diversification [P5—GE23, GE24, GE25, GE26]

- FLR should be implemented using a sustainable economic/livelihood provision model (Case study 2, Ghana).

- Opportunity costs for not converting degraded forest areas into agricultural lands need to be accounted for, for example through payments for ecosystem services, carbon credits, and alternative livelihoods (Case study 2, Ghana).

- Always think about diversifying sources of income (Case study 18, Madagascar).

Applied research [P5—GE22, GE23; P6—GE28, GE29, GE31]

- The enabling conditions for FLR need more research (Case study 6, Ethiopia).

- The spatial, technical and scientific framework for a restoration process should allow all stakeholders to harmonize their approaches (Case study 18, Madagascar).

Technical knowledge [P5—GE23; P6—GE31]

- The major obstacle to using native species for large-scale restoration is the lack of adequate knowledge about their biological characteristics and silvicultural traits. Information about appropriate seed storage, propagation methods and silvicultural treatment options should be adequately retrieved, compiled and applied and the knowledge communicated (Case study 3, Ecuador).

- A condition for successful restoration is knowledge of characteristics of the specific ecosystem, local species, and climatic and hydrological conditions (Case study 16, Myanmar).

- Ex-mining sites can be used for the *ex situ* conservation of endemic, endangered and threatened species with the appropriate planting technology (Case study 7, Malaysia and Thailand).

Monitoring and documentation [P6—GE30, GE31, GE32]

- The careful monitoring and documentation of results can help verify the most cost-effective approaches for FLR and convince observers of its feasibility (Case study 4, the Philippines).

- Establishing an effective monitoring and evaluation system is key for the successful implementation of FLR (Case study 2, Ghana; Case study 12, Peru; Case study 13, Malaysia and Thailand).

Communication—targeted and consistent information campaigns [P6—GE31, GE32]

- Replicating ANR as an important FLR approach requires targeted and consistent information campaigns to generate interest in the approach based on its cost-effectiveness and capacity to develop biologically diverse forest cover, and to increase understanding that forest restoration cannot be achieved solely by planting (Case study 4, the Philippines).