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Guidelines for Forest Landscape Restoration in the Tropics

A CPF Joint Initiative – ITTO, CIFOR, FAO, IUCN, IUFRO, UN-Environment, WeForest and WRI

Prepared for ITTO
by Jürgen Blaser and Cesar Sabogal

October 2019

Explanatory note:

These draft **"Guidelines for Forest Landscape Restoration in the Tropics"** have been prepared for the consideration of the Committee on Reforestation and Forest Management (CRF) at the 55th Session of the International Tropical Timber Council on 2–7 December 2019 in Lomé, Togo.

The process to produce the draft involved:

- Decision at the 53rd Session of the International Tropical Timber Council in November 2017 to review "ITTO guidelines for the restoration, management and rehabilitation of degraded and secondary tropical forests" (ITTO 2002).
- Preparation of a background report on forest landscape restoration (FLR): Analysis of ongoing FLR programs of CPF members and baseline setting for new ITTO/CPF restoration guidelines for tropical forest landscapes, October 2018 under Collaborative Partnership Forest (CPF) Joint Initiative on Forest Landscape Restoration.
- Presentation of background report and an outline of an early draft of the guidelines at the 54th Session of the International Tropical Timber Council in early November 2018.
- A first FLR Expert Group Meeting in Bangkok, Thailand, in mid-November 2018, which brought together restoration experts from member countries, international and regional organization (including members of the Collaborative Partnership on Forests), and civil-society organizations.
- Presentation of the outcomes of the 1st Expert Group Meeting at the Global Landscapes Forum in Bonn, Germany, in December 2018.
- A second FLR Expert Group Meeting in Lüderenalp/Emmental, Switzerland, in June 2019 to review the first full draft and to propose outline and approaches for further review of the draft prepared by two consultants: Dr. Juergen Blaser (Switzerland) and Dr. Cesar Sabogal (Peru).
- Presentation of the outcomes of the 2nd Expert Group Meeting at the Global Landscapes Forum in Bonn, Germany, in June 2019.
- Finalization of the present draft by the consultants in October 2019 for presentation and review at the present Council session

Contents

FOREWORD

- Refers to the extent and issues relating to forests and landscape restoration
- Some overall contents introduction about past, current and restored landscapes including the notion that the restored, ecologically functional landscapes of the future will differ from today's landscapes
- Clarifies that these guidelines are not a revision of the ITTO 2002 Guidelines [that remain valid] but a broader guidelines based on 6 globally agreed principles on forest landscape restoration
- Signed by ITTO Director, [and other CPF member organisations/Global Partnership Forest Landscaper Restoration?]

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ACRONYMS AND ABBREVIATIONS

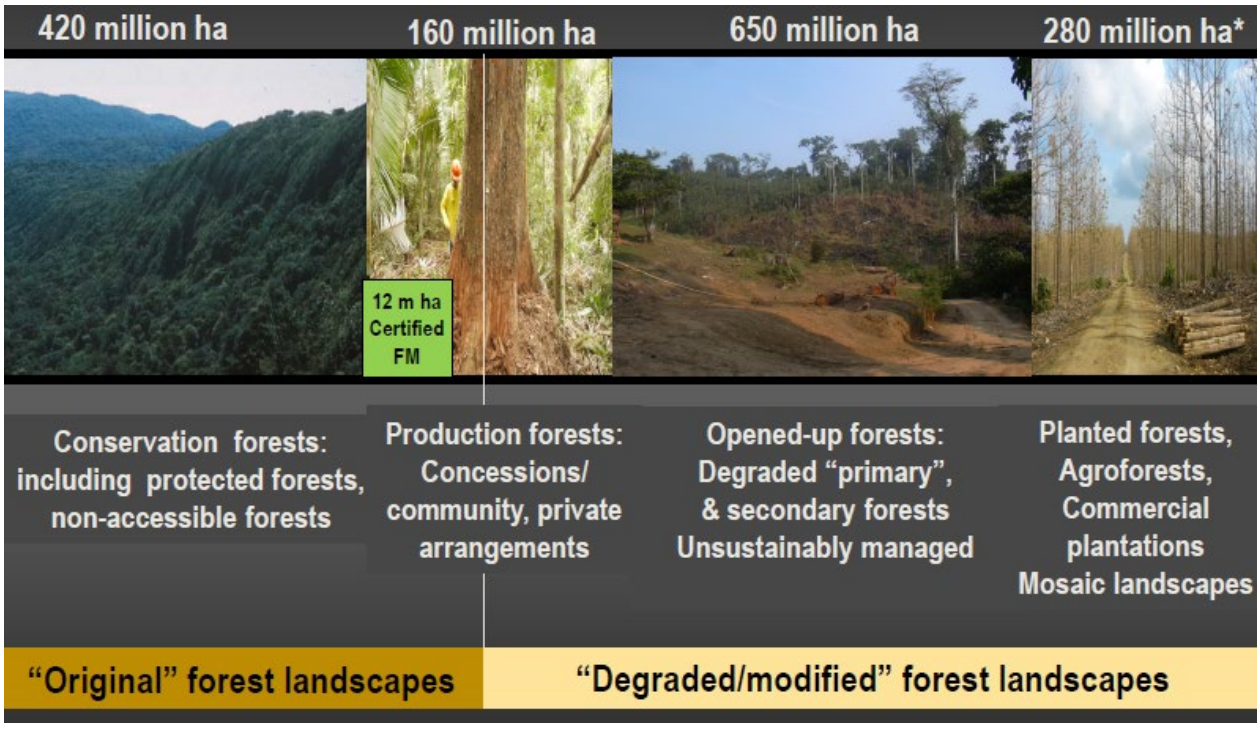
[Will be prepared for final version]

Context

Tropical forest landscapes worldwide are characterized by unprecedented change in the last three decades. Landscapes once largely covered with dense forests now feature vast areas of degraded forests and non-forest lands, and primary forests have dwindled and become fragmented. A generation ago, 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, including mining, and infrastructure. Environmental 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 semi-humid tropics globally by 2019. The total area is estimated at about 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" landscape comprising a mix of agricultural land, woodlots, agroforestry and silvopastoral systems. Thus, it is estimated that the area of degraded or otherwise modified landscapes in the humid and semi-humid tropics amount to about 930 million ha (i.e. the sum of opened-up forests and mosaic landscapes). These estimates are similar to those 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***



*Area estimates are by J. Blaser and C. Sabogal.

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 in 2005, encompassing landscape-scale approaches.

Since then, interest in the development of forest and landscape restoration (FLR) has grown enormously within the international forestry community. Today, FLR is one of the three most prominent international themes in global forestry.[1] New international initiatives and commitments relevant to FLR have emerged, such as 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 Goals of the United Nations Strategic Plan for Forests. FLR processes and concepts 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 UN 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, building on public demand for action on climate change, biodiversity loss and the resultant impacts on economies, livelihoods and human wellbeing.

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

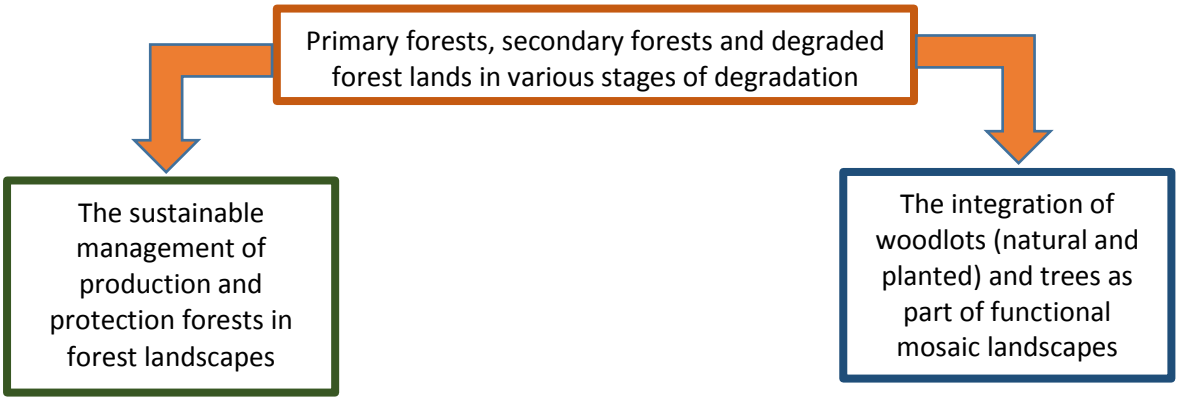
This publication builds on the six globally agreed FLR principles developed by the GPFLR in 2018. For each principle it identifies a number of guiding elements and recommended actions to undertake FLR at scale. The publication also includes a chapter on financing FLR and investments in FLR interventions, and it makes practical recommendations on the design of FLR programmes and projects. A set of FLR case studies is presented to further assist practitioners in the restoration of tropical forest landscapes.

The overall rationale for forest landscape restoration (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 objectives (Figure 2):

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

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

Figure 2 ***Two pathways for the restoration of tropical forest landscapes***



[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."

Overall, the aim of FLR is to restore ecological functions and associated goods and environmental services while improving social outcomes (Mansourian and 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 schematic pathways. Developed using the global principles agreed within the framework of the GPFLR, they provide guidance on the development and implementation of forest landscape restoration processes. The guidelines are linked fundamentally to the 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 Forest*s (published in 2015).

1 Background of the guidelines

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 on overview of the numerous 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. They were developed at a time 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 was 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 analysed 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 FLR guidelines and assessment tools for forest landscape restoration***

Guidelines	Year	Promoter	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 FLR. Several shortcomings from today's perspective, but this publication marked the starting point of today's broad FLR discussions
Rehabilitation and Restoration of Degraded Forests	2003	IUCN	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
International Standards for the Practice of Ecological Restoration	2016	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

Guidelines	Year	Promoter	Scope
Scaling Up Regreening: Six Steps to Success	2016	WRI	Global, landscape level, policy level. Description of six important steps for successful FLR
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
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
Forest Restoration Monitoring Tool (version 1, final version to be published in 2019)	2012	FAO	Global, forest and partly landscape level, planning, implement-tation, monitoring. Checklist for the assessment of initial situations, implementation, monitoring and result-checking
Restoring Tropical Forests: A Practical Guide	2013	RBG, Darwin Initiative	Tropical biome, forest level, implementation and application. Generic, comprehensive practitioners' 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
Restoration Opportunities Optimisation Tool (ROOT)	2016	University Stanford, 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 environmental services gains from FLR
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
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 also addressed
Case study collections			
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
Forest and Landscape	2019	Forestoration	Global, landscape level, case study. Planned but not yet

Guidelines	Year	Promoter	Scope
Restoration Case Study Bank and Atlas		Partners	implemented database for FLR case studies

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, LDSF, Restoration Diagnostics, Spotlight, and the FAO Forest Restoration Monitoring Tool—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 with any new guidelines to the greatest extent possible.

The following main learnings 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.

Definitions and technical context

Terms and definitions

A comprehensive glossary of terms used is presented at the end of this document. Here, we address three crucial clusters of terms: "forest"; "landscape" and "restoration"; and the unifying "forest landscape restoration". Because FLR includes a policy and implementation framework, "process", "programme" and "project" are also defined here.

The term **forest** refers here to an area covered with trees (i.e. a forested area) according to national definitions of forests. Such definitions generally involve a minimum tree crown cover (e.g. 20%), 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).

Generally, three types of forest can be distinguished (see Box 3 for more details):

- **natural forests**, which grow naturally on a site (generally from seeds);
- **semi-natural forests**, which are natural forests that have been enriched with planted tree species and are managed through guided natural regeneration; and
- **planted (or plantation) forests**, which have been established by planting or direct seedling. A tree-intensive agroforestry system that fulfils the forest definition can also be categorized as planted forest.

[3] Upstream processes relate to the conceptualization and planning of FLR, downstream to monitoring and evaluation.

Special types of planted forest are **multifunctional planted forests** and **close-to-nature planted forests**. Multifunctional planted forests pursue silvicultural approaches designed to restore degraded landscapes and ecosystems, sustain rural people's livelihoods and provide environmental 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).

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).

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 and 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 environmental 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. 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.[4]

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 environmental 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 forest**—natural climax forest in which the initial cover has been adversely affected by the unsustainable harvesting of timber or 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.

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 re-establishment of forest (i.e. secondary forest) or other land uses.

Planted forest

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.

Source: Modified from ITTO (2002).

[4] 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 Convention on Biological Diversity).

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 environmental 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 environmental services at a given site and maintains only limited biodiversity. It has lost the structure, function, species composition and productivity normally associated with the natural forest type expected at that site.

Most forest degradation is driven by unplanned or uncontrolled timber extraction and logging, woodfuel collection and charcoal production, and uncontrolled livestock grazing and fire (Hosonuma et al. 2012; Kissinger et al. 2012). Forest degradation is not a permanent stage 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 natural 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 ▪ Overgrazing; small-scale and long-rotation shifting cultivation	▪ The clearcutting, burning and subsequent abandonment of an area without conversion to long-term agricultural use ▪ Catastrophic large-scale natural disturbances (e.g. fire, flood, storm, landslide, drought)	▪ Repeated overuse, repeated fire, overgrazing, and ecological mismanagement on fragile soils ▪ Soil erosion ▪ 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	▪ 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	▪ 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

Status	Degraded natural forest	Secondary forest	Degraded forest land
	→ different stages →		
	cycle replacement regeneration, usually complemented by coppicing and seed banks ▪ Species composition changes with overexploitation of timber	process begins, with high rates of carbon assimilation and biomass aggregation	
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).

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) defines 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 and Jackson 2003).

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; it differs from an ecosystem approach in that it may include multiple ecosystems.

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 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 environmental 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" (Djenontin et al. 2018).

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 forestry 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 and Chavez-Tafur 2014).

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

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** (FLR; also forest and landscape restoration[5]) lacks a universal definition. Maginnis and Jackson (2002) defined it as "a process that aims to regain ecological integrity and enhance human well-being 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/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 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 processes and FLR interventions.

[5] 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.

An FLR process involves three key elements: participation, adaptive management and a consistent monitoring and learning framework. It is mostly implemented through FLR interventions. An FLR process 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 procedures (e.g. institutions, policies, legal prescriptions, governance and technical approaches) that help advance FLR. Thus, an FLR process 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. 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 a range of 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 are linked to large-scale financing frameworks such as the Forest Carbon Partnership Facility's Carbon Fund and the Green Climate 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 short- or mid-term and small or large. They can be top-down, bottom-up, or a mix of these encompassing multiple actors, collaborators and stakeholders; they can involve a single or multiple sites. FLR activities are time- and space-bound, are budgeted, and have clear deliverables.

SFM and FLR—how do they relate?

Sustainably managed natural forests can be sources of a diverse array of products, environmental 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 environmental 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 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 and 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 processes 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.

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, the restored forest 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, 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 very quickly, but FLR entails continuous effort over long periods. There are two main development pathways for degraded forests:

1) towards a more intensively used landscape in a mosaic that includes various land uses, potentially ranging from agroforestry to industrially managed natural or planted forests; and

2) towards a restored natural forest for protection or production purposes, including secondary forests, in which the provision of multiple environmental services (including biodiversity conservation) is the primary objective, at least in the early stages of restoration.

Industrially managed forest restoration 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 for private investors than the first. The suite of environmental services produced in such forests is typically larger 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 forest is limited, and few value chains for timber and NTFPs exist that generate marketable products early in the restoration process. One option would 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 FLR development pathways—that is, weighted 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 their expected costs and benefits—monetary and non-monetary—assessed. This will help identify likely trade-offs among competing interests during the FLR process. 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 increasing 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.

Communication and monitoring to attain commitment and public support

A lack of adequate data, knowledge and expertise on the ecological, socioeconomic, silvicultural and institutional dimensions of 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 the FLR process, and supporting 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 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.

Presenting the guidelines

Scope

These 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.[6] 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, 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 and actions for FLR.

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 options:

1) **Restoring degraded natural (production) 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

[6] The guidelines focus on forest lands; other land-use categories—cropland, grassland and settlement—are not addressed directly.

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 may include to sustainably increase the production of timber and non-timber forest products and improve the supply chains for these; 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 environmental services derived from secondary forests can diversify income through value-added processing and commercialization.

3) **Rehabilitating degraded forested or formerly forested land to improve productive and protective functions.** The rehabilitation of degraded lands set aside for protective functions (e.g. for biodiversity conservation and watershed protection), and their buffer zones, 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 environmental 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, uncontrolled 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 wish to preserve natural forests (although interpretations of the term "preserve" may vary), and others would like to clear the same forest to better exploit its soils or minerals. Between these two extremes is 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 and producer associations, as well as forest-dependent smallholders and rural and forest communities.
- **Private-sector organizations**, such as small, medium-sized and large forest companies and their umbrella organizations, and agricultural investment and trading groups.

- **Civil-society organizations**, such as environmental and development non-governmental organizations and advocacy groups.
- **Research and education institutions**—public and private forest research, education and training institutions and organizations.
- **ITTO consumer-country governments** and other developed and emerging economies, as well public and private international **funding and development agencies**.

Structure: principles, guiding elements and suggested actions

The guidelines comprise five main chapters, plus annexes.

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 an FLR process, and the guiding elements are the components that should be in place to ensure adherence to those principles.

Chapter 3 sets out FLR interventions as they flow from the guiding elements in Chapter 2, and it lists tools and other knowledge materials to assist in such interventions.

Chapter 4 introduces the idea of FLR scenarios and provides illustrative case studies for implementing FLR under certain broadly representative restoration scenarios. The scenarios are defined in terms of the desired outcomes according to the objectives set by local and other stakeholders, as well as by their specific drivers and pathways of degradation.

Chapter 5 provides recommendations on the use of the guidelines.

2 Principles and guiding elements for the restoration of tropical forest landscapes

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 agreed 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 provide the conceptual basis of the present FLR guidelines; together, they form a continuum defining the FLR process. The guiding elements herein further describe each principle and the conditions needed for successful FLR.

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 take into account the variety of existing interacting land uses and tenure and governance arrangements in the landscape and, to the greatest extent possible, 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. 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 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, ecological, economic and social conditions—is crucial for developing effective FLR processes. 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.[7] 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.

GE2: Gain recognition that FLR must transcend sector policies

Policies are needed to promote FLR approaches, 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 environmental services provided, and use the most appropriate methods for sustaining restoration. FLR policies need to be people-centred and applied cross-sectorally.

FLR processes 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 processes.

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

Policy instruments should have a solid 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 needs. Landscapes often transcend political boundaries (or 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.

GE4: Fully address tenure and access rights

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

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 with the aim of benefiting marginalized groups.

[7] 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.

Principle 2: Engage stakeholders and support participatory governance

Rationale

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

FLR actively engages stakeholders—including 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). 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 approaches and define the costs and benefits for each group of actors. Substantial time may be required to develop a common FLR vision and to achieve an agreed, equitable distribution of costs and benefits among stakeholders.

Guiding elements

GE5: Ensure adequate governance capacity for decentralized FLR processes

Decentralized control and decision-making can provide the enabling conditions for FLR processes, programmes and projects.

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, energy and mining) with potential to influence FLR processes.

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 meaningful participation of all actors, minimize power imbalances and achieve equitable outcomes.

Partnerships and strong working relations among communities, local and regional governmental organizations, non-governmental organizations and donor organizations are necessary for helping 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.

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

GE8: Ensure social equity and benefit sharing

All stakeholders should equitably share 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 should understand and support the process underlying it. Stakeholders should

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.

reach agreement on the equitable distribution of incentives, costs and benefits. Local people should be empowered to obtain fair and equitable benefits from FLR.

GE9: Ensure that FLR planning, decision-making and monitoring are fully participatory

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

As outlined in GE1, the entire array of stakeholders needs 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 processes 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 local 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 processes.

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: Secure adequate 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 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 the FLR process. The funding portfolio can be broadened to

GE12: Establish a favourable investment environment for FLR

Investments are needed to ensure the restoration and sustainable management of degraded forests and landscapes, and 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 options. To date, most forest environmental services are unpaid, with only a few payment mechanisms worldwide functioning effectively. Thus, creating the right conditions for investment and resource mobilization for FLR is key.

include payments for environmental services or to tap the potential of mechanisms such as biodiversity offsets and climate funding, including carbon markets and results-based payments for climate-change mitigation.	

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 non-timber forest products, 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 processes 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 particularly high in natural tropical forests and 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 strategies. Conflicts over use can be minimized by clearly defining the objectives of the restoration and legally designating forests for uses that generate the most appropriate economic and social benefits at a given site.

Guiding elements

GE13: Ensure multiple functions and benefits	GE14: Conserve biodiversity and restore ecological functions
At the landscape scale, generating multiple benefits from a variety of interventions is a fundamental aspect of FLR. FLR processes should find and use synergies between people-centred functions in landscapes and ecological goals to achieve sustainable restoration outcomes. New programmes have emerged that value	**Conserving biodiversity will help 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

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 mitigation and adaptation through REDD+.

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, including women.

Strategies may include developing forest and agricultural value chains, 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 the people 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 processes, programmes and projects.

FLR requires the engagement and mobilization of the social and human capital that exists in landscapes. By engaging broader approaches to FLR, including the integration of multiple knowledge systems, 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

FLR processes should aim 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 environmental services. FLR processes should not cause the loss or conversion of natural forests, natural grasslands or other natural habitats.

This FLR principle is directed at restoring and conserving natural ecosystems and habitats in degraded and deforested landscapes. A landscape approach should be adopted to determining trade-offs among land uses in human-dominated mosaics: for example, increasing production may be a focus on degraded agricultural and silvopastoral lands, and biodiversity conservation may predominate in areas with existing natural habitats—although at least some such areas may also be used productively.

The degradation of natural forests is commonly a result of unsustainable (and often overly destructive) timber and woodfuel harvesting, hunting and the patchy clearance and regrowth associated with shifting agriculture. 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 reduce ecological 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 with each cut, 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 non-timber forest products and the provision of environmental 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 processes. 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

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 rapid loss of primary forests worldwide and their importance for biodiversity conservation, carbon storage, the maintenance of cultural values and other reasons, 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. 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 processes and underlying causes of land-use change need to be understood and addressed as part of an overall FLR strategy. Because these causes usually involve socioeconomic factors, local needs and the value systems of local actors must be taken into account, including 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. The local and external pressures that have led to deforestation and forest degradation should be identified and their ongoing threat assessed.

GE18: Restore degraded forests and rehabilitate degraded forest land

Restore and sustainably manage degraded natural forests and degraded forest land, as appropriate.

Degraded natural forests are generally less biodiverse and have reduced capacity to supply goods and environmental services compared with healthy natural forests that would normally 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.

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

Because most tropical old-growth grasslands are dependent on recurring endogenous disturbances, FLR efforts must plan for the long-term maintenance of fire regimes or megafauna herbivory, or both, to prevent the encroachment of woody plants in such ecosystems.

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

Rationale

Invoking landscape history, this principle helps ensure that the planning and implementation of FLR responds to the needs of local people and ecosystems. Ideally, FLR uses a variety of restoration approaches adapted to local social, cultural, economic and ecological values and needs and which take the history of the landscape into account. The best way to ensure that an FLR process is well adapted to the local context 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.

GE22: Allow for future changes in conditions

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

Future change in, for example, economic policies, demographic factors, technologies and climate are likely to have strong impacts on FLR success. Thus, ongoing monitoring and evaluation is vital to enable adaptive approaches to FLR and sustainable landscape management.

GE23: Tailor approaches to the local context and ensure local benefits

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

The benefits of FLR are likely to change over time in

GE24: Ensure the financial and economic viability of FLR investments

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

FLR processes, programmes and projects can only be sustainable if they are economically and financially

both nature and extent, requiring ongoing exchanges and decision-making among stakeholders to ensure the equitable sharing of such benefits.

Approaches should be based on principles 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 a project that may affect them or their territories.

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 crops, fast-growing woodlots and payments for incipient environmental services, as well as longer-term benefits associated with the production of high-quality timber and the sustainable supply of environmental services.

In addition to ensuring 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 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. Market demand (and the prices paid) for the products and environmental services obtained from FLR will be a determining factor in the profitability of FLR-related 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 providing ongoing technical advice.

GE26: Develop sustainable supply chains

FLR processes and interventions should seek to 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 environmental services in forests and landscapes.

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, biosecurity, marginalized people, biodiversity and land use. FLR initiatives should encourage the development of sustainable supply chains to increase marketing potential and to help ensure fair remuneration at each link in the chain.

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 approaches may need to be adjusted over time to reflect changes in 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 and expectations. 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 processes must adopt a long-term perspective and anticipate, as far as possible, future change. They must be tailored to the local conditions prevailing at the time of commencement but be 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.

The potential of FLR to enable the adaptation of tropical landscapes to climate change receives less attention than its role in mitigation. 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

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

FLR processes 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 approaches 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.

GE28: Continually measure the biophysical dimensions of the landscape

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 adaption 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 depends in part on being able to contrast the site before and after initiating FLR processes and their corresponding programmes and projects.

GE29: Periodically assess vulnerability to climate change

Assess the vulnerability to climate change of ecosystems and social systems.

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.

GE30: Develop participatory monitoring approaches

Ensure participatory and user-friendly FLR monitoring as 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.

FLR can increase resilience to climate change and also help mitigate it. FLR processes should consider climate-change scenarios and favour climate-appropriate land-use options and species selection.

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.

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 an FLR process 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 producers, could be a powerful means for informing local people about the potential of FLR to improve their livelihoods and incomes.

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 both successes and failures as a means for increasing effectiveness in the future.

3 Implementation processes and operational guidance

Matching FLR processes with interventions

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 interventions (Figure XX).

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). In FLR, project-cycle management has four phases that progress toward greater specificity with flexible timing (Box 4). 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).

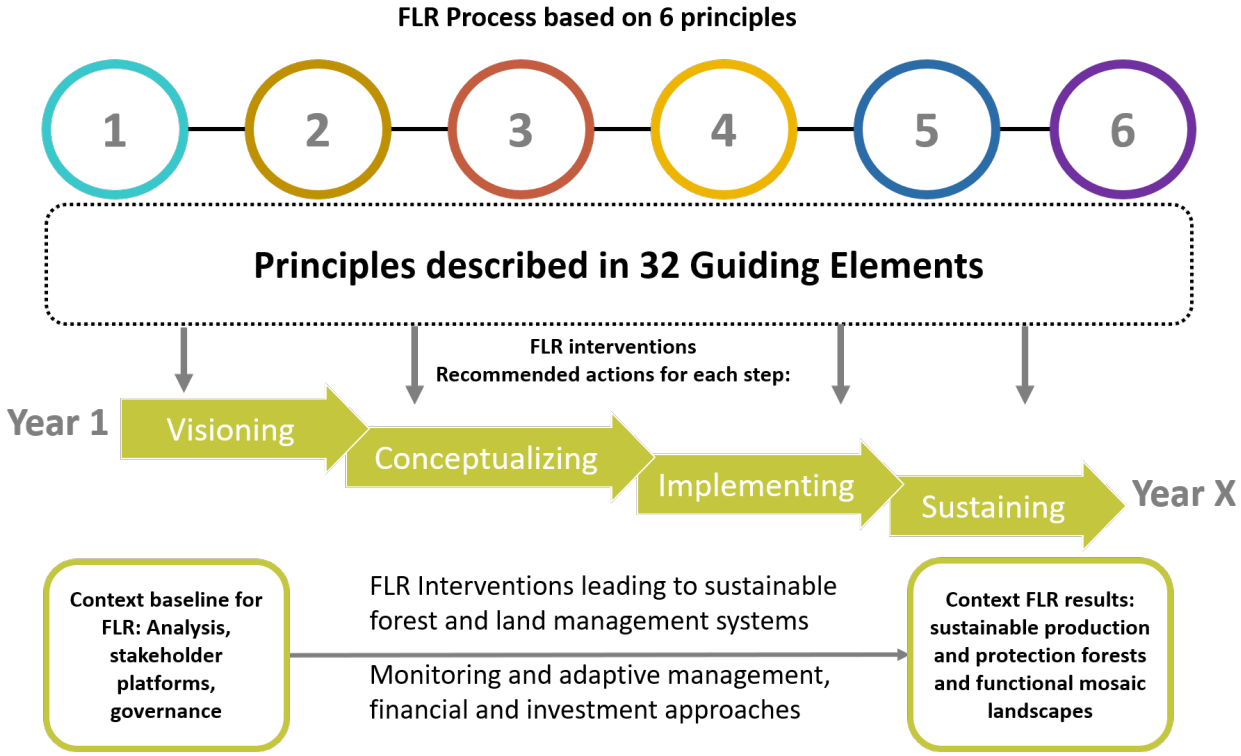
FLR interventions

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).

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, selecting 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 expenditures, 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 3 ***The four phases of FLR implementation***



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

Table 3 ***Hierarchical nature of project-cycle management, with 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 case study x)	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 non-governmental organizations • 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 considers the following four steps of FLR interventions (Figure 3):

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).

Table 4 sets out recommended actions for each of the 32 guiding elements under the six FLR principles.[8]

[8] See Annex 2 for an overview of FLR Intervention processes, including possible activities in the various phases.

Table 4 ***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 and 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 and Barrow 2008)			
	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) in: Restoring forest landscapes. An introduction to the art and science of forest landscape restoration (ITTO/IUCN 2005)			

GE2: Gain recognition that FLR must transcend sector policies	Identify and **analyze the current legal framework** relevant to FLR **Formulate rules and procedures** that enable consistent and effective planning for FLR processes	**Analyze the potential impacts of sectoral laws and policies** on FLR processes. Identify and address discrepancies between sectoral policies **Endorse the ecological and socioeconomic baseline through an adequate consultation process** and obtain agreement on it	**Develop appropriate intersectoral collaboration platforms** between governmental institutions to legitimize FLR processes **Promote actions to ensure that laws requiring FLR are broadly understood** by relevant actors and enforced in a visible, credible and fair manner	**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 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 2012)			
	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)			

<table>
<tr><td rowspan="4">GE3: Conduct FLR at an appropriate scale</td><td>Identify appropriate scales for landscape planning based on, for example, jurisdictional area or biophysical or socioeconomic zones, or in light of customary practices</td><td>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</td><td>Formalize integrated land-use plans at the jurisdictional level as a basis for implementing FLR commitments at the programme and project scales</td><td>Adapt land-use plans periodically, as needed, to changing contexts</td></tr>
<tr><td colspan="4">More information</td></tr>
<tr><td colspan="4">Understanding the landscape mosaic – Gilmour (2005a), in: Restoring forest landscapes. An introduction to the art and science of forest landscape restoration (ITTO/IUCN 2005)</td></tr>
<tr><td colspan="4">Discourses across Scales on Forest Landscape Restoration (Reinecke and Blum 2018)</td></tr>
<tr><td rowspan="4">GE4: Fully address tenure and access rights</td><td>Map the tenure situation, including all claims, at an early stage of designing an FLR process</td><td>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 account in the selection of restoration areas</td><td>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 commercial use of such products</td><td>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 provide security of tenure as a necessary condition for SFM and FLR</td></tr>
<tr><td colspan="4">More information</td></tr>
<tr><td colspan="4">IIED – FAO Improving governance of forest tenure: a practical guide (Mayer et al. 2013)</td></tr>
</table>

	The Sangha Guidelines for the landscape approach (IUCN/Ecoagriculture Partners 2008)
	Case Report Novel governance for forest landscape restoration in Fandriana-Marolambo, Madagascar (Mansourian et al. 2016)

Principles and guiding elements	**FLR INTERVENTIONS IN THE PROJECT MANAGEMENT CYCLE**			
	Visioning	***Conceptualization***	***Acting***	***Sustaining***
Principle 2: ENGAGE STAKEHOLDERS AND SUPPORT PARTICIPATORY GOVERNANCE				
GE5: Ensure adequate governance capacity for decentralized FLR processes	**Identify the appropriate authorities and institutions** 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 to the FLR process **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 processes
	More information			
	Governance and forest landscape restoration: A framework to support decision-making (Mansourian 2017)			
	The Politics of Decentralization: Forests, Power and People (Colfer and 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	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

		conflict and develop common approaches to deal with them		
	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), in ITTO/IUCN 2005			
	Fostering stakeholder commitment in Western Flores, Indonesia - Villages' organization in local conservation and development groups (CDGs) and the Mbeliling Community Forum (FPKM) (Widyanto et al. 2014)			
GE7: Conduct joint stakeholder analysis of the drivers of degradation	**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	Using participatory processes, **determine the underlying causes** of degradation pressures and the potential for addressing them	**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	**Adopt strategies and responsibilities** for the control of illegal activities, focusing on preventive actions
	More information			
	Community-based forest resource conflict management. A Training Package (FAO 2012). Case study "Supporting local mechanisms for conflict resolution in the Chiang Mai Highlands, Thailand" (V. Viriyasakultorn, p. 303)			
	FAO Restoration Guidelines for Drylands (2014)			
GE8: Ensure social equity and benefit sharing	**Create and communicate opportunities for the economic empowerment** of all local stakeholders	**Develop benefit-sharing plans** through a participatory process	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	**Monitor the distribution of the costs and benefits** of forest management among stakeholders

			on the sharing of costs and benefits	
	More information			
	Forest Restoration in Shinyanga, Tanzania / Sources: Fisher et al. 2005, Barrow 2014, Duguma et al. 2015			
	The Sangha Guidelines for the landscape approach (IUCN/Ecoagriculture Partners 2008)			
GE9: Ensure that FLR planning, decision-making and monitoring are fully participatory	**Build consensus among stakeholders on criteria and indicators** for the monitoring and evaluation of FLR **Build up the elements that allow community-based monitoring** of FLR processes, programmes and projects		**Implement the monitoring and evaluation system** (data collection, analysis, reporting and communication) to enable adaptive management in the participatory process	**Revise management strategies periodically** and adapt management procedures as necessary
	More information			
	A diagnostic for collaborative monitoring in forest landscape restoration (Evans and Guariguata 2019)			
	The Sangha Guidelines for the landscape approach (IUCN/Ecoagriculture Partners 2008)			
	LUD Initiative from The Forest Dialogue https://theforestsdialogue.org/initiative/land-use-dialogue-lud			
	Landscape restoration in Hojancha, Costa Rica (Salazar et al. 2005, 2007)			
GE10: Build stakeholder capacity for sharing responsibility for FLR	**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		**Provide training** and capacity building for all stakeholders in the basic skills required to restore and sustainably manage forests for goods and environmental 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	**Assess capacity building activities** and incorporate the results in the management cycle

	More information			
	Implementing Forest Landscape Restoration. A Practitioners' Guide – IUFRO (Stanturf et al 2017)			
	The Sangha Guidelines for the landscape approach (IUCN/Ecoagriculture Partners 2008)			
	The Landscape Academy (https://academy.globallandscapesforum.org/) organizes regular courses on Landscape Leadership, Landscape Governance, Landscape Finance			
	The Environmental Leadership Training Initiative (ELTI) of Yale School of Forestry & Environmental Studies: the "Tropical forest landscapes: conservation, restoration & sustainable use" course (https://elti.yale.edu/)			
	Restoration training programs in http://www.bonnchallenge.org/content/training-program-2			
GE11: Secure adequate financing for FLR initiatives	**Develop an FLR financing strategy** for each of the four FLR phases	**Formulate FLR interventions** in accordance with the **procedures of agencies that provide financial incentives for FLR**	**Analyze the potential for, and develop schemes that allow payments for environmental services** at the landscape scale, such as those related to carbon, water, biodiversity and tourism	Consider domestic and international **private finance or blended public–private finance** for sustaining the FLR intervention
	More information			
	Sustainable financing for forest and landscape restoration (FAO-UNCCD 2015)			
	Towards effective national forest funds (FAO 2015a			
	Generic guide and modular training package to assist countries in developing national forest financing strategies			
	Integrating diverse social and ecological motivations to achieve landscape restoration (Jellinek et al. 2018)			
	The economics of ecosystems and biodiversity (TEEB 2009)			
	Payments for Environmental Services in Latin America as a Tool for Restoration and Rural Development (Montagnini and Finney 2011)			
GE12: Establish a favourable investment environment for FLR	**List potential FLR investors** in a given landscape based on existing knowledge at national level	**Provide enabling conditions** (e.g. legal, policy, institutional, fiscal and tenurial) **to attract investments** in FLR (including ensuring easy access to information)	**Assess potential investor needs and concerns** regarding the investment environment **Promote simple, inexpensive technologies** that directly address investors' needs	**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)
	More information			
	Sustainable financing for forest and landscape restoration: Opportunities, challenges and the way forward. FAO/UNCCD. 2015b			
	Global guidelines for the restoration of degraded forests and landscapes in drylands: building resilience and benefiting livelihoods (FAO 2014))			
	Coalition for Private Investment in Conservation' Blueprints: http://cpicfinance.com/blueprints/			

Principles and guiding elements	FLR INTERVENTIONS IN THE PROJECT MANAGEMENT CYCLE			
	Visioning	***Conceptualizing***	***Acting***	***Sustaining***
Principle 3: RESTORE MULTIPLE FUNCTIONS FOR MULTIPLE BENEFITS				
GE13: Ensure multiple functions and benefits	**List known and readily available forest products, based on local knowledge**	**Assess environmental services and trade-offs for different land uses** in the landscape **Evaluate prospects for the multiple use of forest products** and, potentially**, payments for environmental services**, as a strategy for creating multiple benefits	**Develop a comprehensive knowledge of forest and tree resources** with the aim of boosting the value of forest goods and environmental services, and uphold usufruct rights	**Provide incentives for farmers to diversify their agricultural production systems** with a variety of 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 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	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)			
	Biodiversity in forest landscape restoration assessment planning (in Beatty et al 2018)			
	Forest and water on a changing planet: Vulnerability, adaptation and governance opportunities. A global assessment report - IUFRO (Creed and Nordwijk 2018)			
GE15: Improve livelihoods	Using participatory processes, **determine and prioritize options for improving livelihoods** through FLR	**Plan targeted participatory assessment and monitoring** of the socioeconomic situations of households and communities before,	**Consider incentive mechanisms, capacity building and institutional development** (including producer associations) **to encourage the**	**Set rules to allow the continued use of traditional forest and tree products**, including regulations to ensure sustainable harvesting

		during and after FLR interventions to evaluate the effectiveness of livelihoods 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	**development of value-added marketable products** based on FLR outcomes **Develop viable business plans** for FLR-related economic activities.	Implement the **participatory monitoring** of the socioeconomic situations of households and communities
	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 livelihood, well-being, and resilience through FLR / Source: Forest landscape restoration for livelihoods and well-being (Erbaugh and Oldekop 2018)			
	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 processes that include local knowledge** relating to the use of non-timber forest products and bushmeat	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 forest landscape	Make adequate provision in FLR processes 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,b)			

Principles and guiding elements	FLR INTERVENTIONS IN THE PROJECT MANAGEMENT CYCLE			
	Visioning	*Conceptualizing*	*Acting*	*Sustaining*
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**		**In a participatory** process, define **the permanent forest estate** (for protection and production functions) in a jurisdictional area and demarcate its boundaries **Create incentives for stabilizing land use by local stakeholders in agricultural frontiers** in the vicinity of the designated PFE (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)			
	Examples of actions that could be taken to address deforestation drivers, see FAO-SFM Toolbox module “Reducing Deforestation” in: http://www.fao.org/sustainable-forest-management/toolbox/modules/reducing-deforestation/basic-knowledge/en/			
	Examples of strategies and actions to prevent and halt forest degradation, see FAO-SFM Toolbox, module “Reducing Forest Degradation” in http://www.fao.org/sustainable-forest-management/toolbox/modules/reducing-forest-degradation/basic-knowledge/en/			
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	**Using a participatory process**, define the **objectives** of the FLR intervention **Determine FLR approaches and techniques** suited to achieving agreed objectives **Screen and select the most appropriate tree species**, based on ecological, market and	**Develop an FLR plan through a participatory process** **Address former and current pressures or drivers of forest and land degradation** and their consequences and impacts, including, where appropriate, through	Where legally feasible, **encourage economic activities** such as intercropping to increase the economic viability of FLR interventions, especially early in the restoration process

	environmental services, the risks associated with climate change, livelihood needs, and market opportunities	socioeconomic criteria Where appropriate, **carry out cost–benefit analyses** of promising FLR interventions, as determined with the participation of stakeholders	government concession agreements and agreements with local people on forest use	
	More information			
	Technical 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: building resilience and benefiting livelihoods – FAO (2014)			
	A guide to the Restoration Opportunities Assessment Methodology (ROAM): Assessing forest landscape restoration opportunities at the national or sub-national level (IUCN and WRI 2014)			
	International standards for the practice of ecological restoration – including principles and key concepts (McDonald et al. 2016)			
	Implementing Forest Landscape Restoration. A Practitioners' Guide – IUFRO (Stanturf et al 2017)			
	Case: Rainforest Restoration: A Guide to Principles and Practice (Mudappa and 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		Where possible, **create corridors** between fragmented forest stands for wildlife and tree seed dispersal 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** undertaken
	More information			
	Guidelines for the conservation and sustainable use of biodiversity in tropical timber production forests (ITTO/IUCN 2009)			
	Restoring Tropical Forests. A Practical Guide – Forest Fragmentation, 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 a participatory process, **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	Undertake, through **cross-sectoral collaboration**, 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: https://www.wetlands.org/?s=restoration			

Principles and guiding elements	**FLR INTERVENTIONS IN THE PROJECT MANAGEMENT CYCLE**			
	Visioning	***Conceptualizing***	***Acting***	***Sustaining***
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		**Analyse potential opportunities and restrictions** for implementing FLR, given the local context Through participatory process, **determine the types and aims of FLR interventions** on specific sites	**Locally adapt,** as needed, to the changing context, 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 Practitioners' Guide (Stanturf et al. 2017)			
GE22: Allow for future changes in conditions	**Conduct a general assessment of the national climate risk** in the country as it relates to land use, land-use change and forestry	**Analyze current conditions and projected sociocultural, political and climate-related trends** and assess the associated opportunities and	**Monitor trends and assess associated risks and potential opportunities** **Introduce and apply emerging technologies** such as open-access remote sensing, geographic information systems and models, digital	**Diversify land uses, biota and livelihoods** to reduce risk and increase landscape resilience **Provide incentives for climate-smart technologies** in

		risks **Review selected FLR approaches for their adaptability to future landscape-scale trends**	elevation models and software that facilitates the detection of landscape-scale patterns	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 approaches to the local context and ensure local benefits	**Define a set of FLR interventions suitable to the local context and develop a landscape vision** acceptable to all stakeholders	**Review selected approaches for their adaptability to future trends** in the local context **Assess locally important environmental services**, including regulating and cultural services, and ensure their continued supply through FLR within a landscape	**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 and mosaic landscapes	**Fully involve local stakeholders** in FLR design, implementation and evaluation, and take into account the landscape history and people's expectations
	More information			
	Decision support tools for forest landscape restoration (Chazdon and Guariguata, 2018)			
	A tool for planning community-based tree and forest product enterprises: Market Analysis & Dev. - MA&D (FAO 2011)			
	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), in: Restoring forest landscapes (ITTO/IUCN 2005			
GE24: Ensure 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 environmental services At the programme and project levels, conduct **economic analyses of pilot FLR initiatives** to	**Determine how to gain added value for the goods and environmental services generated by FLR interventions,** such as through ecotourism, reducing waste and improving product quality

			help guide policy formulation in the use of incentives	
	More information			
	FAO – CBD project: Cost/Benefit analysis for FLR investments			
	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 non-timber forest products **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 environmental 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 and Oldekop 2018)			
GE26: Develop sustainable supply chains	**Identify the potential to develop green supply chains** for products produced in restored forest landscapes	**Build on existing sustainable supply-chain initiatives**, such as those associated with certification and timber legality, with the aim of making similar processes more accessible to local and indigenous communities and smallholder farmers **Develop public–**	**Develop instruments to support financial returns for sustainable forest land-use options**, including mechanisms to provide payments for environmental services in restored landscapes **Create enabling conditions**,	**Scope out potential marketing opportunities and value chains** for tree species that are abundant in the landscape but relatively unknown in the market

		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	including incentives, access to finance and fair taxes, and simplified regulations, to develop sustainable supply chains for promising products from restored forests and agroforestry	
	More information			
	The buzz on green supply chains – TFU (2018)			
	Is community forestry open for business (Greijmans and Gritten, 2015) World Forestry Congress Durban			

Principles and guiding elements	**FLR INTERVENTIONS IN THE PROJECT MANAGEMENT CYCLE**			
	Visioning	***Conceptualizing***	***Acting***	***Sustaining***
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 the** FLR intervention and adapt it 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)		
	Technical 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 Practitioners' Guide – IUFRO (Stanturf et al 2017)		
	Co-creating Conceptual and Working Forest and Landscape Restoration Frameworks Based on Core Principles (Gutierrez et al. 2018)		
GE28: Continually measure the biophysical dimensions of the landscape	**Determine the specific physical and environmental risk and stress factors** with the potential to affect FLR Interventions	**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	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
	More information		
	Climate change guidelines for forest managers (FAO 2013)		
	Synergies between Climate Mitigation and Adaptation in Forest Landscape Restoration (Rizvi et al. 2015)		
GE29: Periodically assess vulnerability to climate change	Assess FLR approaches according to their ability to **increase the long-term adaptive capacity of stakeholders** **Encourage research to improve and apply ecological knowledge** aimed at maintaining ecological processes such as pollination, seed dispersal and nutrient cycling	**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	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
	More information		
	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)		
GE30: Develop participatory monitoring approaches		**Develop and implement a comprehensive set of process indicators and monitoring protocols** that	**Monitor institutional arrangements** for landscape governance, including laws and customs, regulations,

			cover: ▪ the livelihoods of communities, disaggregated by social group; ▪ biodiversity values and ecological functions; and ▪ the productivity of agricultural and natural resource systems	and norms of behaviour Use FLR approaches that enhance ecosystem resilience and the adaptive capacity of local stakeholders
	More information			
	Applying an adaptive management approach in FLR – Gilmour (2005b), in: ITTO/IUCN (2005)			
	Measuring the effectiveness of landscape approaches to conservation and development (Sayer et al. 2016)			
	Monitoring Forest Landscape Restoration Projects (Stanturf et al. 2017)			
	Success from the ground up: Participatory monitoring and forest restoration (Evans and Guariguata 2016)			
	A Guide to identifying priorities and indicators for restoration monitoring -WRI/FAO (Buckingham et al. 2019)			
GE31: Encourage open access to, and the sharing of, information and knowledge	**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, and international levels	**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	**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, the medium and the target group	
	More information			
	IUFRO practitioner' s guide – implementing forest landscape restoration (Stanturf et al, 2017, p 94-109)			
	Measuring the effectiveness of landscape approaches to conservation and development (Sayer et al. 2016)			
	Mansourian and Vallauri (2014): Restoring forest landscapes: important lessons learnt (see ref. list)			
	IUCN ArborVitaeSpecial (2008): Learning from Landscapes: https://www.iucn.org/downloads/a_avspecial_learning_from_landscapes_1.pdf			
	FAO's Forest and Landscape Restoration Mechanism (FLRM) – Knowledge Base: http://www.fao.org/in-action/forest-landscape-restoration-mechanism/knowledge-base/en/			
GE32: Report on FLR outcomes	**Develop a social monitoring and evaluation plan** in the early stages of an FLR process, including indicators for measuring progress		**Monitor households and communities before, during and after the implementation** of	**Ensure the continuation of monitoring over time on aspects such as** carbon stocks, biodiversity,

		an FLR intervention to generate data on changes in livelihoods, wellbeing and resilience due to FLR	environmental services, and the livelihoods of local stakeholders **Communicate monitoring findings** to national and international FLR networks, including the FLR Barometer
	More information		
	IUFRO practitioner' s guide – Implementing forest landscape restoration (Stanturf et al, 2017, p. 64-74)		
	IUCN overall monitoring framework		
	Criteria and communication in the IUCN Bonn Challenge Barometer of Progress measures restoration efforts https://infoflr.org/bonn-challenge/bonn-challenge-barometer		
	The Forest and Landscape Restoration Mechanism (FLRM) Monitoring website		
	Monitoring and evaluating site-level impacts – Gasana, J (2005), in (ITTO/IUCN 2005)		
	Participatory planning, monitoring and evaluation of multi-stakeholder platforms in integrated landscape initiatives (Salvemini and Remple 2014)		
	Indicators for improved forest ecosystem function, livelihood and resilience – Erbaugh/Oldekop 2018)		

4 Case studies on 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)

This chapter presents 17 case studies of FLR processes 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 approaches given local biophysical, socioeconomic and governance contexts, stakeholder objectives and available resources.

Case studies were sought to highlight one of the following six common options (conforming with the four options described on page XX) for restoring degraded tropical forest landscapes:

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

The cases studies were described using a standard template covering a number of relevant characteristics (Box 4).

BOX 4 ***Template for describing case study of tropical FLR***

1. Proponent	7. Target main objective	13. Innovative aspects
2. Country of implementation	8. Target group or users	14. Outcomes
3. Location	9. Partners and collaborators	15. Conditions (institutional, economic, social, cultural, environmental) for successful replication in a similar context
4. Implementation period	10. Context (initial situation) and challenge (problem) being addressed	16. Main challenges faced 17. Key messages and lessons learned
5. Restoration option	11. Process and methodological approach, techniques and tools used	18. Sources describing the case 19. Contributors
6. Focus of the case	12. Field-level practices implemented	20. Photos

Of the 17 selected case studies, three are from tropical Africa (Ethiopia, Ghana and Madagascar), six are from tropical Asia (Cambodia, Indonesia, Myanmar, the Philippines and Thailand) and eight are from Latin America (Brazil, Colombia, Ecuador, Guatemala and Peru).

Table 5 ***Selected case studies of FLR in the tropics***

CASE STUDY	COUNTRY	RESTORATION OPTIONS					
		Restoration of degraded forests for production	Restoration of degraded forests for protection	Rehabilitation of degraded forest land through plantation	Rehabilitation of degraded forest land through agroforestry or silvopastoral systems	Restoration and management of secondary forests	Restoration or rehabilitation of mangroves
		I	II	III	IV	V	VI
1. Restoration of overlogged forests with intensive silviculture	Indonesia	✔					
2. Rehabilitation of degraded forests by local communities	Ghana	✔					
3. Facilitation of biodiversity by shelter effects of *Pinus patula* and *Alnus acuminata* in montane ecosystems of South Ecuador	Ecuador	✔	✔	✔			
4. Assisted natural regeneration for watershed restoration	Philippines		✔				
5. Early example of FLR in northern Thailand	Thailand		✔				
6. Restoration of degraded tropical forests: A performance-based payment approach	Ethiopia	✔	✔	✔			
7. Achieving Prey Lang landscape restoration through community forestry approaches	Cambodia		✔			✔	
8. Restoring cloud forest on private and communal land in the Ecuadorian Andes	Ecuador		✔			✔	
9. *Matas Legais* project	Brazil		✔	✔		✔	
10. Land Use Dialogue planning sustainable landscapes in the Atlantic rain forest	Brazil	✔	✔	✔	✔	✔	
11. Private restoration of degraded forest land with native tree species in the Peruvian Amazon	Peru			✔		✔	
12. From *Eucalyptus* monocultures to high diversity mixed forests: bringing together wood production and tropical	Brazil			✔			

CASE STUDY	COUNTRY	RESTORATION OPTIONS					
		Restoration of degraded forests for production	Restoration of degraded forests for protection	Rehabilitation of degraded forest land through plantation	Rehabilitation of degraded forest land through agroforestry or silvopastoral systems	Restoration and management of secondary forests	Restoration or rehabilitation of mangroves
		I	II	III	IV	V	VI
forest restoration							
13. Strengthening cocoa value chain for upscaling FLR through agroforestry	Guatemala				✔		
14. Productive rehabilitation of tropical cattle ranching lands – the Colombian Sustainable Cattle Ranching Project	Colombia				✔		
15. Restoration of mangrove ecosystems through community forestry	Myanmar						✔
16. Empowering local communities for restoration of a coastal landscape in Ayeyarwaddy	Myanmar						✔
17. Restoration and community management of mangroves in the western coast of Madagascar	Madagascar						✔

Note: Dark green indicates the main restoration option.

Table 6 ***Case studies of tropical FLR illustrating the practice of FLR principles (P) and guidelines (G)***

(Marks in dark green means the case study has a strong contribution to the guiding element)

PRINCIPLE	GUIDING ELEMENTS	CASE STUDIES																
		Indonesia	Ghana	Ecuador-1	Philippines	Thailand	Ethiopia	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**
1 Focus on landscapes	1: Undertake inclusive, gender-responsive landscape-level assessment and land-use planning							X		X	**X**				X		**X**	X
	2: Gain recognition that FLR must transcend sector policies										**X**			X	**X**	**X**	X	X
	3: Conduct FLR at an appropriate scale	X										X			**X**			
	4: Fully address tenure and access rights						X	X								**X**	**X**	
2 Engage stakeholders and support participatory governance	5: Ensure adequate governance capacity for decentralized FLR processes							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**	
	8: Ensure social equity and benefit sharing							**X**			**X**							
	9: Ensure that FLR planning, decision-making and monitoring are fully participatory		**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: Secure 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**				

3 Restore multiple functions for multiple benefits	13: Ensure 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**	**X**
	16: Make full use of locally based knowledge		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**			
	20: Conserve natural grasslands, savanna and wetlands														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					
	23: Tailor approaches to the local context and ensure local benefits		**X**		X		X	**X**		X	**X**	X				**X**	**X**	**X**
	24: Ensure 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**	**X**
	26: Develop sustainable supply chains	X						X		**X**		X		**X**				
6 Manage adaptively for long-term resilience	27: Take an adaptive management approach										**X**		X			X		
	28: Continually measure the biophysical dimensions of the landscape	X		**X**	X	X				X		X	**X**			**X**		X
	29: Periodically assess vulnerability to climate change																X	
	30: Develop participatory monitoring approaches				X		**X**	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
	32: Report on FLR outcomes	X	**X**	**X**	X	**X**	**X**					X	**X**					

Case studies

Sustaining timber yields in dipterocarp forests through Indonesia selective logging and strip planting (TPTI/SILIN) technique	
1. Proponent	Sari Bumi Kusuma logging concession Ministry of Environment and Forestry of Republic of Indonesia
2. Country of implementation	Indonesia
3. Location	Sari Bumi Kusuma logging concession, Central Kalimantan Province, Indonesia (lowland dipterocarp forest)
4. Implementation period	1999 – present
5. Restoration option	Restoration of degraded forests for production ✓ Restoration of degraded forests for protection ☐ (Ecological restoration of protective functions, e.g. soil, water, biodiversity) Rehabilitation of degraded forest land through planted forests ☐ Rehabilitation of degraded forest land through agroforestry and/or silvopastoral systems ☐ Management of secondary forests Restoration or rehabilitation of mangroves ☐
6. Focus of the case	Process ☐ Planning ☐ Assessment / Monitoring ✓ Intervention level ✓
7. Target/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.
8. Target group or users	Forest managers, government's decision-makers, impact investors and local people.
9. Partners & collaborators	Faculty of Forestry, Tanjungpura University, West Kalimantan
10. Context (initial situation) and challenge (problem) addressed	Under the currently allowable logging intensities and cutting cycle of 30 years, timber yields are not sustained in selectively logged dipterocarp forests in Indonesia. Timber harvest volumes decrease from more than 60 m^3/ha when primary forests are harvested to only 32-40 m^3/ha from second harvests, with only 19 m^3/ha expected from the third harvest. Yields of <30 m^3/ha are not financially remunerative, and forests without valuable timber are prone to conversion to more lucrative land uses. To sustain timber yields, Indonesia strip planting technique (TPTJ/SILIN) was piloted in two logging concessions in 1999. This case study is from one of these logging concessions. TPTJ is 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 with 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/ha) after 40 years. Carbon stocks recover to primary forests levels in just 35 years.
11. Process, methodological approach, techniques	– 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

and tools used	improvement, and species selection were integral to the success of this intervention. – Intensive tending of the seedlings for the first years after planting. – Planting on fairly level terrain where access for planting and tending crews is easy.
12. 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 Local people as a contractor are responsible for site preparation, planting and tending, while the rest of activities are the responsibility of the concession's employees.
13. Innovative aspects	– Planting native commercial fast-growing species at industrial scales (i.e., 4,000 ha/year) – Maintaining natural forest cover between planted strips – Applied only on level terrain with easy access from maintained logging roads so the planting and monitoring costs could be minimized. – Employing local people as workers or planting contractors
14. Outcomes	– Line planted area of 49,000 ha in the Sari Bumi Kusuma logging concession – More than 2,000 employment of workers from local communities for planting of 4,000 ha per year – Commercial timber growth of 5 m^3/ha/year in TPTJ area compared to only 1 m^3/ha/year in selective logging only (TPTI) area. – Scientific publications and training for local researchers and forest workers (the concession has SOPs for each of the TPTJ activities, as the concession has been FSF certified)
15. Conditions (institutional, economic, social, cultural, environmental) for successful replication in a similar context	– The TPTI/SILIN technique should be implemented only on reasonably level terrain in areas 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 was about US $ 429/ha and net present value was US $ 628/ha for the timber only revenue and US $ 1056/ha for the timber and carbon payment revenues, at the cutting cycle of 25 years as specified by government and a discount rate of 6%/year – Government support, including incentives such as reducing timber royalty
16. 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 regulation that the planted trees will be owned by the concession and there is a guarantee from the government that the concession license will be extended allowing for the concession to harvest the planted trees. – No harvesting method has been defined to minimize the impacts of future harvests of large volumes
17. Key messages and lessons learned	– Silvicultural knowledge about the planted species is critical – Dedicated and well-trained concession staff is paramount to make sure all procedures are implemented properly and innovatively – Strong commitment from concession owners, including financial support, is required – Government support, including incentives, are needed for its wider adoption – Local community members should be employed
18. Source(s) describing	Ruslandi, W.P. Cropper, F.E. Putz. 2017a. Effects of silvicultural intensification on timber

the case	yields, carbon dynamics, and tree species composition in a dipterocarp forest in Kalimantan, Indonesia: An individual-tree-based model simulation. For. Ecol. Manage. 390. doi:10.1016/j.foreco.2017.01.019 Ruslandi, C. Romero, F.E. Putz. 2017b. Financial viability and carbon payment potential of large-scale silvicultural intensification in logged dipterocarp forests in Indonesia. For. Policy Econ. 85. doi:10.1016/j.forpol.2017.09.005
19. Contributors	Ruslandi (Yayasan Konservasi Alam Nusantara , an affiliate of The Nature Conservancy, Jakarta Indonesia) and Francis E Putz (Department of Biology, University of Florida)

20. Photos

Figure 2. Site preparation for strip planting at SBK concession with annual targets of 3,000 – 4,000 ha. @Ruslandi

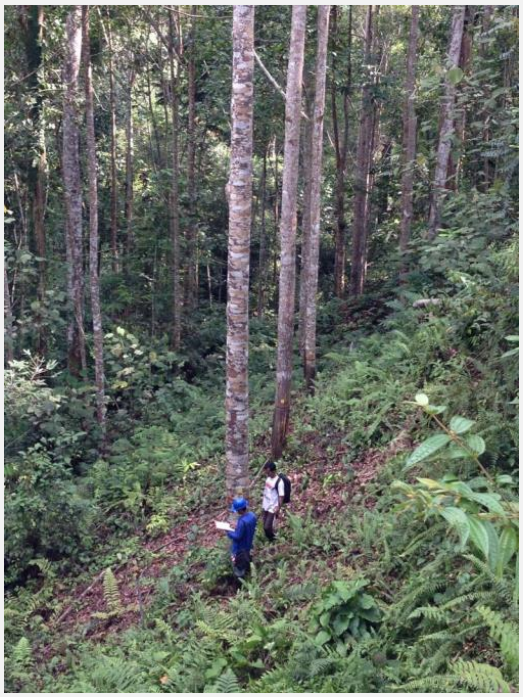


Figure 4. A 16 year-old plantation in SILIN/TPTI area of SBK concession @ SBK concession

Rehabilitation of degraded forests by local communities in Ghana	
1. Proponent	ITTO (International Tropical Timber Organization) CSIR-FORIG (Forestry Research Institute of Ghana)
2. Country of implementation	Ghana
3. 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)
4. Implementation period	2012 – 2017
5. Restoration option	Restoration of degraded forests for production ✓ Restoration of degraded forests for protection ☐ (Ecological restoration of protective functions, e.g. soil, water, biodiversity) Rehabilitation of degraded forest land through planted forests ☐ Rehabilitation of degraded forest land through agroforestry and/or silvopastoral systems ☐ Management of secondary forests ☐ Restoration or rehabilitation of mangroves ☐
6. Focus of the case	Process ☐ Planning ☐ Assessment / Monitoring ✓ Intervention level ☐
7. Target/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 livelihood.
8. Target group or users	Local communities living in and around the reserved forest areas in three districts
9. Partners & collaborators	Local communities, FSD (Forest Service Division of the Forestry Commission), traditional authorities and district assemblies
10. Context (initial situation) and challenge (problem) addressed	The over-exploitation of forest resources, agricultural expansion into forest areas, wildfires and mining activities have significantly reduced the forest cover and degraded most of the reserved forest areas in Ghana. This negatively affects biodiversity, soils and finally agricultural productivity. After an initial focus on the rehabilitation of degraded reserved forest areas through community plantation and agroforestry establishment, it became clear that long-term success depends on the elaboration of a sustainable management and monitoring system including capacity building and governance aspects.
11. 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. Furthermore, capacity building on plantation management techniques, timber and carbon valuation, monitoring and governance were central aspects of the approach.
12. Field-level practices implemented	– Seed propagation and nursery establishment – Establishment of tree plantations with various indigenous (*Albizia adianthifolia, Altsonia boonei, Ceiba pentandra, Ficus exasperate, Milicia excelsa, Sterculia tragacantha, Terminalia* spp., …) and one exotic tree species (*Cedrela odorata*) – Enrichment planting of five NTFPs in the plantations – Methodology for communities to calculate timber financial values – Estimation of carbon stocks and CO^2-reduction through restoration

	– Plantation registration and development of management plans
13. Innovative aspects	– Planting distance: The project used wider planting distances than suggested by the Forestry Commission for the Taungya system, as farmers preferred 8m x 3m or 6m x 6m to have more light for growing crops. – Registration: Project supported farmers to register established plantations to get a share of benefits at the time of harvest. – NTFPs: The inclusion of NTFPs in the Taungya system has not been done before in Ghana.
14. Outcomes	– 225 ha of plantation with 48 tree species established in 4 years → the increased forest cover contributes to water supply and carbon sequestration – Over 180 farmers have registered their plantation plots with the government – 5 species of NTFPs integrated in established plantations in one project site – Several technical reports and publications which support researchers and practitioners in community-based degraded forest restoration
15. Conditions (institutional, economic, social, cultural, environmental) for successful replication in a similar context	– Local institutional arrangements need to be in place 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 fire breaks around established plantations to prevent wildfires
16. Main challenges faced	– Restricted tree tenure and complicated plantation registration procedure – Continued wildfires, unsustainable farming practices and illegal logging – Conflicts with nomadic livestock herders
17. Key messages and lessons learned	– Strong commitment from forest resources managers (communities) needed – Opportunity costs for not converting degraded forest areas into agricultural lands need to be accounted for, e.g. through PES, carbon credits, or alternative livelihoods
18. Source(s) describing the case	ITTO - FORIG, 2017. Management of forests established through rehabilitation of degraded forests by local communities in Ghana. Completion report (PD 530/08 Rev.3 (F)). Kumasi, Ghana
19. Contributors:	Mélanie Feurer (Bern University of Applied Sciences, Switzerland) and Lawrence Damnyag (CSIR-Forestry Research Institute, Ghana)
20. Photos	

Figure 1 Section of ITTO Rehabilitation project community plantation with Khaya senegalensis, Terminalia superba and Terminalia ivorensis in Olantan community, Begoro Forest district site. © Alex Aglebe

Figure 2 Collecting biodata from farmers for benefit sharing document of the plantation in Nsugunsua community, Offinso district. © Emmanuel Antwi Bawuah

Facilitation of biodiversity by shelter effects of *Pinus patula* and *Alnus acuminata* in montane ecosystems of South Ecuador	
1. Proponent	Universidad de Cuenca - Centro de Agroforestería y Manejo de Paisaje, Facultad de Ciencias Agropecuarias; Technical University of Munich (TUM) - School of Life Sciences Weihenstephan, Chair of Silviculture; and Thünen Institute of International Forestry and Forest Economics
2. Country of implementation	Ecuador
3. Location	Loja canton, Loja province, Southern Ecuador. Six study sites within 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 in the altitudinal range between 1935 m and 2450 m a.s.l.
4. Implementation period	2011 – 2016
5. Restoration option	Restoration of degraded forests for production ✓ Restoration of degraded forests for protection ✓ (Ecological restoration of protective functions, e.g. soil, water, biodiversity) Rehabilitation of degraded forest land through planted forests ☐ Rehabilitation of degraded forest land through agroforestry and/or silvopastoral systems ☐ Management of secondary forests ☐ Restoration or rehabilitation of mangroves ☐
6. Focus of the case	Process ☐ Planning ☐ Assessment / Monitoring ✓ Intervention level ✓
7. Target/Main objective	Reforestation of degraded areas is a promising strategy for sustainable land-use and the conservation of biodiversity, especially for the tropical mountain forest ecosystem of Ecuador. However, native tree species have been predominantly neglected so far and introduced species have been favoured, resulting in monocultures of *Pinus* spp. and *Eucalyptus* spp. with well-known ecologic 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 plantings. This is of particular importance since experimental trials showed that many native species require shelter for their successful establishment. Fostering the establishment of mixed forests, this concept can be used for restoration of degraded areas and for the conversion of existing monocultures and has been tested within the scope of the "***Nuevos Bosques para Ecuador, a DFG-Technology Transfer Project***". The objectives of this project have been focused on topics of (i) *scientific research* and (ii) *technology transfer* with a participatory approach: the central work package was responsible for the installation of experimental plots and the realization of thinning treatments and enrichment plantings, in order to enable for 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, a broad implementation of the silvicultural concept and the communication of suitable techniques and instruments for further continuation of the pilot project.
8. Target group or users	Private landowners, National Environmental Agency, local government agencies and NGOs

9. Partners & collaborators	Technical University of Munich (TUM), Universidad Técnica Particular de Loja (UTPL), Naturaleza y Cultura Internacional (NCI), Westfälische Wilhelms-Universität Münster, Thünen Institute of International Forestry and Forest Economics, Georg-August-Universität Göttingen, Freie Universität Berlin, Universidad Nacional de Loja (UNL), Ecuadorian Ministry of Environment (MAE), Provincial Government of Loja, Municipality of Loja, Municipality of Zamora and local landowners.
10. 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, besides positive experiences in Central America and other regions of the world. The aim of this pilot project is to foster the establishment of mixed forests with native species and tested enrichment plantings with native tree species in naturally regenerated stands of *Alnus acuminata* and plantations of *Pinus patula*.
11. Process and methodological approach, techniques and tools used	In total, 50 experimental plots have been installed: 33 in plantations of *P. patula* and 17 in *A. acuminata* stands. Each experimental plot has been divided into 16 sub-plots where nine native tree species were randomly distributed. The study areas were visited by local staff from different institutions to learn *in situ* of the different activities of enrichment planting as strategy of restoration. Moreover, planting stock propagation techniques have been shared with different local institutions. Additionally, several training courses in tree climbing and seed collection techniques have been carried out in order to facilitate propagation of autochthonous material.
12. Field-level practices implemented	Enrichment planting has been carried out in the experimental plots and surrounding demonstration areas during the rainy season in March and April 2015, immediately after performing different levels of thinning operations. 3267 seedlings have been planted in pine plantations and 1683 seedlings in alder stands. The project aims included the comparison of both shelter tree species and the evaluation of environmental factors facilitating or impeding the establishment of native species. Thinning operations with different thinning 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.
13. Innovative aspects	Institutional objectives and technology transfer aspects have focused on training of local staff in environmental sciences and technical issues (incl. tree climbing courses, seed management practices, nursery techniques, silvicultural treatments, monitoring systems of nutrient cycling and biodiversity), and the improvement of inter-institutional cooperation concerning environmental issues and upscaling of technical experiences. Another innovative aspect is combining productive and protective functions into restoration concepts.
14. Outcomes	Forest plantations with exotic species in southern Ecuador have mostly been characterized as having negative externalities in both ecological and economic aspects. After 10 years of research in mountain forests in southern Ecuador on aspects of restoration and reforestation few native tree species with good growth response (e.g. *Handroanthus chrysanthus*, *Cedrela montana*, *Juglans neotropica*) in comparison to exotic species have been identified under open field conditions. Some more species were able to adapt under the shelter of *Pinus* and *Alnus*, e.g. *Podocarpus oleifolius* and *P. sprucei*.
15. Conditions (institutional, economic, social, cultural, environmental) for successful replication in a	A participatory approach through active and well-balanced joint cooperation of national, provincial and municipal agencies with non-governmental organisations (NGOs) and research organizations (Ecuadorian and German universities) conducted according to the objectives of local landowners and implementing factual corporate social responsibility.

similar context	
16. Main challenges faced	– Creating a platform for effective and harmonic 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
17. Key messages and lessons	– Applied science with a long-term perspective contributes to better decisions – The major obstacle to use 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 has to be adequately retrieved, compiled, applied and 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 essentially support forest management planning, e.g. in stands of the site class with the highest productivity, investments are more effective and in stands with lower productivity forest conversion into mixed stands might be more applicable. The developed classification system should be expanded to other native tree species – Since 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 nutrient uptake, water balance and pathogen tolerance of their host plants. However, the forestry sites used in this project for afforestation of 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*
18. Source(s) describing the case	Data are published in the database of the *Platform for Biodiversity and Ecosystem Monitoring and Research in South Ecuador* (http://tropicalmountainforest.org/) or available from the project partners on request.
19. Contributors	Dr. *Ximena Palomeque* (Universidad de Cuenca, Centro de Agroforestería y Manejo de Paisaje, Facultad de Ciencias Agropecuarias), Dr. *Bernd Stimm* (Technical University of Munich, TUM School of Life Sciences Weihenstephan, Chair of Silviculture), Dr. *Sven Günter* (Thünen Institute of International Forestry and Forest Economics)
20. Photos	

Figure 1 Dense *Pinus patula* plantation in Southern Ecuador. © Baltazar Calvas

Figure 2 Regeneration after thinning in a pine plantation. © Bernd Stimm

Assisted natural regeneration (ANR) for watershed restoration	
1. Proponent	Bagong Pagasa Foundation and the Food and Agriculture Organization of the United Nations (FAO)
2. Country of implementation	Philippines
3. Location	Danao Municipality, Bohol
4. Implementation period	2002 - 2010
5. Restoration option	Restoration of degraded forests for production ☐ Restoration of degraded forests for protection ✓ (Ecological restoration of protective functions, e.g. soil, water, biodiversity) Rehabilitation of degraded forest land through planted forests ☐ Rehabilitation of degraded forest land through agroforestry and/or silvopastoral systems ☐ Management of secondary forests ☐ Restoration or rehabilitation of mangroves ☐
6. Focus of the case	Process ✓ Planning ☐ Assessment / Monitoring ✓ Intervention level ✓
7. Target/Main objective	To promote ANR as a cost-effective restoration method for recovering biodiversity, enhancing resilience and supplying multiple forest products and ecosystem services.
8. Target group or users	National government planners and extension agents, local government officers, non-government organizations, and local communities.
9. Partners & collaborators	Non-government organizations, local communities, and government extension agents. Additional funds were provided by the Japan Fund for Global Environment (JFGE).
10. Context (initial situation) and challenge (problem) addressed	The once-forested watersheds 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 and inadequate funds to implement and sustain such planting efforts. Previous reforestation efforts involving conventional tree planting were largely unsuccessful due to the lack of support from local people. ANR was introduced as a low-cost approach toward restoration, with attractive benefits for local people and clear advantages in enhancing biodiversity and watershed protection.
11. 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 as a key strategy. The process started with the demonstration and explanation of ANR so that all concerned would understand the approach. Initial field work involved locating and staking wildlings (naturally regenerating seedlings and saplings) and nurturing their growth by reducing competition from weeds and grasses and protecting against fire. Local farmers were encouraged to plant food crops on firebreaks to provide economic benefits for local people. The approach prioritized fire prevention, establishment of firebreaks, "lodging" of fire-prone grasses (e.g., *Imperata cylindrica*), and control of unplanned grazing and fuelwood gathering. As the local community began to appreciate the potential of ANR for restoring degraded forest lands, the municipality organized civic groups (associations of teachers, police, etc.) who "adopted" additional areas of nearby land for protection and expansion of the restoration efforts.

12. Field-level practices implemented	Firebreak establishment and planting of food crops on the fire breaks, preventing recurrence of fire through community patrols, pressing (or "lodging") of grasses and other weedy vegetation, regular patrols, community meetings and discussions.
13. Innovative aspects	Active nurturing of natural regeneration (i.e., "assisted") is itself a rather innovative approach in most areas where planting of trees 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. Multi-sectoral collaboration was key. Provision of meaningful incentives to local people served to gain their commitment and support.
14. Outcomes	– The case clearly demonstrated the potential of ANR as a cost-effective approach for restoring an ecologically diverse forest, capable of providing multiple benefits. Based on the results, the local government passed a resolution declaring itself as the first "ANR municipality" in the Philippines – Monitoring data collected during the project confirmed the cost of ANR-based restoration to be approximately half that of conventional reforestation, resulting in a highly diverse natural forest comprising native species well adapted to the site – The Danao site became a "showcase" for demonstrating the potential and feasibility of ANR to a multitude of forestry officials and other visitors in subsequent year – Several international workshops financed by international NGOs have been conducted at the site, in addition to workshops and trainings conducted by FAO – Largely attributable to the pioneering work at Danao, ANR has increasingly been recognized recommended for ecologically sound forest restoration by Philippine government agencies, NGOs and international donors (e.g., Asian Development Bank, USAID)
15. Conditions (institutional, economic, social, cultural, environmental) for the successful replication in a similar context	– Patient and steady community organizing – Targeted and consistent information campaign that generates interest in ANR based on cost savings, development of biologically diverse forest cover and the need to understand that forest restoration cannot be achieved solely by planting – Enlisting cooperation of local NGOs and educational institutions – There appears to be a range of population density that favors ANR: where population pressure on the land is not so intense that all available land is cultivated and not so sparse that labor is unavailable to implement ANR field practices – Recognition by local people of the direct and indirect benefits of forest restoration is essential to secure commitment and support of the efforts
16. Main challenges faced	The widely held misperception that forest restoration can be achieved only via extensive tree planning.
17. Key messages and lessons learned	– ANR is an effective, low-cost approach to restoration that can achieve impressive results by working with nature – Engagement of local stakeholders and provision of incentives to local communities were the key factors in convincing the concerned parties that ANR can be used to restore forests for the protection of watershed as a shared objective – Careful monitoring and documenting of results can verify the cost-effective aspects of ANR and help to convince observers of its feasibility
18. Source(s) describing the case	*Restoring forest landscapes through assisted natural regeneration (ANR)* (http://www.fao.org/3/ca4191en/CA4191EN.pdf) *Forests beneath the grass* (http://www.fao.org/3/a-i1734ee.pdf)
19. Contributors	Patrick Dugan (Bangong Pagasa Foundation), Kenichi Shono (Forestry Officer, Forest Management, Food and Agriculture Organization of the United Nations), and Patrick

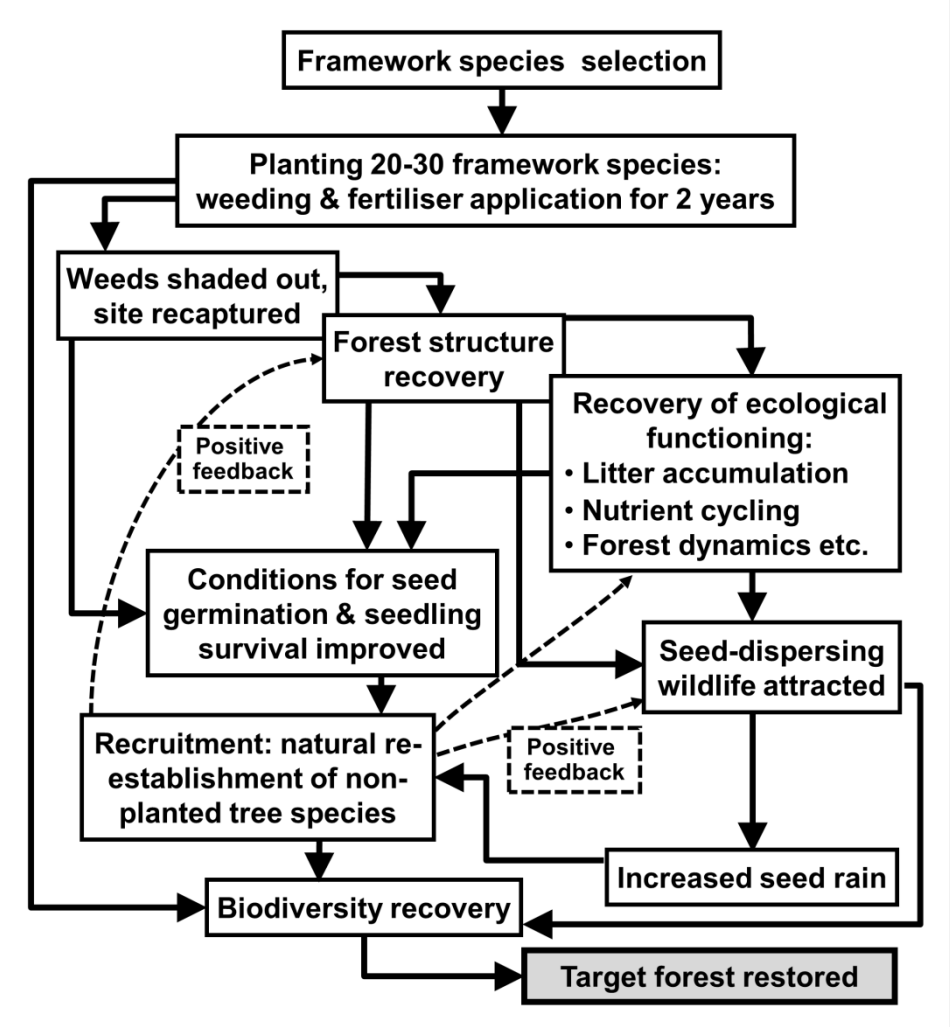
	Durst (Forestry and Natural Resources Consultant; former Senior Forestry Officer, FAO)

20. Photos

Figure 1. Forest restored through ANR (©Patrick Durst)

Figure 2. Forest restored through ANR (©Patrick Durst)

Early example of FLR in northern Thailand	
1. Proponent	Forest Restoration Research Unit, Biology Department, Science Faculty, Chiang Mai University (FORRU-CMU)
2. Country of implementation	Thailand
3. Location	Upper Mae Sa Valley, Chiang Mai Province, northern Thailand
4. Implementation period	1996 till present
5. Restoration option	Restoration of degraded forests for production ☐ Restoration of degraded forests for protection ✓ (Ecological restoration of protective functions, e.g. soil, water, biodiversity) Rehabilitation of degraded forest land through planted forests ☐ Rehabilitation of degraded forest land through agroforestry and/or silvopastoral systems ☐ Management of secondary forests ☐ Restoration or rehabilitation of mangroves ☐
6. Focus of the case	Process ✓ Planning ☐ Assessment / Monitoring ☐ Intervention level ☐
7. Target/Main objective	To develop effective techniques to restore upland evergreen tropical forest. To stabilize watershed services and to restore biodiversity to degraded forest sites in a national park.
8. Target group or users	Villagers living within a national park, National Park officers, students and practitioners of forest restoration, NGO's etc.
9. Partners & collaborators	FORRU-CMU, the communities of Ban Mae Sa Mai and Ban Mae Sa Noi, Doi Suthep Pui National Park Authority
10. Context (initial situation) and challenge (problem) addressed	The community of Ban Mae Sa Mai was founded in 1922 at an altitude of about 1,400 m but the village was moved down to its present location (1,081 m altitude) in the early 1960's, after deforestation had caused the water supply to run dry. In 1981, the village was included within the Doi Suthep-Pui National Park. This meant that the villagers faced possible eviction, since they had no land titles. Consequently, a few villagers formed the "The Ban Mae Sa Mai Natural Resources Conservation Group" in the early 1990s, to demonstrate that they were responsible custodians of the forest. Furthermore, 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 and reforest the area, whilst intensifying agriculture on the more fertile land in the lower valley by installing an irrigation system. When FORRU-CMU approached the villagers in 1996 to discuss planting framework species trial plots, they readily agreed, recognizing an opportunity to improve their reforestation efforts.
11. 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 protection of remnant trees. Framework tree species are selected from the indigenous tree flora characteristic of the target forest ecosystem for their ability to (1) survive and grow well in deforested sites; (2) shade out weeds (with dense spreading crowns); and (3) produce resources, such as fleshy fruit or nectar-rich flowers, early in life, to attract seed-dispersing animals and consequently promote biodiversity recovery. FORRU-CMU guided the experimental design whilst villagers worked voluntarily to plant the trees

	and received payments for monitoring and maintenance, including fertilizer application, weeding and fire prevention. 
12. Field-level practices implemented	– Planting stock raised from locally collected seeds – Planting 20-30 framework tree species to increasing stocking density to 3,100/ha – Site clearance with glyphosate – Weeding and fertilizer application 3 times in the first rainy season and 3 times in the 2nd – Fire prevention in the dry season – Monitoring 2 weeks after planting and at the end of the 1st and 2nd rainy seasons – Comparison among species and silvicultural treatments using performance indices derived from survival and growth rates
13. Innovative aspects	First time testing of the framework species method of forest restoration outside of Australia where it originated (https://www.dropbox.com/s/x87seamzady6fe0/2003%20Selecting%20framework%20spp%20forecol.pdf?dl=0)
14. 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
15. Conditions (institutional, economic, social, cultural, environmental) for successful replication in a similar context	– Communities that recognize the benefits of forest restoration in terms of both environmental services and political clout – Co-operative park authority – University with access to fundraising mechanisms – Students to undertake scientific aspects of the work for their projects
16. Main challenges faced	– Need for continuous fundraising – National park regulations prohibit 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
17. 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 whilst rural populations continue to grow and aspirations rise.
18. Source(s) describing the case	https://www.mdpi.com/1999-4907/10/9/732/htm
19. Contributors	Stephen Elliott (FORRU, Biology Department, Chiang Mai University, Thailand)
20. Photos	

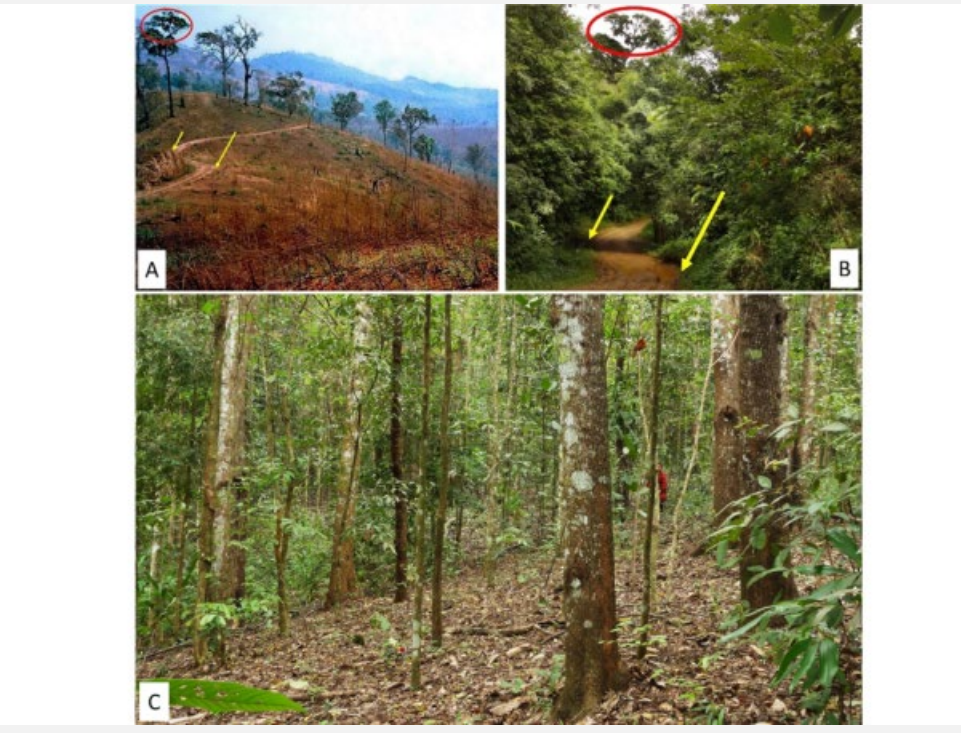


Figure 1. Forest restoration using the framework-species method has transformed the landscape of the upper Mae Sa Valley. (**A**) May 1998 before restoration; (**B**) same site, left of the track, restored forest, 15 years old, planted 2001; right, 9-year-old restored forest, planted 2007 (photo September 2016). (**C**) Inside nearby restored forest, 18½ years old, a dense understory develops that comprises seedlings and saplings of >70 recruit tree species. (Credit: FORRU-CMU).

Original: https://www.dropbox.com/s/7llm5vmhd45j3rg/FIG%204%20RESTORATION%20EXAMPLE.tif?dl=0

Restoration of Degraded Tropical Forests: A performance Based Payment Approach	
1. Proponent	Thuenen Institute of International Forestry and Forest Economics. Case implemented by Gesellschaft für Internationale Zusammenarbeit- Biodiversity and Forestry Program (GIZ-BFP) Ethiopia.
2. Country of implementation	Ethiopia
3. 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 (SNNPR).
4. Implementation period	Since 2017
5. Restoration option	Restoration of degraded forests for production ✓ Restoration of degraded forests for protection ✓ (Ecological restoration of protective functions, e.g. soil, water, biodiversity) Rehabilitation of degraded forest land through planted forests ✓ Rehabilitation of degraded forest land through agroforestry and/or silvopastoral systems ☐ Management of secondary forests ☐ Restoration or rehabilitation of mangroves ☐
6. Focus of the case	Process ☐ Planning ☐ Assessment / Monitoring ✓ Intervention level ✓
7. Target/Main objective	– Restoration of tropical degraded forest sites from the landscape perspective – Creation of forests beyond tree planting e.g. a combination of natural forests plantation with mixed age and diverse tree species in buffer zones – Improved sustainable forest management and conservation of biodiversity – Increased forest protection and productivity within area enclosures – Supply of ecosystem services such as provisioning services e.g. timber, firewood, charcoal; regulating services e.g. erosion control, carbon sequestration; supporting services e.g. biodiversity conservation and cultural services like recreation – Enhanced livelihood opportunities and long-term resource security
8. Target group or users	Local communities around highly degraded forest landscapes and protected sites.
9. Partners & collaborators	Universities, private partners, state and regional administration, community-based organisations, farmers and farmer groups.
10. Context (initial situation) and challenge (problem) addressed	– Geiza forest was degraded and highly depleted due to over exploitation of forest resources (timber, NFTP especially wood-fuel) and encroachment for farming by the surrounding communities – Some parts of the forest areas were enclosed by excluding local people from access and use (grazing and farming). This aimed to allow for natural regeneration and recovery of pasture and trees. Unfortunately, due to inadequate management, more than 5 years after the establishment of the enclosures, productivity was still low and consequently the supply of forest products. This called for alternative interventions in particular enrichment planting and establishment of mixed species woodlots – Lack of sufficient supply of good quality seedlings – Lack of capacity (knowledge and financial) in tree nursery and plantation management by the local communities
11. Process and methodological	– Engagement of various stakeholders, especially local communities at all stages of tree establishment and monitoring through participation, negotiation and signed

approach, techniques and tools used	agreements of restoration goals – Tree planters have to fulfil the terms and conditions for the signed agreement referred to as Tree Planting Modality Agreement. The agreement clarifies duties for the different stakeholders specifically GIZ-BFP and farmers and farmer groups. Key duties of the 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, including weeding, beating up and guarding of the plantations, establishment of mixed forest stands with diverse species and uneven age distribution. GIZ-BFP on the other hand is responsible for providing partial finances for purchasing seedlings and providing technical advice, support and tools. The programme also provides a onetime payment for healthy trees (15 to 18 months after tree planting). Prior to payments, both the GIZ-BFP, partner organisations and farmers jointly conduct tree monitoring and survival assessments. This is done to allow transparency, trust and acceptance of the results obtained from the assessments. In situations where forest sites are owned by a group, payments are not given to individual members but directly given to the whole group – Performance based payments/incentives for tree nurseries and forest establishment activities depending on agreed indicators, e.g. survival of at least 1600 trees per ha at the time of monitoring (15 to 18 months after tree planting) – Monitoring and follow-up of newly established afforestation sites – Capacity building for local individual farmers, farmer groups and communities in all forestry related silvicultural activities such as nursery and stand establishment, maintenance, tending and harvesting
12. 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 10 years rotation and 75% of short rotation tree species (e.g. *Eucalyptus* spp.) so to ensure restoration of multiple functions, benefits and long-term resilience – Field participatory monitoring through survival rate assessments – Advice and technical support for tree nursery, plantation establishment and maintenance, capacity building and training on silvicultural practices and development of a management plan including sustainable harvesting and utilization of tree resources
13. Innovative aspects	Performance-based payments/incentives through contractual agreements between the individuals, groups, small enterprises, and biodiversity and forestry program of GIZ-Ethiopia.
14. Outcomes	– Increased tenure and access rights to forest land for the 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 within a community/individual based land use plan within 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
15. Conditions (institutional, economic, social, cultural, and environmental) for the successful replication in a	– Land tenure regulations and assurance of land use and tree harvesting rights (provision of land certificates for at least 30 years and above) – Availability of voluntary agreements between main stakeholders and tree growers – Benefit sharing mechanisms (bylaws) – State's willingness and support towards tree planting.

similar context	– People's understanding of the value of trees – Market assurance for different tree products encouraged by stakeholders – Availability of human labour – Enabling conditions need more research.
16. Main challenges faced	– Unclear land and tree tenure rights – Assurance of its sustainability to other stakeholders since such models take time to provide convincing results
17. Key messages and lessons learned	– Stakeholder engagement, especially from 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 in forest activities and use of 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 of enclosure areas – Forest landscape restoration 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
18. Source(s) describing the case	Key informants: Julian Schmid (GIZ-Development Advisor for Forestry), and Alemayehu Asefa and Shibire Bekele (GIZ).
19. 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 program manager) for the logistic support.

20. Photos

Figure 3: Site preparation and pitting for the next tree planting activities carried out by a group of farmers in a formerly degraded enclosure. (Credit: Vianny Ahimbisibwe)

Figure 2. Re-forested site with different tree species (Cypress spp., Grevillea spp., Eucalyptus spp. and others) through the Performance based incentive approach. (Credit: Vianny Ahimbisibwe)

Achieving Prey Lang landscape restoration through community forestry approaches	
1. Proponent	The Center for People and Forests (RECOFTC)
2. Country of implementation	Cambodia
3. Location	Prey Lang Landscape includes Prey Lang Forest, a nature reserve in Kampong Thom, Preah Vihear, Kratie and Stung Treng Provinces.
4. Implementation period	Since 2006
5. Restoration option	Restoration of degraded forests for production ☐ Restoration of degraded forests for protection ✓ (Ecological restoration of protective functions, e.g. soil, water, biodiversity) Rehabilitation of degraded forest land through planted forests ☐ Rehabilitation of degraded forest land through agroforestry and/or silvopastoral systems ☐ Management of secondary forests ✓ Restoration or rehabilitation of mangroves ☐
6. Focus of the case	Process ✓ Planning ☐ Assessment / Monitoring ☐ Intervention level ☐
7. Target/Main objective	1. Formalizing local communities' rights to manage forests 2. Fostering multi-stakeholder 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 Prey Lang landscape. This includes local communities, the Forest Administration (FA), NGO partners and local government officials to sustainably manage the network of community forests.
8. Target group or users	Communities living and using forest resources in the Prey Lang landscape, in particular ethnic Kuy people making up 30% of its population.
9. Partners & collaborators	– The Cambodian Forest Administration (FA) at national, cantonment, division and triage level – Local NGO partners: Action For Development, Cambodian Community Development, Save Cambodian Wildlife, Buddhism For Development Kampong Thom, and Environment Protection and Development Organisation, Ponlork Khmer, World Conservation Society, World Wildlife Fund – Provincial CF Programme Coordination Committees, formal platforms/networks for CF development partners
10. 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. This 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 1,000 sites over an area of two 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.
11. Process and methodological	RECOFTC places local people at the center of forest landscape restoration and envisions a future where people in the Asia-Pacific live equitably and sustainably with thriving forests

approach, techniques and tools used	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 FA. 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 by-laws 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 trainings with forest dependent villages, FA, NGO partners and local authorities to explore collaborative forms of forest stewardship. Initiatives in Prey Lang focus on: 1) researching and training on Community forest management planning and strengthening institutions; 2) piloting CF partnerships that implement forest management; 3) supporting multiple stakeholder processes to link national and grassroot initiatives developing CF, and; 4) developing initiatives increasing equitable benefits from sustainable forest management.
12. Field-level practices implemented	Highlighted are the main practices as part of the implementation of the CF Steps. Field trainings and coaching. Capacity development involved CF stakeholders tailoring specific CF training modules to provide communities, local government officials, FA and NGO participants with practical management skills to assess, zone, plan and manage forest resources. Forest management planning. CF land is surveyed, mapped, and divided into zones for restoration, conservation, firewood and pole extraction, each requiring a plan of action. CF management is participatory and integrates community initiatives with scientific forestry 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 artificial regeneration (interplanting) of trees. CF nurseries maintained with FA support produce seedlings each year including *Afzelia xylocarpa*, *Sindora cochinchinensis*, *Hopea odorata*, *Acacia* hybrids, *Dipterocarpus alatus*, *Anisoptera costata* and bamboo species. Fencing and fire breaks protect tree plantings while CFMC and CF members carry out weeding and pruning. CF establishment. Early in the CF application process, the villagers must learn how to self-organise 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. Once this occurs, the development of CF procedures and documentation of CF membership application can start. Once CFMCs are established, CFs demarcate and map the community forestry boundaries, which allows them to develop CF regulations for resource use within the area. After these steps are complete, CF communities sign formal agreements with the FA to formalize their rights to manage the community forest. Multi-stakeholder processes. Throughout the CF application process, coordination among CF stakeholders is crucial. RECOFTC works with the FA at the district level to ensure that CF

	initiatives support the government's 5-year work plans. Multi-stakeholder consultations and participatory operational planning at the local level help to 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 (CFDF). CFDFs 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.
13. Innovative aspects	Running a CF credit scheme in areas that are resource deficient is important because they can help kick-start businesses. These CFs struggle to generate revenues to support sustainable forest management and are unable to initiate forest-based businesses due to the degradation of their landscapes. *How does it work?* A core budget of USD 1,000, which comes from a project or the CFDF, is made available for CFs and placed under the control of the CFMC. A certain amount is allocated for CF members to invest in small businesses (often agriculture based), which is then paid back within three to six months at low-interest rates, allowing the fund to grow. In a 2015 assessment, 11 established CFs managed funds between USD 1,000 and USD 5,000. USD 10 to USD 40 per month was used to support basic CF management activities, regular patrolling, constructing fire breaks, restoring degraded forest areas or meeting with members to resolve conflicts. After achieving a certain level of financial stability, CFs 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 from CF members, especially women, in both business development and CF management. Women are motivated by the CF credit schemes and now hold 24% of the committee positions.
14. Outcomes	In Prey Lang Landscape 4,594 people were trained on various topics. This resulted in 164 operational CFs with a 15-year agreement. CFs now cover over 200,000 hectares and involve 29,654 households in operational forest management plans.
15. Conditions (institutional, economic, social, cultural, environmental) for successful replication in a similar context	Legal recognition of CF. The government has committed to increasing CF to 1,000 sites over an area of two million hectares, and to formalising 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 granted CFs so far are degraded, which is likely to prevent communities from gaining short-term benefits and reduce management efforts. Community incentives/interest. The implementation of CF should help to 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 agreement and CF management plan, and develops its capacity, the CFMC can effectively: 1) govern its members, 2) put in place transparency metrics for financial management and decision making processes, and 3) partner with local authorities, FA, and NGOs to combat illegal logging activities and land encroachment. An example is documented on the RECOFTC website. 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 institutionalisation within the FA, while CF Networks and platforms for learning and information sharing require local level FA support.

16. 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 instance, CFMCs are sometimes formed but not fully functioning (step 2) or CFMC by-laws (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 of 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 CFs have a business plan but without the resources, capacities and support to implement these, they are not operationalised. Through collaboration among CFs they might be able to accumulate sufficient volumes of forest products to attract business partners. Developing effective partnerships between CF organisations and private sector, for example trading cashew or acacia, may pose another challenge for FA officials who often have no expertise of 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 for legal timber in Cambodia, but this link is not yet developed. However, with the increase in CF sites across the country and CFs maturing to harvest timber, attention is needed to improve forest governance and strengthen forest law enforcement where communities and smallholders are involved. See also this site.
17. 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. Multi-stakeholder approaches: *Stakeholder engagements assist the process of establishing CFs and helps with laying the groundwork of effective partnerships with government, among CF groups and networks, and the private sector*. Involving staff from different sectors and organisations builds relationships, which can ensure a shared understanding of what CF development requires and an appreciation of strengths and constraints of each other's institutional arrangements. Training for action: *Participatory approaches have proven to be effective in capacity building where training is linked to 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 activities in newly established CFs*. CF requires maintained motivation to continue efforts in management especially where multiple objectives are pursued, such as protection of biodiversity and natural resources, restoring forest functions, and production of forest products.. Examples to stimulate this is by the provision of modest financial support to CFMCs through the establishment of CFDFs, but also in maintaining close relations, providing institutional support and communication between the FA and CFMCs. The role of FA in attracting private sector partnerships in this context is highly recommended as to develop a realistic outlook to restore forests and develop market access.
18. Source(s) describing the case	Bampton, J.F.R., Heng, D., & Long, R. 2009. Partnerships for Community Forestry Development in Cambodia. Paper presented at Community Forestry International Workshop, 15-18 September 2009, Pokhara, Nepal. Center for People and Forests - RECOFTC. 2017. Prey Kbal Bey CF Development and Forest Restoration. Internal report. Center for People and Forests - RECOFTC. 2017/2018. Prey Kbal Bey, Trapeang Roung and

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19. Contributors

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20. Photos

Figure 1. Community members of Phnom Dek Chambok Hos patrol their community forest near Prey Lang Sanctuary. (Photo credit: RECOFTC)

Figure 2. RECOFTC facilitates a group discussion with CF members of Borie Ousvay Community Forest

(Photo credit: RECOFTC)

Restoring cloud forest on private and communal land in the Ecuadorian Andes	
1. Proponent	*Defensa y Conservación Ecológica de Intag* (DECOIN)
2. Country of implementation	Ecuador
3. Location	Intag Valley, Imbabura Province
4. Implementation period	2001-2012 (incl. site maintenance)
5. Restoration option	Restoration of degraded forests for production ☐ Restoration of degraded forests for protection ✓ (Ecological restoration of protective functions, e.g. soil, water, biodiversity) Rehabilitation of degraded forest land through planted forests ☐ Rehabilitation of degraded forest land through agroforestry and/or silvopastoral systems ✓ Management of secondary forests ☐ Restoration or rehabilitation of mangroves ☐
6. Focus of the case	Process ✓ Planning ✓ Assessment / Monitoring ☐ Intervention level ☐
7. Target/Main objective	The main goals of the work were to (1) restore water to local communities undertaking restoration (local objective); (2) conserve biodiversity in a highly deforested, megabiodiverse region (international (funders)), and (3) provide local communities with land sovereignty in the face of mining interests in the region.
8. Target group or users	Implementers, donors, local and regional NGOs and government agencies. Target group of 'users' of the restoration include local communities to restore much-needed water to their communities; downstream communities for water benefits< and international community for biodiversity conservation.
9. Partners & collaborators	*Defensa y Conservación Ecológica de Intag* (DECOIN), a local NGO and implementer; local communities; international private donors (United States); and Rainforest Concern, Ecuador (International NGO with national chapter).
10. 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 to nearly 4000 masl in elevation, with annual rainfall from 1500 to 3300 mm. Intag is in the centre of the Tropical Andes biodiversity hotspot, and its cloud forests are exceptionally diverse with 80 to 120+ tree species in 1/10 of a hectare. Clearing patterns here are typical of many places in the Andes - following centuries of sparse habitation and dense forests, after the Ecuadorian land reform laws in the 1960s and 70s deforestation rates increased precipitously throughout the 1970s, 80s and 90s, mainly for cattle ranching and small-scale farming. Today, cloud forests have been extensively cleared (upwards of 60%). Intag's population (~1600 people) is primarily rural and mestizo, with minority populations of *Otavaleños* (indigenous people from the Central Valley) and Afro-Ecuadorians, and dispersed across 76 communities. Farming is largely non-mechanized as most occurs on 10–35° slopes. This case is based on work with residents in four small communities (23–45 households, average farm size 13 ha) in northeast Intag that participated in forest restoration projects supported by the local NGO 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 during the dry season. Summer drought conditions were so severe that, combined with declining soil fertility and underperformance of 'green revolution' farming technologies, these traditionally agrarian communities were uncertain if they would be able to continue farming. The community was in crisis.
11. 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 farmers 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: (1) improve the quality of water resources in communities (in particular, maintain summer stream-flow); (2) restore and conserve forest biodiversity in the region; and (3) provide local sovereignty over land development in strategic locations throughout the region. DECOIN purchased land in watersheds from local farmers and signed the title over to communities for the purpose of conservation and restoration, with use restrictions in the title: no burning, cattle, cultivation, or harvesting for sale. 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, grow them, and plant and maintain them – Engaged trusted local leaders/managers in each community – Ensured that trees were properly maintained
12. Field-level practices implemented	– Training and materials for establishing tree nurseries – Creating restoration associations/cooperatives within communities – Training for collecting and propagating native species, training to plant trees and maintain restored areas – Education on unsustainable land use practices (i.e., burning, cattle on marginal lands, etc.) – Maintaining planted areas 3-4 per year for 2-3 years after initial planting Planting involved using commercial seed for a quick growing, nitrogen-fixing exotic (*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 a limited number of *A. nepalensis*. Seedlings were planted 2.5 m apart, and people planted a total of 50 species with between 12 and 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.
13. 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 first-hand 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 in a meaningful way – Allowing local people to plant the species they wanted but within a given framework (i.e., allowing some exotics and a choice of natives) really helped make the project locally relevant and accepted
14. 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, ~ 60% of households (69 people) restored over 70 hectares of land in four microwatersheds, planting over 75,000 trees. Most people reported planting trees to restore water resources, and four to seven years after the inception of the projects, more than half reported an increase in water quality, 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: c**ompared to 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 to 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 were both attractive and accessible when the resources of the community (labour, knowledge, motivation) were pooled. This allowed a broader range of community members, from the land rich to the land poor or landless, to participate and benefit from restoration.
15. 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 that they needed and forest restoration. A desire to remain on the land and identification with a land-based livelihood, as well as communities with some degree of cohesion, were also key enabling conditions. People chose to restore forests in Intag because they faced a dire situation: their future as farmers was uncertain in the face of environmental change. By framing forest restoration as a way to alleviate urgent environmental problems, the NGO DECOIN initiated restoration projects with exceptionally high participation rates. Households planted trees in communal reserves and on farms to obtain different ecosystem services, but the ultimate goal was the same – to restore and provide products and services to 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.

16. Main challenges faced	– Lack of resources for maintenance and monitoring (donors do not want to support these activities) – Threats from mining and 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
17. Key messages and lessons learned	**Restoring communal lands allowed for more inclusive participation, larger restored areas, and facilitated knowledge sharing and acquisition**. It was thus well suited to achieve the goals of both ecological forest restoration (focus on restoring intact ecosystems), and forest landscape restoration (focus on the spatial allocation of restored/reforested sites to benefit a range of stakeholders). This case suggests a few **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 that may be possible as a group Restoring forests thus fits a typology of extensive land uses, such as pastures and wild woodlands, that have been traditionally man- aged communally even in places where agricultural plots are managed privately. – Within 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 also suggests that the **perceptions of environmental crisis due to forest loss can strongly influence people's motivation to plant trees,** on farms or off. In Intag, people engaged 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 an integral part of 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 case shows that communities experiencing 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, high levels of community and on-farm engagement with the projects and 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 the 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, as all landholders would have had to (1) agree to participate; (2) agree to restore that particular area of land; and (3) 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 an additional number of households that had not participated in the projects also began planting on-farm trees at that time (prior to 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.
18. Source(s) describing the case	Wilson, S.J., O.T. Coomes, and C. Dalaire. Local forest transitions in the Ecuadorian Andes: Forest recovery amidst deforestation, 2001-2010. *Regional Environmental Change. In press.* Wilson, S.J. and O.T. Coomes. 2019. Crisis restoration in post-frontier tropical environments: Replanting cloud forests in the Ecuadorian Andes. *Journal of Rural Studies.* 67: 152-165. Wilson, S.J. and J. Rhemtulla. 2018. Small montane cloud forest fragments are important for conserving tree diversity in the Ecuadorian Andes. *Biotropica,* 50: 586-597. Wilson, S.J. 2016. Communal management as a strategy for restoring cloud forest landscapes in Andean Ecuador. *World Development Perspectives.* 3: 47-49. Wilson, S.J. and J. Rhemtulla. 2016. Community-based tree planting accelerates forest recovery but creates novel forests in Andean Ecuador. *Ecological Applications*. 26: 203-218.
19. Contributors	Sarah Jane Wilson (Department of Geography, McGill University, Canada)
20. Photos	

Figure 1. The Intag Valley, Imbabura Province, NW Andean Ecuador. @ Sarah Wilson

Figure 2. Restoring pastures in watersheds – clearing grass from around recently planted trees. @Sarah Wilson

Matas Legais Project	
1. Proponent	Apremavi - *Associação de Preservação do Meio Ambiente e da Vida* (Environmental and Life Preservation Association) and Klabin company
2. Country of implementation	Brazil
3. Location	States of Paraná and Santa Catarina
4. Implementation period	Since 2005
5. Restoration option	Restoration of degraded forests for production ☐ Restoration of degraded forests for protection ✓ (Ecological restoration of protective functions, e.g. soil, water, biodiversity) Rehabilitation of degraded forest land through planted forests ✓ Rehabilitation of degraded forest land through agroforestry and/or silvopastoral systems ☐ Management of secondary forests ✓ Restoration or rehabilitation of mangroves ☐
6. Focus of the case	Process ✓ Planning ✓ Assessment / Monitoring ✓ Intervention level ☐ Environmental suitability of rural properties and Atlantic Rain Forest restoration
7. Target/Main objective	Develop actions in conservation, environmental education and forest promotion that help preserve and restore the remnants of native forests, improve quality of live and forestry development based on planning at the landscape and rural properties level
8. Target group or users	Rural owners, outgrowers of Klabin.
9. Partners & collaborators	The *Matas Legais* project is a partnership between the association Apremavi and the company Klabin (the biggest producer and exporter of papers for packaging in brazil and leader in the production of paper packaging).
10. Context (initial situation) and challenge (problem) addressed	The project emerged from the need for the properties of Klabin's outgrowers to be environmental suitable according to the government regulations.
11. 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, direct visits and seminars. In agreement with the landowner, it is decided on the areas where commercial forests can be planted, areas that need to be conserved, areas that must be restored (such as water springs and riparian forest) and areas of secondary forests to be enriched. Planning activities take place at the properties. These are mapped out and the data is inserted into Apremavi's Environmental Portal, a platform of geographic data that helps monitor the activities. With this virtual platform it is possible to access data such as: areas and restoration methodology, information over seedlings used, data, maps and sketches of

	the properties, and photos of the different stages of execution.
12. Field-level practices implemented	The activities start with field visits to the owners to analyse the property's situation. Conversations take place about the environmental adequations that need to be carried out. After agreeing on the needed actions, reforestation and restoration areas are demarcated. The project offers seedlings and materials for the construction of fences, when needed, and the owner plants the trees and does the maintenance of these trees. After trees are planted, monitoring visits are scheduled.
13. Innovative aspects	The partnership between a NGO and a private company. For the embodiment of the partnership several meetings between both parties were scheduled, aiming to design a project that was interesting for both institutions and also important for the society. The success of this type of partnership can be measured by the number of years that it has been in development: 15 years in 2020. The Environmental Portal. This virtual platform guarantees transparency to the project, which is fundamental for credibility to the society and also promotes a sense of belonging for everybody that participates in the project.
14. Outcomes	Until July of 2019 the project worked in 1019 areas reaching 391 hectares of restoration with native trees planting and 2566 hectares of natural regeneration and conservation. Over 1.4 million seedlings were donated and planted in the states of Paraná and Santa Catarina.
15. 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 to other partnerships between companies and civil society organizations. It is a partnership built on dialogue using the assets of each partner organization in a complementary way, seeking a common and important goal for each of the organizations, but that also to benefit society as a whole. There are countless opportunities to build this kind of partnership between companies and civil society organizations, which requires a dialogue to be established and certain conditions such as trust, commitment, non-exclusion, integration, respect for diversity, proactivity and transparency. Partnerships built this way are meant to last.
16. Main challenges faced	The process of learning and coexisting between the different sectors, in this particular case involving a company and an environmental NGO working with rural owners and communities. It is a continuous learning experience that requires constant evaluations and adaptations, without diverging from the main purpose.
17. Key messages and lessons learned	The main message is the importance that dialogue processes have in building long-term partnerships.
18. Source(s) describing the case	Apremavi. 2008. Matas Legais - Planning properties and landscapes. Edited by Miriam Prochnow. Rio do Sul (SC). The Brazilian Forestas Dialogue. 2013. Writings of the Dialogue - Silvicuture and communities. Sergio Adeodato. P. 26. Atalanta (SC). Apremavi's environmental database platform: http://apremavi.cargeo.com.br/publico/mapa/ Klabin website: https://www.klabin.com.br/en/
19. Contributors	Miriam Prochnow (Steering Committee Member, The Forest Dialogue / Association for the Preservation of the Environment and Life Brazil), and Leandro da Rosa Casanova and Maurício Batista Reis (Technical Coordinators of the *Matas Legais* Project).

20. Photos

Figure 1. Area with newly planted Eucalyptus seedlings and demarcated restoration area on Valmor Catafesta property. Year 2007. (Photo by Leandro Casanova)

Figure 3. Aspect of Valmor Catafesta's area in 2019. (Photo by Leandro Casanova)

Figure 4. Image of Apremavi's environmental database platform with infomation of Valmor Catafesta property.

Land Use Dialogue (LUD) - Planning Sustainable Landscapes in the Atlantic Rain Forest	
1. Proponent	Apremavi - *Associação de Preservação do Meio Ambiente e da Vida* (Environmental and Life Preservation Association)
2. Country of implementation	Brazil
3. Location	Alto Vale do Itajaí Region, State of Santa Catarina
4. Implementation period	Since 2016
5. Restoration option	Restoration of degraded forests for production ✓ Restoration of degraded forests for protection ✓ (Ecological restoration of protective functions, e.g. soil, water, biodiversity) Rehabilitation of degraded forest land through planted forests ✓ Rehabilitation of degraded forest land through agroforestry and/or silvopastoral systems ✓ Management of secondary forests ✓ Restoration or rehabilitation of mangroves ☐
6. Focus of the case	Process ✓ Planning ✓ Assessment / Monitoring ☐ Intervention level ☐ Focus on planning sustainable landscapes, engagement of stakeholders and supporting participatory governance
7. Target/Main objective	The goal of the LUD initiative is to support a stakeholder driven landscape platform for learning around collaborative, adaptive land management in selected landscapes around the world. The multi-stakeholder 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 community and private sector; – testing sustainable land use practices; and – establishing information sharing and learning networks locally and internationally.
8. Target group or users	NGOs, communities, private companies, academia and governments.

9. Partners & collaborators	The Forests Dialogue (TFD), The Brazilian Forests Dialogue, Apremavi and IUCN
10. Context (initial situation) and challenge (problem) addressed	In Brazil the LUD initiative was launched in April 2016 in Atalanta, Santa Catarina, focused on planning and implementing sustainable landscapes in the Alto Vale do Itajaí (Upper Itajaí Valley). The Alto Vale do Itajaí was chosen as pilot because the region's land use already fulfils a great deal of the characteristics of sustainable landscapes. It is an opportunity to exchange ideas and experiences that can contribute to improve land use in the region and also advertise the project to other regions. The Valley was colonized in the beginning of the 20th century, and in less than 100 years of "economic growth" 80% of the forests in the region were destroyed. The floods, a secular phenomenon of the region, started to occur more frequently, and today the Alto Vale is highly affected by the climate crisis. With less forests to explore, particularly after 1970, companies and small rural owners started to plant exotic tree species to supply the market. In the 1980s, with the native forest restoration projects starting, and the environmental laws specific to rain forest protection being regulated (since 1990), deforestation started to slowly drop, and the restoration of the biome started.
11. Process and methodological approach, techniques and tools used	The process began with a seminar to gather available information and integrate the regional actors that have great 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, aiming at the basin of the Itajaí river involving 31 municipalities in Santa Catarina State. In this first historic meeting, where objectives to continuing the dialogue with practical actions were defined, 49 NGOs, agricultural, public and private companies, government, universities, cooperatives and rural producers' associations participated. A working group to articulate the next steps was formed. The second step of the process was the II seminar of Land Use Dialogue in the Rain Forest - Planning sustainable Landscapes in the Alto Vale do Itajaí, held in March 2017. Consisting of 90 participants, the initiative was supported by databases and geoprocessing images - the knowledge of local actors - to elaborate the first map of priority areas envisioning sustainable landscapes in the Alto Vale do Itajaí.
12. Field-level practices implemented	During the I seminar several field visits were made to better understand the reality of the region. After this first encounter, a SIG database was organized, producing a pilot map of the social/environmental situation of the region. This data base was used to support the debates of scenarios for 2030 and 2050, discussed in the second seminar. A research on perceptions was also made, asking "What is your opinion over the scenarios for 2030/2050 in the Alto Vale do Itajaí?" The research covered eight main topics: Forests and Biodiversity, Water Resources, Protected areas, Farming, Silviculture/Reforestation, Rural roads, Landslide and Flood risk areas, and rural area x urban area.
13. Innovative aspects	For the first time, in the Valley region, different sectors sat at the same table to look beyond the backyard, proposing priorities and actions aiming to follow the law and also transcend it with additional measures, focusing on improving the quality of life as a whole.

	The involvement in the mapping process motivated, for example, not only the adequacy of the environmental legislation, but also production practices not regulated by law capable of bringing together production and environmental conservancy in a more effective way in the long run. Some organisations that participated in the process incorporated the results in their strategic planning.
14. Outcomes	The first Map of Priority Areas for Sustainable Landscapes in the Alto Vale do Itajaí; recommendations for prevention and mitigation of environmental risks; and a list of priority actions to guide public policy, investment in conservation, and private sector initiatives. Around 150 areas were demarcated according to the eight themes: – Areas that have the potential or that already have sustainable production activities, such as agroecological production and agroforestry systems, etc – Priority areas for water resources and biodiversity conservation, such as water springs and basins, besides places of endangered fauna and flora – Forestry restoration areas, such as permanent preservation areas and Legal Reserves – Areas with environmental impacts that need to be resolved – Areas with potential of ecological enrichment with native trees – Priority areas for the formation of biodiversity corridors and integrative landscape management – Areas with a higher risk of landslides and floods Part of the recommendations in the restoration theme is being implemented by the *Restaura Alto Vale* project that started in 2018 and, so far, already engaged with 368 rural owners in 27 municipalities. Some 64 000 native tree seedlings have already been distributed covering 91 hectares of restoration.
15. 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. It is important the there is an information sharing mechanism, so that participants know who is doing what in the landscape. Clear dialogue structure and objectives. A central tenet to a landscape approach is that the end goal is not pre-defined but determined by the stakeholders involved through a process of visioning and balancing trade-offs. Leadership**.** It is clear that the success of a multi-stakeholder platform is enabled by a key group of actors in the landscape to champion the identified priority actions and continued flow of information beyond platform meetings.
156 Main challenges faced	The question of inclusivity. To achieve the goal of inclusive decision making, the platform must be viewed as a legitimate mechanism to influence change by all actors, including those not traditionally involved. Overcoming power imbalances for participatory decision making. Participants of the LUD platforms include both, those that would be considered current decision makers and those impacted by landscape decisions. Policy as an entry point. While focusing on land use policy allows for dialogue to be focused and action oriented, it also has its challenges. Focusing on policy can lead discussions to center on the overlap or lack of synergy between policy from different sectors.

17. Key messages and lessons learned	Attending to scales. 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. In order for the dialogue platform to be truly inclusive, it must not only make space for different stakeholders to participate in the dialogue but enable actors to present and negotiate their priorities.
18. Source(s) describing the case	The Brazilian Forest Dialogue/Apremavi. 2019. Writings of the Dialogue - Volume 9: Land Use Dialogue - Planning Sustainable Landscapes. Edited by: Miriam Prochnow e Fernanda Rodrigues. Atalanta (SC).
19. Contributors	Miriam Prochnow (Steering Committee Member, The Forest Dialogue / Association for the Preservation of the Environment and Life Brazil) and Wigold Bertoldo Schaffer (Technical coordinator of the LUD project for the Alto Vale do Itajaí Region).

20. Photos

Figure 1. Alto Vale do Itajaí region. (Photo by Wigold Schaffer)

Figure 2. Field visit during the I LUD seminar in April 2016. (Photo by Wigold Schaffer)

Private restoration of degraded forest land with native tree species in the Peruvian Amazon	
1. Proponent	*Bosques Amazónicos SAC* (BAM) company through its *Campo Verde* project[9]
2. Country of implementation	Peru
3. Location	Campo Verde, Ucayali Region (Peruvian Amazon)
4. Implementation period	Ongoing since 2008
5. Restoration option	Restoration of degraded forests for production ☐ Restoration of degraded forests for protection ☐ (Ecological restoration of protective functions, e.g. soil, water, biodiversity) Rehabilitation of degraded forest land through planted forests ✓ Rehabilitation of degraded forest land through agroforestry and/or silvopastoral systems ☐ Management of secondary forests ☐ Restoration or rehabilitation of mangroves ☐
6. Focus of the case	Process ☐ Planning ✓ Assessment / Monitoring ✓ Intervention level ✓
7. Target/Main objective	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.
8. Target group or users	Reforestation companies, rural communities and extensionists
9. Partners & collaborators	AIDER (Asociación para la Investigación y Desarrollo Integral), INIA (National Institute for Agrarian Innovation), GOREU (Regional Government of Ucayali)
10. Context (initial situation) and challenge (problem) addressed	The company's property in the central Peruvian Amazon of around 18 000 hectares comprises degraded pastureland, wetlands, grasslands and primary and secondary forests, reveals a pattern of unsustainable logging and farming since the 1960s. Since the 1980's, it was cleared in successive stages for cattle ranching and by the mid-1990's, active production on the land ceased. Continuous fires from neighbouring smallholding plots and soil degradation resulting from overgrazing and soil fragility precluded the natural regeneration of the original forest cover. In 2007 an area of 2,040 hectares of degraded pastures were targeted for restoration under the *Campo Verde* project.
11. Process and methodological approach, techniques and tools used	The design and planning of the *Campo Verde* Project considered a sequence of assessments/studies and activities: – Biophysical assessment for the characterization of 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 the understanding of the core characteristics and aspirations of the village people and settlements located in the proximity to the project area – Design of the technical proposal, including the preparation of the main components of the proposal (species selection, soil preparation, quality of plants to use according to the dominant vegetation and planting design, spacing, management regimes etc.) based upon the infield biophysical surveys and analyses, literature review and

[9] 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 operates since 2008 (http://www.bosques-amazonicos.com/en)

	experts' opinion. – Establishment of a central nursery with a production capacity of one million plants per year in polyethylene bags from seed propagation – Establishment of the forest plantation using four native timber species combining fast (*Simarouba amara* Aubl., local name marupa), medium (*Dypterix ferrea* Ducke, shihuahuaco) and slow (*Tabebuia serratifolia* (Vahl) Nichols, tahuarí, and *Swietenia macrophylla* King, caoba or mahogany) growing species. In addition, the planting of the nitrogen-fixing species *Inga edulis* Mart. (guaba) with the purpose of ameliorating the soil, suppressing weed growth and providing 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 the mortality level, maximise growth and yield and mitigate the risk of pests and diseases – Research, carried out directly by BAM company or through partnerships with acknowledged research organisations – Monitoring, both for carbon marketing purposes (carbon stocks, leakages, emissions) and for the company's management needs in order to timely assess 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 such as the replication of the plantation model in parcels of rural families, and other crops.
12. Field-level practices implemented	Biophysical diagnosis to assess the drivers and level of degradation and to assist in the design of the intervention (species selection, soil preparation, quality of plants to use according to the dominant vegetation and planting design, among other aspects). 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 the pasture areas and the enrichment planting of the 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 neighboring population) and fire protection (20 to 30 m wide firebreaks, construction of water points for fire tenders, etc.) Community development program with neighboring villagers to prevent encroachment and contribute to local livelihoods
13. Innovative aspects	– The project management and business model considers 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 the phytosanitary control), for basic studies of plant production (cloning, etc.), monitoring and research as well as product processing and commercialization. For instance, the management regime for site preparation and the establishment of the 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 upon 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 biological control of insects attacking the planted timber species – Implementation of eco-business with carbon credits from greenhouse gas emission reductions through reforestation of native tree species on land degraded due to cattle ranching, as well as through natural regeneration. In 2008 the Campo Verde project became a Verified Carbon Standard (VCS) Afforestation/Reforestation (ARR) Project under the CCBA – Climate, Community and Biodiversity Alliance
14. Outcomes	The project restoration interventions have: – contributed to the valorisation of 2,040 ha of degraded land through forest plantations and assisted natural regeneration. By 2018 around 870 hectares have been reforested with almost two million valuable native trees (an average plantation rate of 270 ha/year). Additionally, 124 ha are being restored through protection measures and assisted natural regeneration – 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/metric ton) – fundamentally contributed to reverse a typical 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. Furthermore, the project intends to establish mahogany which is under serious risk of extinction (included in CITES list) because of its over exploitation for many years. An additional benefit is the improvement of water quality and quantity in the Agua Blanca river and other tributaries of the local water system. The project is generating interest for ecotourism as evidenced by the many visitors to the area (over 2,000 people annually), including professionals, producers (small- and medium landholders), interns and students from national and foreign universities The project is currently considered a reference for other companies and landholders interested in the business of planting native tree species in deforested/degraded forest lands in the country's Amazon region. BAM company has received a number of awards for its Campo Verde project, e.g.: the Gold level certification by the Climate, Community and Biodiversity Alliance (CCBA) 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*.
15. Conditions (institutional, economic, social, cultural, environmental) for successful replication in a similar context	– Private investors decision to finance a high-risk project – Careful planning considering specialization by activities to facilitate their correct understanding and the adoption of a working schedule geared to improve the technology, reduce costs and adapt to changing situations 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 the institutional alliances to the improve the 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
16. Main challenges faced	– Financial constraints. The initial objective of the *Campo Verde* Project to produce wood and commercialize carbon was later changed to just focus on the production of wood with native species of fast and slow growth. The sale of carbon was discontinued due to the heavy burden of prerequisites demanded that was not compensated by the income received. – High operational costs. The reforestation of degraded pastures in the local conditions is an expensive business, amounting to around USD 7,000 per hectare (including all direct and indirect costs). The challenge is to scale up operations and integrate with the management of the residual logged-over and secondary forests in the area – Weak government support. The regional and national governments have not shown real interest in the initiative and its potential model for adapting to smallholders' settlements. – Gaps of information. The use of native tree species at scale brings a number of challenges, particularly with regards to the gaps of information on taxonomy, silviculture and technological properties of several tree species.
17. 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 to be a success in the plantation model – Soil cover with legumes has proved to be an efficient way of biological control of 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 in the system at the third year – The accompaniment to the planted timber species through the regrowth or natural regeneration left on site is critical. The cutting of lianas or other creeping plants is essential – To ensure quality final products from the forest plantation the origin of the planting material and its traceability is of utmost importance – 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 alternate hosts and shelters to parasitoids is a good option to maintain the balance of 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 program to approach and raise awareness with neighbouring villagers and communities
18. Source(s) describing the case	Chavez R., J. and C. Sabogal. 2019. Restoring degraded forest land with native tree species: the experience of "Bosques Amazónicos" in Ucayali, Peru. *Forests 2019, 10(10), 851; https://doi.org/10.3390/f10100851* BAM - Bosques Amazónicos: http://www.bosques-amazonicos.com/en/our-projects/reforestation-of-native-species-in-campo-verde-ucayali

19. Contributors	Jorge Chávez Rodríguez (Bosques Amazonicos SAC) and Cesar Sabogal (independent consultant)

20. Photos

Figure 1. Degraded pasture with remaining high forest before start of the Campo Verde project showing the delimitation of the restoration area in management units (Photo by BAM)

Figure 2. Planting Inga edulis and timber species (Photo by BAM)

Figure 3. View of the Campo Verde reforestation area on degraded pastures 7 years after starting (Photo by BAM)

From *Eucalyptus* monocultures to high diversity mixed forests: bringing together wood production and tropical forest restoration	
1. Proponent	University of São Paulo – "Luiz de Queiroz" College of Agriculture (USP / ESALQ) - *Laboratório de Ecologia e Restauração Florestal – LERF and Laboratório de Silvicultura Tropical - LASTROP*
2. Country of implementation	Brazil
3. Location	Aracruz (State of Espírito Santo), Mucuri and Igrapiúna (State of Bahia)
4. Implementation period	2011 - 2012
5. Restoration option	Restoration of degraded forests for production ✓ Restoration of degraded forests for protection ☐ (Ecological restoration of protective functions, e.g. soil, water, biodiversity) Rehabilitation of degraded forest land through planted forests ☐ Rehabilitation of degraded forest land through agroforestry and/or silvopastoral systems ☐ Management of secondary forests ☐ Restoration or rehabilitation of mangroves ☐
6. Focus of the case	Process ☐ Planning ☐ Assessment / Monitoring ☐ Intervention level ✓
7. Target/Main objective	Temporary mixed plantations of *Eucalyptus* and a high diversity of native trees to produce wood and offset part of the costs of planting and maintaining tropical forest restoration.
8. Target group or users	Small to large farmers who need to restore degraded sites in marginal areas of production.
9. Partners & collaborators	The University of São Paulo, FAPESP, The Atlantic Forest Restoration PACT, pulp and paper companies and the NGO *Organização de Conservação da Terra*.
10. 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 monoculture plantations and were then converted to a mixed forest composed of *Eucalyptus* and a high diversity of native trees to offset the costs of tropical forest restoration.
11. Process and methodological approach, techniques and tools used	Use of active restoration through tree seedling plantation to establish a high diversity mixed forest following the best commercial silvicultural techniques available to grow and harvest trees.
12. Field-level practices implemented	Up to 30 native tree species were intercropped with *Eucalyptus* at a 2x3 or 3x3 m spacing. Common silvicultural practices (soil fertilization, weed- and ant-control) for all seedlings, either native or *Eucalyptus* were adopted. The native trees were grouped in rows according to three main ecological groups to facilitate future harvesting. We used two types of native seedling rows: 10 species of intermediate growth rate in one type of row and 10 latter successional species alternated with 10 fast-growers in the other type of row. These types of native species rows were alternated with rows of clonal *Eucalyptus* in a 1:1 proportion.
13. Innovative aspects	This was the first time *Eucalyptus* was intercropped with a high diversity of tropical tree species. We used controlled conditions and tested this silvicultural solution in large scale in three different sites. As part of the same experiments, we also compared these

	high diversity mixed forests with traditional restoration plots and pure *Eucalyptus* plots to serv as controls.
14. Outcomes	The survival rates of all species in these high diversity mixed stands was generally the same as in *Eucalyptus* monocultures and in traditional restoration sites. The competition with *Eucalyptus* slowed the growth of the fastest growing native trees, and did not affect the slow-growers. So far, two of the three sites have been harvested using both chainsaw and animal traction in one site and harvesters and forwarders in the other site. The volume of wood produced in the first rotation of *Eucalyptus* and the damage of harvesting operations on native trees were measured. *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 near sources of seeds and other propagules, natural regeneration potential may be high and can occupy the space left after the harvest of *Eucalyptus*. Most of the mixing effects we observed (increased growth of *Eucalyptus* and slowed growth of native trees) were attributed to competition for water. Thus, we suggest that the native fastest growing species are planted after the final harvest of *Eucalyptus* (if already not present as a result of natural regeneration).
15. Conditions (institutional, economic, social, cultural, environmental) for successful replication in a similar context	This solution applies to small- to large-scale forestry and can be easily replicated in other regions of the tropics if seedlings of *Eucalyptus* and 10-30 or more different native species are available. Even when the volume produced is not enough for commercial operations, the wood produced can be used within the property for fencing and other constructions, firewood and other valuable uses.
16. Main challenges faced	The high costs of restoring tropical forests and the need to develop economically viable ecological restoration projects with economic returns are the reasons that encouraged us to develop these high diversity mixed forests. Now that this has been successfully tested, landowners can adopt similar solutions and adapt to their regions at the scale they need in a way to achieve the highest conservation values and the maximum economic return.
17. Key messages and lessons learned	– The system is a viable option for forest landscape restoration; – Tree survival is high, the growth of individual *Eucalyptus* trees is increased in the mixed plantation, while the growth of some native trees is decreased (specially the naturally fast-growing ones); – The natural regeneration in the understory can be abundant and depends on the matrix the plantation is embedded in; – The harvesting of *Eucalyptus* causes some damage to neighbouring planted native trees and to seedlings from natural regeneration, but the damage may be compensated by their growth after *Eucalyptus* removal.
18. Source(s) describing the case	Amazonas, N. T., Forrester, D. I., Silva, C. C., Almeida, D. R. A., Rodrigues, R. R., & Brancalion, P. H. (2018). High diversity mixed plantations of *Eucalyptus* and native trees: An interface between production and restoration for the tropics. Forest Ecology and Management, 417, 247-256. Amazonas, N. T., Forrester, D. I., Oliveira, R. S., & Brancalion, P. H. (2018). Combining *Eucalyptus* wood production with the recovery of native tree diversity in mixed plantings: Implications for water use and availability. Forest Ecology and Management, 418, 34-40. Amazonas, N. T. (2018) High diversity mixed plantations in Brazil: Eucalyptus intercropped with native tree species (Doctoral dissertation, Universidade de São

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19. Contributors	Nino Tavares Amazonas [a], Carina Camargo Silva [a], Pedro H.S. Brancalion [a], Ricardo Ribeiro Rodrigues [b] [a] University of São Paulo, "Luiz de Queiroz" College of Agriculture, Forest Sciences Department, Tropical Silviculture Laboratory, Avenida Pádua Dias, 11, CEP 13.418-900 Piracicaba, SP, Brazil [b] University of São Paulo, "Luiz de Queiroz" College of Agriculture, Biology Department, Forest Ecology and Restoration Laboratory (LERF/ESALQ/USP), Avenida Pádua Dias, 11, CEP 13.418-900 Piracicaba, SP, Brazil

Photos (Please indicate title and credit for each high-resolution photo)

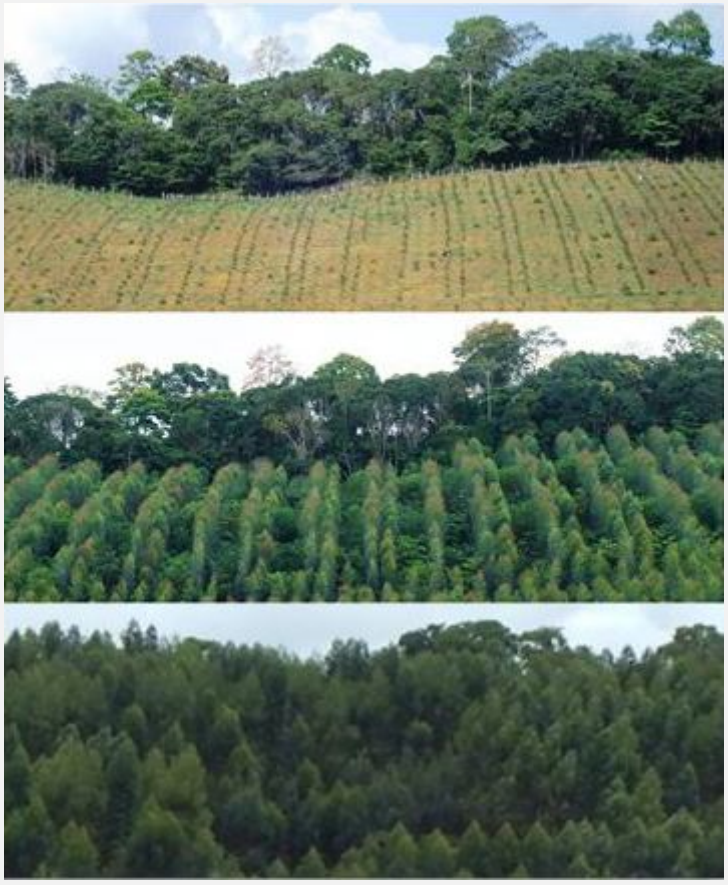

Figure 1. Growth of a mixed forest composed of Eucalyptus intercropped with a high diversity of native trees in an experimental site in Igrapiúna (Bahia), Brazil. Photos were taken one week after planting, 30 and 44 months after planting. (Photos by Carina Camargo)

Figure 2. 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 State, Brazil, and had 51 months when the picture was taken. 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, that could still access full sunlight. (Photo by Nino Amazonas).

Strengthening cocoa value chain for upscaling FLR through agroforestry in Guatemala	
1. Proponent	International Union for Conservation of Nature (IUCN)
2. Country of implementation	Guatemala
3. Location	*Franja Transversal del Norte*[10], Guatemala
4. Implementation period	2011 – 2019
5. Restoration option	Restoration of degraded forests for production ☐ Restoration of degraded forests for protection ☐ (Ecological restoration of protective functions, e.g. soil, water, biodiversity) Rehabilitation of degraded forest land through planted forests ☐ Rehabilitation of degraded forest land through agroforestry and/or silvopastoral systems ✓ Management of secondary forests ☐ Restoration or rehabilitation of mangroves ☐
6. Focus of the case	Process ✓ Planning ✓ Assessment / Monitoring ☐ Intervention level ✓
7. Target/Main objective	To promote agroforestry restoration in the Biological Corridors of the Lachuá Ecoregion and to improve people´s livelihoods through the strengthening of cocoa production and supply chains, as well as ensuring an adequate source of funding from both public and private investors.
8. Target group or users	Cocoa producers, field technicians and government officers.
9. Partners & collaborators	Fundalauchuá (Fundación Lachuá)
10. Context (initial situation) and challenge (problem) addressed	The cacao market in the world has currently an unmet demand of about 150,000 metric tons 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 this crop a source of income and employment generation for small, medium and large producers who live in areas with potential for the development of this crop. Currently, Guatemala contributes only to 0.26% of the global cacao production with around 5,000 ha. The goal of the N Strategic Plan of the Cacao Agro-chain of Guatemala[11] (2016-2025) is to increase the cacao area up to 15,000 ha during the next 10 years. Cacao agroforestry systems have a high conservation value and potential for landscape restoration in areas that have been degraded over the years due to the advance of the agricultural frontier, through unsustainable crops, livestock, and other factors. In the last 20 years the country has invested in the forestry sector a total of USD 173 million through the forestry incentives PINFOR and PINPEP[12]. While PINPEP is still in place, in September 2015 a new program, PROBOSQUE[13], replaced PINFOR to continue with this effort for an additional period of 30 years with the aim of contributing to the government target of

[10] 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, part of the departments of Huehuetenango, Quiché, Alta Verapaz and Izabal

[11] The document of the strategy can be found, in Spanish, here: https://www.maga.gob.gt/download/enac16-25.pdf

12 PINFOR is the Forest Incentives Program. PINPEP is the incentive program for holders of small areas of forest or agroforestry land.

[13] PROBOSQUES is the incentive program for the establishment, recovery, management, production and protection of forests in Guatemala.

	restoring 1.2 million ha of degraded forest land. The National Restoration Strategy of Guatemala was designed and approved in 2015. Its main economic support is the PROBOSQUE program, as well as PINPEP. The National Restoration Strategy has been supported by IUCN through ROAM (the Restoration Opportunities Assessment Methodology) implementation and the facilitation and strengthening, since 2014, of the National Forest Landscape Restoration Roundtable. The restoration strategy aims at generating income and livelihoods improvement through addressing poverty and natural resource degradation. It clearly seeks to establish public-private partnerships and attract investment, to strengthen value chains and promote the demand for sustainable products from restoration actions. In line with the different FLR related policies and programs, since 1997 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 - is promoting the conservation of the Lachuá ecoregion through (i) governance strengthening; (ii) natural ecosystem management and promotion of sustainable forest management; and (iii) sustainable productive economic options, such as agroforestry. Since 2016, IUCN and Fundalachuá shifted their action towards the development of business models focusing on supply-demand of added value products and building alliances with the public and private sector to scaling up the experience, including the improvement of access to technologies and market products. Under 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 (establishment of at least 15,000 ha of cocoa in SAF by 2025) in other areas, in particular in the Verapaz area (Lachuá, Cahabón, Polochic) and the southern part of Petén.
11. Process and methodological approach, techniques and tools used	The methodological approach defined the strategy of intervention as an innovation model operating through five dimensions: production technology, commercialization, organization, governance and finance. – Production technology: Creating conditions and capacities for the production of highquality 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 through centers for collection and transformation which aggregate value to production, and guarantee quality and quantity in stocks, giving producers the power for negotiating directly with international buyers. – Organization: Creating the conditions to allow that producers' associations have the capacity of absorbing 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 grains in quality and quantity to the buyers. – Governance: Developing multistakeholders platforms for the management of the production chain with a strong public support in cooperation with the private sector. – Finance: Providing opportunities and prospects for private investors, as well as promoting public investment.
12. Field-level practices implemented	Field activities are mostly represented by technical support and capacity building for the establishment of cocoa agroforestry systems, including the identification, selection and reproduction of high value genetic material through cloning superior trees. This generated 85,000 cloned plants in the Lachuá Ecoregion which are expected to produce

	1,000 kg/ha/year with proper management.
13. Innovative aspects	The innovative aspect is represented by the strong focus on strengthening the value and production chains of a specific commodity (cacao) in order to generate the conditions and the enabling environment (political, institutional and economic) for upscaling FLR through agroforestry models based on this commodity. Indeed, project results have motivated the government to prioritize the promotion of the cocoa production and the creation and integration of policies and government programs such as the "Zero Hunger" program, Forestry and Agroforestry Incentive Programs, the Rural Outreach Program, and the National Fund for Agricultural Development. By integrating human, technical and financial resources; and using the experience generated in Lachuá, these programs will become an economic engine of broad institutional base to generate employment and increase income in the most marginalized areas with great land base potential for cultivating cocoa agroforestry systems in the *Franja Transversal* del *Norte* Region in Guatemala.
14. Outcomes	The Project generated a change within the cocoa vale chain, from production to commercialization, as well as to the services supporting it, such as organization, governance and finance, showing that it is possible for organized groups of small-scale producers to manage a profitable production model without affecting the natural resources of the landscape. Specifically, the results obtained where the following: – 500 producers involved and 776 ha of cocoa agroforestry implemented – Increased cocoa yields from 180 kg/ha to 500 kg/ha (70 kg/ha to 192 kg/ha dry grain) – Increased average annual income of an estimated USD 1,411 per producer – Creation of 315 new full-time jobs – Positioning and access to the international cacao bean market through trade agreements allowing 236 small organized private producers of Alta Verapaz selling their product with annual revenue of USD 197,400 – “Bean to bar” market: Commercial alliances with 36 chocolate enterprises from the international market of United States, Europe and Asia, allowing a price increase from USD 2.28/kg to USD 4.5/kg (USD 4,500 per metric ton) – Improved consistency of dry-fermented grain in terms of quality and volume, with fermentation rates between 70% and 90% and grain moisture between 7% and 7.5% – A financial program relying on an operational plan for production and the creation of a revolving fund, guarantying that the material needed for production will be in the quality and quantity required – More than USD 1 million invested by the government in supporting agroforestry models – Setting up of three collection and processing centers strategically located in producing areas in Cahabón and Lachuá Ecoregion, especially with the opening of the Cacao Verapaz Company which links producers directly with chocolate companies.
15. Conditions (institutional, economic, social, cultural, environmental) for successful replication in a similar context	Institutional conditions that need to be in place are the coordination of policies and government programs integrating human, technical and financial resources. Moreover, the impact of field activities must be reflected in increasing income and employment in marginalized areas. Under this context, while public investments can create the conditions for natural assets to be managed for the delivery of a range of societal benefits, the role of private finance and the need for business models at different levels have been identified as critical components.
16. Main challenges faced	Main challenges have been mostly related to the strengthening of value chain and unlocking private finance at the necessary scale, including: – matching quantity and quality (different groups) to respond to increased demand;

	– diversifying buyers; – providing evidences of impact on farming systems, livelihoods and ecosystem services; – need for a substantial increase in the pipeline of investable projects; – need for systematic de-risking of projects that are often perceived as unfamiliar and risky by the conventional finance sector; – construction of investment vehicles of an appropriate size and familiarity to interest institutional investors.
17. Key messages and lessons learned	Nature conservation wasn't always regarded as the obvious route to development. In Guatemala, where farmers are sustainably growing cocoa while conserving forests, it has become just that. Sustainable cocoa products allow Guatemalan farmers to earn up to USD 1000 per hectare, compared to USD 60 per hectare for subsistence agriculture. Strengthening the cacao producer organizations and improving supply chain performance motivate producers to continue establishing cacao agroforestry production systems. At the same time, more actors such as government, private companies, and non-governmental support agencies are interested in making investments to promote cacao cultivation, trying to take advantage of the current market opportunities through the improved business environment. All this generates a virtuous cycle which allows upscaling of FLR at the landscape level.
18. Source(s) describing the case	https://i-m-magazine.com/?p=1053 https://www.uncommoncacao.com/lachua-guatemala https://www.iucn.org/node/31940
19. Contributors	Silvio Simonit, Orsibal Ramírez and Leander Raes, all from IUCN
20. Photos	

Figure 1. IUCN has strengthened livelihoods of rural communities in Guatemala through the improvement of the value chain of the cocoa production. (Photo by IUCN ORMACC/ Erick Ac)

Figure 2. Local producers of Alta Verapaz region participated in Cocoa Field Schools on pre-production, production, value added and marketing. (Phot by: IUCN ORMACC/ Erick Ac)

Productive rehabilitation of tropical cattle ranching lands in Colombia	
1. Proponent	Colombian Sustainable Cattle Ranching Project (*Proyecto Ganadería Colombiana Sostenible*)
2. Country of implementation	Colombia
3. Location	The Colombian Sustainable Cattle Ranching Project (CSCRP) takes place in 87 municipalities of 12 departments, grouped into five ecoregions where cattle ranching exists close to protected areas: Lower Magdalena, Cesar River Valley, Coffee Ecoregion (Quindío, Risaralda, Caldas, Tolima and Valle del Cauca), Oak Corridor (Boyacá and Santander) and Andean Foothills (Meta).
4. Implementation period	2012 – 2020
5. Restoration option	Restoration of degraded forests for production ☐ Restoration of degraded forests for protection ☐ (Ecological restoration of protective functions, e.g. soil, water, biodiversity) Rehabilitation of degraded forest land through planted forests ☐ Rehabilitation of degraded forest land through agroforestry and/or silvopastoral systems ✓ Management of secondary forests ☐ Restoration or rehabilitation of mangroves ☐
6. Focus of the case	Process ☐ Planning ☐ Assessment / Monitoring ☐ Intervention level ✓
7. Target/Main objective	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: (i) improving productivity in participating farms through Silvopastoral Systems – SPS; (ii) enhancing connectivity and reducing land degradation through different Payment for Environmental Services - PES schemes; and (iii) enabling a wider adoption of SPS by building the capacities of farmers and extensionists and strengthening institutions in the livestock sub-sector.
8. Target group or users	Cattle ranchers of five Colombian ecoregions (> 85% of participating farms were small and medium sized).
9. Partners & collaborators	FEDEGAN (lead executing agency); CIPAV[14], FONDO ACCIÓN[15] and The Nature Conservancy (allies and co-implementers); GEF and the UK government (funding agencies), and The World Bank (implementing agency).

[14] CIPAV - *Fundación Centro para la Investigación en Sistemas Sostenibles de Producción Agropecuaria (www.cipav.org.co).*
[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/en/home/)

10. Context (initial situation) and challenge (problem) addressed	Cattle ranching contributes 1.4% of Colombia's gross domestic product (GDP) and 21.8% of the agricultural GDP and generates 810,000 direct jobs that represent 6% of national employment and 19% of employment in the agriculture sector. Cattle grazing occupies approximately 39.2 million hectares, equivalent to 34.3% of the Colombian territory and supports a bovine population of 23,475,022 animals. Most conventional livestock systems rely heavily on grass monocultures where 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, loss of hydrological regulation and increased greenhouse gas emissions.
11. 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 in their farms. Payment for environmental services: Two PES schemes were applied. One rewarded biodiversity conservation resulting from forest and wetland protection or the implementation of SPS; the other scheme promoted intensive silvopastures for their contribution 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 the cultural change of conventional farmers. They were used to (1) evaluate silvopastoral innovations; (2) generate information on the established SPS; (3) train ranchers, students, technicians and professionals; (4) serve as a model for cultural change towards sustainable livestock production, which includes the transmission of values and intergenerational exchange; and (5) showcase behaviors of respect for nature. Research, innovation and monitoring: Research done within 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 6 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 a set of native trees and palms of global conservation concern, which were planted or managed in SPS and riparian forests in order to enhance connectivity and the conservation value of livestock dominated landscapes.
12. 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 to 50 trees per hectare, planted or protected in paddocks. Intensive silvopastoral systems (ISPS): From O-2,000 meters above sea level, ISPS include 5,000 or more fodder shrubs and up to 500 trees per hectare. The most common shrub species are *Leucaena leucocephala, Tithonia diversifolia and Guazuma ulmifolia*, combined with fruit trees, timber trees or palms. Above 2000 meters of altitude, ISPS include 100 native trees per hectare, interspersed with 2000 forage shrubs planted in strips of four rows every 40 meters. Fodder hedges: Strips of fodder shrubs planted in high density. They include a line of trees at the center, planted 3 m from one another. Mixed fodder banks: 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 fiber), 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 some organisms and provide complementary resources for the farm such as fodder, fruits and wood.
13. Innovative aspects	– Technical assistance for sustainable ranching was implemented on an unprecedented scale and required a great 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 in participating farms – PES for carbon sequestration in participating farms – An inter-institutional public policy committee (two ministries and the national planning department) that articulated the project's activities to international goals – An inter-institutional arrangement where the livestock sector accepted the challenge of leading silvopastoral training based on agroecological principles
14. Outcomes	– Four open calls and 44,100 farmers approved for participation, 79.3% of which (3,250) were still active at the end of the Project. – 8,060 people trained in field days, 221 technicians and external professionals trained in sustainable cattle ranching and 2,807 beneficiaries of technology brigades. – Personalized support to participating farmers interested in establishing silvopastoral systems (5,978 technical visits for plantings in one semester). – A total of 30,080 hectares of silvopastoral systems and 4,572 hectares of intensive silvopastures established; 3,329 hectares of enrichment planting in natural forests (until June 2019). – 15,538 hectares of scattered trees in paddocks, established through natural regeneration.
15. 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 program – Infrastructure to provide technical assistance for small farmers – 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)
16. Main challenges faced	– High mortality of planted trees and shrubs during implementation phase associated with climatic uncertainty (three ENSO episodes during 8 years of implementation, with extreme and unpredictable weather, prolonged drought periods and atypical heat waves) – Geographic dispersion of participating farms – Imperfect land tenure
17. Key messages and lessons learned	– Farms should be concentrated in watersheds. The proximity and spatial aggregation of participating farms are critical for the efficient use of resources in a large-scale project such as this one. – Land use planning and training of farmers are required for the 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.
18. Source(s) describing the case	Giraldo C., Chará J., Uribe F., Gómez J.C., Gómez M., Calle Z., Valencia L.M., Modesto M., Murgueitio E. 2018. Ganadería Colombiana Sostenible: entre la productividad y la

	conservación de la biodiversidad. Pp 31-61 en: Halffter, G., M. Cruz y C. Huerta (Comps.). Ganadería sustentable en el Golfo de México. Instituto de Ecología, A.C., México, 432 pp. Federación Colombiana de Ganaderos - FEDEGAN. 2006. Plan Estratégico de la Ganaderia Colombiana 2019. Federación Nacional de Ganaderos de Colombia. Bogotá, Colombia. 296p. Federación Colombiana de Ganaderos - FEDEGAN. 2014. Disponible en: http://www.fedegan.org.co/estadisticas/produccion-0-2014. Federación Colombiana de Ganaderos. Bogotá, Colombia. Federación Colombiana de Ganaderos - FEDEGAN. 2018. Coyuntura ganadera 2018. Federación Colombiana de Ganaderos. Bogotá, Colombia. 14p.
19. Contributors	Zoraida Calle (Coordinator, Ecological Restoration Area, CIPAV and of the Colombian Programe of ELTI - Environmental Leadership & Training Initiative, Yale School of Forestry and Environmental Studies) and Enrique Murgueitio (CIPAV Executive Director)

20. Photos

Figure 1. The silvopastoral system as practiced in a farm in Cascajal, Piojó – Atlántico. (Photo by Carlos Alfaro)

Figure 2. The silvopastoral system as practiced in a farm in Palmarito - El Retorno, Guaviare. (Photo by Adolfo Galindo and Walter Galindo)

Restoration of mangrove ecosystems through community forestry in Myanmar	
1. Proponent	FREDA (Forest Resource Environment Development and Conservation Association) ACTMANG (Action for Mangrove Reforestation)
2. Country of implementation	Myanmar
3. Location	Pyindaye Reserved Forest (Pyapon Tsp, Ayeyarwady Region, Myanmar)
4. Implementation period	1999 – ongoing (Phase V: 2019 – 2024)
5. Restoration option	Restoration of degraded forests for production ☐ Restoration of degraded forests for protection ☐ (Ecological restoration of protective functions, e.g. soil, water, biodiversity) Rehabilitation of degraded forest land through planted forests ☐ Rehabilitation of degraded forest land through agroforestry and/or silvopastoral systems ☐ Management of secondary forests ☐ Restoration or rehabilitation of mangroves ✓
6. Focus of the case	Process ☐ Planning ☐ Assessment / Monitoring ☐ Intervention level ✓
7. Target/Main objective	Restoration of degraded mangrove forests and rehabilitation of abandoned paddy fields through mangrove reforestation with a community forestry approach.
8. Target group or users	Communities living within the Pyindaye Reserved Forest
9. Partners & collaborators	FD (Forest Department of Myanmar) FUGs (Forest User Groups) consisting of household heads, including villagers of all wealth classes, landless, young adults and women Tokio Marine (Tokio Marine & Nichido Fire Insurance Co. Ltd)
10. Context (initial situation) and challenge (problem) addressed	The mangroves in the Ayeyarwady Region experienced severe degradation and deforestation in the past decades. Due to the necessity of fuelwood and timber, the mangrove areas of the Ayeyarwady Delta had been particularly overexploited since the 1970s. Many degraded areas were later converted to rice fields and shrimp ponds so that by 2000 only 46% of the original 2623 km^2 of mangroves in 1978 were left. In the project area rice productivity strongly declined after about 10 years and as a result 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 (Cyclone Nargis in 2008).
11. Process and methodological approach, techniques and tools used	The project made use of the Community Forestry Instruction (1995) to restore mangrove forests together with local FUGs. Through a collaborative approach between the FD, local communities, NGOs and researchers, the strategy was to find locally adapted solutions to restore degraded mangrove areas and to jointly develop community forestry management plans for the long-term success. The methodology included field trials and research, capacity-building and trainings.
12. Field-level practices implemented	– Nursery establishment at different 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 revolving fund for aquaculture and crab farming – Eco-tourism trial – Capacity-building and environmental education for local communities
13. Innovative aspects	Additional activities to improve community livelihoods included crab farming in existing degraded mangrove areas and different types of aquaculture and agrosilvofishery on villagers' land.
14. Outcomes	– 2 639 ha of mangrove reforested (as of March 2019) – 4 279 households from 26 villages have forest user rights through the CFI (Phase I to IV) – Improved livelihoods of both FUG and non-FUG (non-timber forest products) – Increased awareness on the importance and sustainable use of mangroves in the wider project area – Reduced disaster risk for local communities
15. Conditions (institutional, economic, social, cultural, environmental) for successful replication in a similar context	– Knowledge on characteristics of the specific ecosystem, local mangrove species, and climatic and hydrological conditions – Collaboration between the Forest Department, local communities and regional NGOs as mediators – Local communities' awareness of mangroves' benefits and willingness to contribute to their restoration
16. Main challenges faced	Previous: – Complete soil degradation made the successful planting difficult – Encroachment of shrimp pond agriculture and salt production areas – Cyclone Nargis destroyed 25 000 ha of mangrove plantations in 2008 Current: – Commercialization rights for FUGs – Limited funding (roughly USD 650 / ha needed)
17. Key messages and lessons learned	Community-based mangrove restoration has high potential but needs long-term planning.
18. Source(s) describing the case	FREDA, ACTMANG, 2012. Ten years in Pyindaye. Restoration of mangrove ecosystems and community development. Thin Publishing House, Yangon Springate-Baginski O, Than MM, Wah NH, Win NN, Myint KH, Tint K, Gyi MKK, 2011. Community forestry in Myanmar. Some field realities, 50 p. Webb EL, Jachowski NRA, Phelps J, Friess DA, Than MM, Ziegler AD, 2014. Deforestation in the Ayeyarwady Delta and the conservation implications of an internationally-engaged Myanmar. Global Environmental Change, 24, 321–333
19. Contributors	Mélanie Feurer (Bern University of Applied Sciences, Switzerland) and Koichi Tsuruda (ACTMANG, Japan)
20. Photos	

Figure 4 Mangrove nursery managed by staff members from the surrounding communities © Mélanie Feurer 2015

Figure 2 Community forestry user group members in front of a 11-year old Bruguiera sexangula plantation © Mélanie Feurer 2015

Empowering local communities for restoration of coastal landscape in Ayeyarwaddy, Myanmar	
1. Proponent	The Center for People and Forests (RECOFTC)
2. Country of implementation	Myanmar
3. Location	Pyar Pon Township of Ayeyarwaddy Region, located in low lying Ayeyarwady Delta in the southwestern part of Myanmar.
4. Implementation period	2015 – 2018
5. Restoration option	Restoration of degraded forests for production ☐ Restoration of degraded forests for protection ☐ (Ecological restoration of protective functions, e.g. soil, water, biodiversity) Rehabilitation of degraded forest land through planted forests ☐ Rehabilitation of degraded forest land through agroforestry and/or silvopastoral systems ☐ Management of secondary forests ✓ Restoration or rehabilitation of mangroves ✓
6. Focus of the case	Process ✓ Planning ☐ Assessment / Monitoring ☐ Intervention level ☐
7. Target/Main objective	RECOFTC sought 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.
8. Target group or users	1,083 households/families from 22 community forestry user groups (CFUGs) participated.
9. Partners collaborators	RECOFTC and the Forest Resource Environment Development and Conservation Association (FREDA), with support by the Myanmar government's Forest Department (FD), implemented these interventions under the Norwegian Embassy in Yangon-funded "Scaling Up Community Forestry" (SUComFoR) project.
10. Context (initial situation) and challenge (problem) addressed	Local communities living along the coast in Pyar Pon Township were vulnerable to climate-induced, socio-economic shocks. The forests and rice paddies of the low lying Ayeyarwady Delta provided the sources for community livelihoods. But due to salt intrusions, 49% of the paddy fields were unproductive. This increased local pressures on the forest, which decreased at a rate of 1.9% per year between 1990 and 2015. The forests also faced threats from external illegal logging, unsustainable shrimp farming and salt production. These threats were evident in the severe reduction and fragmentation of surrounding mangrove forests. Mangrove forests were instrumental in protecting the settlements and agricultural lands from cyclones. Although their income relied on forests, local people were unable to play a meaningful role in restoring and conserving the landscape since 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 firewood, crabs and other forest products.
11. 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 program, the interests and needs of local communities to participate in the program and the 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 program. Trainings were designed and delivered: A landscape workshop was organised at the township level to discuss collaboration among stakeholders, including government, Civil Society Organizations (CSOs) and local communities. It was followed by general trainings 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, where the participants would immediately apply the knowledge and skills in their localised context. Those trained at the national level—Forest Department officials and CSO staff—would then train stakeholders at the township level. Community Forest Management Committee members would then train their respective CFUG members. Support was provided for CF formalization and management: RECOFTC supported local communities to follow the 9-step formalization process outlined in the Community Forestry Instructions (1995, revised 2016 and 2019). This process coincided with additional trainings. 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 further training and financial resources for restoration practices. Each local community received between USD 5,000 and USD 8,000 to establish nurseries and plantations, including mangroves. Policy issues were addressed at the national level: The challenges of 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 with one another to address the common issues facing the landscape. This network was connected to the national level through the Community Forestry National Working Group, a national multi-stakeholder platform that discusses issues related to community forestry.
12. 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 formalise 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 landscape 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 have also planted 585,000 mangrove seedlings across 1500 ha in 2017, and 225,000 mangrove seedlings across 600 ha in 2018. These actions have reduced forest degradation and contributed to reforestation efforts within the CFs. 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 also been erected for protection. With these interventions, local communities have reported higher incomes from the mangrove seeds, fish, crabs and prawns.
13. Innovative aspects	By focusing on formalizing rights and enhancing livelihoods, this case provided local communities with the support and resources needed for them to protect and reforest their degraded landscape. By empowering people to make the decisions on forest management, this approach ensures ownership of action and financial viability. This is necessary to sustain participation following a project's completion.
14. Outcomes	Local communities now have greater control over the natural resources they use for their livelihoods, including 4,159 ha of forest. The CFUGs also 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 who were interviewed reported better forest health and reduced degradation. This was 10% higher than in 2016. Of those interviewed, 60% also said the forest plays a larger role in their livelihoods. This is compared to 20% who reported this in 2016.
15. Conditions (institutional, economic, social, cultural, environmental) for successful replication in a similar context	Landscape beneficiaries need to be the primary focus of restoration practices. Institutional frameworks are necessary to support local initiatives but are not sufficient by themselves. Projects must incorporate community needs and interests and provide capacity development when necessary. This often also requires supporting multiple stakeholders who face capacity issues when engaging with local communities. Communities working to reduce deforestation and implement reforestation policies need to have strong rights and secured tenure based on customary practices. This ensures effective participation from local stakeholders and guarantees fair benefits.
16. Main challenges faced	Local communities rightfully expect restoration practices to increase their livelihoods through forest products. But improvement in the condition of degraded forests is a slow process which 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 forest landscape restoration (FLR).
17. Key messages and lessons learned	The equitable participation of local people is a precondition for FLR to be successful. The formalization of rights and tenure, the enhancement of livelihoods and the development of key capacities are important when encouraging local communities to engage in restoration and address issues of forest degradation. If these are not secure, FLR will not be successful
18. Source(s) describing the case	Feurer, M. 2017. The role of mangrove community forests for climate change adaptation in the Ayeyarwady Delta, Myanmar. M.Sc. thesis School for Agricultural, Forestry and Food Sciences HAFL, Bern University of Applied Sciences BFH. RECOFTC, 2018. Scaling Up Community Forestry in Myanmar (SUComFor): Final report, submitted to the Royal Norwegian Embassy of Myanmar. Regional Community Forestry Training Center for Asia and the Pacific- RECOFTC.
19. Contributors	Aung Kyaw Naing, Lok Mani Sapkota, Jeffrey Williamson, Anna Roebuck and Martin Greijmans (RECOFTC)
20. Photos	

Figure 1. Participants examine agroforestry designs including crab culturing and the conservation of natural mangroves.
(Photo credit: RECOFTC)

Figure 2. A mangrove nursery in Pyar Pon Township.
(Photo credit: RECOFTC)

Restoration and community management of mangroves in the western part of Madagascar	
1. Proponent	World Wildlife Fund (WWF) Madagascar
2. Country of implementation	Madagascar
3. Location(s)	West coast of Madagascar
4. Implementation period	Since 2010
5. Restoration option	Restoration of degraded forests for production ☐ Restoration of degraded forests for protection ☐ (Ecological restoration of protective functions, e.g. soil, water, biodiversity) Rehabilitation of degraded forest land through planted forests ☐ Rehabilitation of degraded forest land through agroforestry and/or silvopastoral systems ☐ Management of secondary forests ☐ Restoration or rehabilitation of mangroves ✓
6. Focus of the case	Process ☐ Planning ☐ Assessment / Monitoring ☐ Intervention level ✓
7. Target/Main objective	Improving the resilience of the mangrove ecosystem to ensure the maintenance of its ecological functions and improving the well-being of the communities to alleviate pressures on this ecosystem due to the overexploitation of resources.
8. Target group or users	Members of the local basic communities (COBA), fishermen's cooperatives members, federations of the COBAs and civil societies members.
9. Partners & collaborators	Region, Districts, Municipalities Decentralized technical services, especially the Regional Directorate of Agriculture, Livestock and Fisheries (DRAEP) and the Regional Directorate for Environment and Sustainable Development (DREDD) Civil society members National and international NGOs and programs
10. Context (initial situation) and challenge (problem) addressed	Madagascar's mangroves are the second largest mangrove swamp in the Western Indian Ocean (WIO) region with relatively high mangrove diversity (8 species). The annual deforestation rate in Madagascar showed that mangrove ecosystems suffered less than other forest ecosystems. However, the irrational exploitation of resources and the massive arrival of migrants mostly from the south part of Madagascar to settle in the mangrove areas is a threat to this ecosystem. Migrants are in search of survival means, potential resources and markets, and their practice converting mangroves areas into cultivated land leads to a consequent loss of mangroves. The local governance of natural resources is still weak, and the impacts of climate change are real. For the Manambolo-Tsiribihina delta, between 1990 and 2000, it is estimated a loss of 38.9% of the total area of mangroves. To tackle this degradation, WWF identified priority sites for restoration and defined strategies to cope with threats and pressures on this ecosystem.
11. Process and methodological approach, techniques and tools used	Community-based approach. A participatory and inclusive approach integrating local communities along the restoration process. It empowers them as actors and beneficiaries in the process of improving their life quality. Multi-level and multi-stakeholder holistic approach: As the legislative framework alone

	does not preserve natural resources, collaboration with other actors (NGOs, associations, ...) for improving the living standards of community people is required. During its interventions, WWF and its partners demonstrated how the positive impacts of conservation can improve the quality of life of communities. This intervention is based on a community management transfer system, a tool set up to empower local communities in Madagascar. Through this management transfer system, WWF strengthens the communities on their capacities to manage these natural resources, providing technical and organizational support for community-based organizations. WWF also supports communities through the promotion of income-generating activities to diversify community sources of income and thereby reducing the pressure of over-exploitation of mangroves. The field team presence is essential in order to build a relationship, trust and to ensure real appropriation of activities.
12. Field-level practices implemented	– Support on implementation of the sustainable management plan – Sensitization and mobilization sessions for COBas members and the community, and promote their empowerment – Taking into account the social (community involvement, choice of IGA, development of collaboration) and cultural aspect of the region (e.g. community meal during the restoration campaign, festive driving campaign) when implementing all activities of restoration – Monitoring system implemented with communities´ members (Patrol led by "polisin'ala")
13. Innovative aspects	Proximity support provided through establishment of a direct fund for local partner associations to carry out their activities. This strengthens the technical and institutional skills of these structures, allowing them to carry out their mission according to their mandate.
14. Outcomes	– 1,600 households in the 12 local communities are empowered in the sustainable management of the 47,000 ha of mangroves – 560 ha of degraded mangrove areas planted – Keeping the ecological goods and services of the mangroves (e.g., recurrence of the mangrove crabs in the restored sites) which benefit the local communities and subsequently improve the food security and their incomes (beekeepers, community tourism ...) – Reduction of deforestation of mangroves is observed within areas managed by communities – Communities are aware of the link of mangrove restoration and the availability of halieutic resources (crabs, shrimps, ...)
15. Conditions (institutional, economic, social, cultural, environmental) for successful replication in a similar context	– Spatial, technical and scientific framework of the restoration process allowing all stakeholders to harmonize their approach – Presence of a structure / space of consultation for the various actors concerned – Building relationships and trust – Local communities are aware and convinced of the economic and social importance by preserving the mangrove ecosystem – Combined approaches with local culture (traditional dance…), village festival (football match, poems contest…) – Integrate the activities in a regional scale plan (e.g., fisheries management plan, regional development plan…)
16. Main challenges	– Difficult accessing and isolation of certain sites

faced	– Securing restoration area – Sufficient support at the level of local / regional policy makers – Integration of migrants (especially seasonal migrants) in the structures in place (COBAs)
17. Key messages and lessons learned	– Active restoration is a way of engaging communities and showing them that they are part of the solution for the preservation of the environment – Local communities are the core of the mangrove management mechanism – Considering various local dynamics (social, economic, cultural) in the implementation activities especially alternative income generation activities – Ensure the durability of the results/achievements/impacts by integrating them into a stable structure such as municipalities (e.g., integration of restoration activities, protection of the restored area into a municipal decision) – Always think about diversification of the sources of income – Periodic appraisal with the community members is important
18. Source(s) describing the case	Shapiro A., et al. 2019. The mangroves of Madagascar - cover, status and trends 2000-2018. WWF Germany and WWF Madagascar Jones T., L. Glass, S. Gandhi, L. Ravaoarinorotsihoarana, A. Carro, L. Benson, G. Cripps. 2016) Madagascar's Mangroves: Quantifying Nation-Wide and Ecosystem Specific Dynamics, and Detailed Contemporary Mapping of Distinct Ecosystems. Portland University. Projet Eco-Régional REDD+. 2015. Forêts Humides de Madagascar (PERR-FH), Consortium Wildlife Conservation Society (WCS), Office National pour l'Environnement (ONE), Madagascar National Parks (MNP), Association ETC TERRA Edmond R., H. Razakanirina , H. Rakotondrazafy, T. Ramahaleo. 2012. Vulnérabilité des mangroves de la cote oust de Madagascar au changement climatique : cas des écosystèmes des mangroves de Belo sur tsiribihina et de Masoarivo. DBEV et WWF MWIOPO
19. Contributors	Eric Ramanitra (eramanitra@wwf.mg), Tony Rakotondramanana (trakotondramanana@wwf.mg) and Mialisoa RAHARIMANANA (mraharimanana@wwf.mg) - WWF Madagascar
Photos	

Figure 1. Women leading mangrove restoration in Benjavilo village, Manambolo delta, western Madagascar. (Photo by Tony Rakoto, WWF) MDCO

Figure 2. Women from Manombo Village, western Madagascar are spending a whole afternoon sorting out mangrove propagules before planting them. (Photo by Pauline Dame / WWF Madagascar)

LESSONS FROM THE CASE STUDIES FOR THE SUCCESSFUL IMPLEMENTATION OF FLR IN THE TROPICS

Addressing the FLR principles and guiding elements

Most of the case studies illustrate the application of three or more FLR principles, especially principles 2 (*stakeholder engagement and participatory governance*), and 3 (*multiple function restoration*). Efforts to address principle 1 (*landscape focus*) are least represented. Of the guiding elements, the most deployed among the case studies are *stakeholder engagement* (G6), *stakeholder capacity* (G10), *restoration for livelihood improvement* (G15), *restoration of degraded forests and rehabilitation of degraded forest lands* (G18), *income opportunities* (G25), *participatory planning, decision-making and monitoring* (G9) and *biodiversity conservation and restoration of ecological functions* (G14).

Key conditions and lessons

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

Landscape/land-use planning [P1, GE1, GE3; and 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 10, 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 10, Brazil)
- Planning should link and integrate activities at larger jurisdictional scales (case study 17, Madagascar), and sufficient funding should be allocated (case study 14, Colombia)

Land tenure and rights [P1, GE4; and 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 7, 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 (case study 16, Myanmar)

Stakeholder engagement and commitment—addressing community needs and interests [P2, G6]

- Stakeholder engagement, especially among local communities, plays a big role in the success of forest restoration projects (case study 6, Ethiopia). It helps in laying the groundwork for effective partnerships among government, community forestry groups, and the private sector (case study 7, 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 16, Madagascar)
- The engagement of local stakeholders and the provision of incentives for local communities are key factors in convincing concerned parties that assisted natural regeneration (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 believe and develop a sense of ownership towards surrounding forests. This improves not only forest production but also forest conservation (case study 6, Ethiopia)

Awareness and recognition of benefits [P2, G6, G12]

- 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 for FLR (case study 4, Philippines; case study 16, 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 or off (case study 3, Ecuador)

Institutional coordination and supporting arrangements [P2, G5]

- 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 13, Guatemala)
- Institutional frameworks are necessary to support local initiatives at the landscape scale (case study 16, 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 17, Madagascar)

Collaboration and cooperation [P2, G6, G9, G10]

- Collaboration and cooperation among stakeholders contribute to the success of FLR (case study 4, Philippines; case study 15, Myanmar). Among other things, this requires building relationships and trust (case study 17, Madagascar), and the clear distribution of roles (case study 2 – Ghana)

Participation and participatory approaches [P2, G6, G9]

- The equitable participation of local people is a precondition for successful FLR (case study 16, Myanmar)
- Participatory approaches have proven to be effective in capacity building where training is linked to the implementation of community forestry activities (case study 7, Cambodia)
- Participatory approaches conducive to the success of FLR involve the active, balanced cooperation of national, provincial and municipal agencies with non-governmental organizations and research organizations, according to the objectives of local landowners and implementing factual corporate social responsibility (case study 3, Ecuador)

Leadership [P2, G9, G10]

- Projects should engage locally trusted, respected and visionary leaders (case study 3, Ecuador)
- The success of multistakeholder platform will be enhanced when key groups of actors in the landscape champion the identified priority actions and by the ongoing flow of information beyond platform meetings (case study 10, Brazil)

Dialogue process [P2, G6, G9, G7, G12]

- Dialogue processes are important for building long-term partnerships (case study 9, Brazil). For a dialogue platform to be truly inclusive, it must not only make space so that different stakeholders can participate but enable actors to present and negotiate their priorities (case study 9, Brazil)
- A central tenet of a landscape approach is that the end goal is not pre-defined but determined by the stakeholders through a process of visioning and balancing trade-offs, and this requires clear dialogue structure and objectives (case study 10, Brazil)

Capacity development [P2, G10, G5, G9]

- The development of key capacities is important for encouraging local communities to engage in restoration and address forest degradation (case study 15, Myanmar)

Investments and business plans [P2, G12; P5, G24]

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 critical components of FLR (case study 13, Guatemala)

Use of local knowledge [P3, G16]

Within 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 11, 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 17, Madagascar)

Livelihood provision, alternative income generation activities and diversification [P5, G23, G24, G25, G26]

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 environmental services, carbon credits, or alternative livelihoods (case study 2, Ghana)

Always think about diversification of the sources of income (case study 17, Madagascar)

Applied research [P5, G22, G23; P6, G28, G29, G31]

The enabling conditions for FLR need more research (case study 6 – Ethiopia)

The spatial, technical and scientific framework of the restoration process should allow all stakeholders to harmonize their approaches (case study 17, Madagascar)

Technical knowledge [P5, G23; P6, G31]

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 has to 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 15, Myanmar)

Monitoring and documentation [P6, G30, G31, G32]

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

Establishing an effective monitoring and evaluation system is a key for the successful implementation of FLR (case study 2, Ghana; case study 11, Peru)

Communication—targeted and consistent information campaigns [P6, G31, G32]

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, Philippines)

An effective information-sharing mechanism is essential so that all participants know who is doing what in the landscape (case study 10, Brazil)

5 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 functional 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. The SDGs and several other globally agreed policy instruments include FLR as a 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 processes, programmes and projects. A number of immediate actions can be taken to encourage the use of these guidelines at the national and local levels, including the following:

- Test and apply the guidelines as a reference and guiding document in the development of FLR processes at 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 long-term commitments to the implementation of FLR, including putting in place mechanisms for learning and exchanging information between such landscapes and 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.
- 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.

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GLOSSARY

Adaptive management	Process by which people adjust their management strategies to better cope with change, while also maintaining the integrity of their forest management objectives (Wollenberg et al. 1999)
Afforestation	The establishment of a planted forest on non-forested land
Agroforest	A complex of trees within an area broadly characterized as agricultural or as an agroecosystem
Alien species	A species, or subspecies introduced outside its normal past and present distribution
Carbon offset	The result of any action undertaken specifically to prevent the release of carbon dioxide into the atmosphere and/or to remove it from the atmosphere
Biological diversity/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 articles of the 1992 Convention on Biological Diversity]
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
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 wood or non-wood 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
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
Environmental services	All benefits that people obtain from natural or semi-natural ecosystems, including provisioning, regulating, cultural and supporting services
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
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)
Forest fallow	The intermediate time between two periods of shifting agriculture. In a functional shifting agricultural system, the fallow period is long enough that a functional secondary forest stand can develop (e.g.>20 years)
Jurisdictional area	An area in a country under the control of a subnational government entity which is different from that in neighbouring areas
Native species	A species that occurs naturally in a region
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 environmental services for current and future generations (FAO 2017)
Natural regeneration	Renewal of trees by self-sown seeds or natural vegetative means (Ford-Robinson, cited in Wadsworth 1997)
Non-wood forest products	All forest products except timber and wood, including products from trees, plants and animals in the forest area
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
Old-growth forest	A primary or secondary forest which has achieved an age at which structures and species normally associated with old primary forests of that type have sufficiently accumulated to act as a forest ecosystem distinct from any younger age class (UNEP/CBD/SBSTTA 2001)
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 biological diversity, as well as land intended to fulfil a combination of these functions
Pioneer species	Heavily light-demanding and short-lived species that can rapidly invade large canopy gaps in disturbed natural forests and colonize open land
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

ANNEXES

ANNEX 1: EXISTING GUIDELINES AND TOOLS FOR TROPICAL FOREST LANDSCAPE RESTORATION

(1) GUIDELINES AND TOOLS PREPARED BY CPF MEMBERS and ORGANIZATIONS ASSOCIATED TO THEM	
International Tropical Timber Organization (ITTO)	**ITTO Guidelines for the restoration, management and rehabilitation of degraded and secondary tropical forests (2002)** Scope: Tropical Forest, Forest level, policy level *First guidelines developed for pantropical use with a focus on restoration of degraded natural "primary" tropical forests and the particular role of managing secondary forest successions and rehabilitating degraded forest land that can be potentially restored. Designed as a (i) knowledge base for forest restoration of degraded forests' management, (ii) planning tool at the local and landscape level, (iii) basis for stimulating best management practice, (iv) contribution to a policy framework for forest restoration and secondary forest management*
	Restoring forest landscapes - An introduction to the art and science of forest landscape restoration (in collaboration with IUCN, 2005) Scope: Tropical Forest, landscape level, policy level as well as implementation and monitoring *Technical report divided in a "guideline" and a "tool" part. The guideline part representing the latest thinking on the emerging concept of forest landscape restoration at the time. It widened the field from forest restoration to forest landscape restoration and from policy to practice.*
International Union for Conservation of Nature (IUCN)	**Guidelines for Forest Restoration in Ghana (2006)** Scope: national (Ghana), forest level, policy level *Guidelines stating 10 principles and the respective strategies and actions to take for FLR in Ghana*
	Principles and Practice of FLR (2011) Scope: regional (drylands, Tropical Americas https://portals.iucn.org/library/sites/library/files/documents/2011-017.pdf)
	Rehabilitation and Restoration of Degraded Forests (2003) Scope: Global, forest and landscape level, policy and implementation *Guideline defining deforestation and FLR, laying out the necessity of FRL and explaining the main concepts of FLR in its first chapters. The following chapters do explain the options for FLR measures on site level and do introduce the concept of landscape level FLR. A collection of case studies does complete these guidelines*
	Restoration Opportunities Assessment Methodology (ROAM, in cooperation with the WRI, 2014) Scope: Global, process framework at national level, policy level *Step-by-step analytical framework that enables countries to identify suitable restoration techniques and priority areas for restoration. When applying ROAM user are guided through*

	a three-step assessment form (i) Preparation and planning, over (ii) data collection and analysis to (iii) Results to recommendations: Testing the validity and relevance of the assessment results. A ROAM application can deliver six main results: (i) identifying priority areas for restoration; (ii) prioritizing relevant and feasible restoration intervention types; (iii) quantifying costs and benefit; (iv) analyzing the finance and investment options-, (v) estimate the values of additional carbon sequestered; (vi) come up with a diagnostic of 'restoration readiness' and strategies for addressing major policy and institutional bottlenecks. ROAM also includes a guidance to assess how existing tenure rights in areas targeted for restoration are likely to influence FLR implementation.
	Restoration Ecosystem Service Tool Selector (RESTS,2016) Scope: Global, process framework at national level, policy level *Decision framework for identifying models to estimate forest environmental services gains from restoration aiming to help specialist in finding and understanding the right ecosystem service assessment tool for their purpose, covering 13 assessments tools (ARIES, Co$ting Nature, EcoMetrix, EnSym, Envision, ESR for AI, EVT, InVEST, LUCI, MIMES; NAIS, SoIVES, TESSA*).
	Forest Restoration Prioritization Tool (ROOT, in cooperation with NatCap amd University of Minnesota, 2016) Scope: Global, process framework at national level, policy level *Open access environmental services software tool assisting with FLR planning and optimizing the location of forest restoration activities and to support increased ecosystem service benefits. The information is provided through (i) maps representing how alternative restoration strategies would affect the provision of multiple environmental services, (ii) trade-off curves depicting the relationship between two alternative restoration objectives and (iii) restoration portfolios identifying optimal restoration strategies.*
International Union of Forest Research Organizations (IUFRO)	**Implementing Forest Landscape Restoration - A Practitioner's Guide (2017)** Scope: Global, landscape level, policy and implementation level *The 2017 IUFRO tool is developed as a modular package that focuses on a set of well delimited chapters including (i) Governance and Forest Landscape Restoration; (ii) Designing a Forest Landscape Restoration Projects; (iii) Technical Aspects of Forest Landscape Restoration Project Implementation; (iv) Monitoring Forest Landscape Restoration Projects; (v) Climate Change Mitigation and Adaptation in Forest Landscape Restoration; and (vi) Communicating Forest Landscape Restoration Results. The particular chapters of the guidelines are structured in explanatory sections and further readings as well as sections with advice for practical application sections also containing important key questions, checklists and other tools for the realization of FLR.*
	Spotlight Tool (2015) Scope: global, landscape level, policy level *Tool presenting complex restoration initiatives in a simplified way with the aim to provide a quick rating of where a given FLR project stands relative to different criteria. The tool leads to better communication of technical issues among specialists and also among specialists and decision makers and stakeholders. The tool aims to combine restoration and climate change mitigation and adaptation aspects and to contribute to restoration at large scales.*
Food and Agriculture	**Forest Restoration Monitoring Tool (2012)** Scope: Global, Forest and partly Landscape level, planning, implementation, monitoring

Organization of the United Nations (FAO)	*Checklist that guides users through the (i) assessment of the initial situation of a FLR site, (ii) the assessment of the field implementation and (iii) monitoring and result checking. The tool is very easy to understand and provides comprehensive tools for quick assessments of FLR actions before, during and after FLR activities*
	Global guidelines for the restoration of degraded forests and landscapes in drylands (2015) Scope: Ecological area (drylands), landscape level, policy, implementation and monitoring level Reference book with detailed step-by-step instruction for different levels of FLR, from policy making to planting trees, predominantly focusing on drylands and not on forests directly. The guidelines than consist of three main chapter on (i) Guidelines for policy makers, (ii) Guidelines for practitioners, (iii) FLR monitoring and evaluation. The publication contains an extended collection of case studies.
Center for International Forestry Research (CIFOR)	**Decision support tools for forest landscape restoration: Current status and future outlook (2018)** Scope: Global, landscape level, planning and monitoring *A report serving as a tool for reviewing existing knowledge and experience on support tools for FLR, including (i) Tools for preparation and assessment; (ii) Tools to evaluate potential restoration outcomes; and (iii) Tools for prioritization, spatial planning and species selection. The report identifies a gap in tools for the implementation of landscape-scale restoration initiatives and for guiding monitoring and adaptive management. The review also reveals that available tools primarily focus on assessing restoration opportunities at a broader scale, rather than within landscapes where implementation occurs*
World Resources Institute (WRI)	**The Atlas of Forest and Landscape Restoration Opportunities (in collaboration with IUCN and the University of Maryland, 2009)** Scope: Global, landscape level, policy level *Information management tool in the form of an interactive atlas, aiming to help identifying opportunities for restoration. First published in 2009 and reviewed and expanded over time to cover today all main forest biomes. Contains interactive information on the following six main topics: (i) Bonn Challenge Pledges; (ii) Restoration Opportunities; (iii) Forest Condition; (iv) Current Forest Coverage; (v) Potential Forest Cover; (vi) Human Pressure*
	The Restoration Diagnostic (2015) Scope: Global, landscape level, monitoring *Method for developing FLR strategies by rapidly assessing the status of key success factors. Developed to help implementing findings of a ROAM process. It features comprehensive definitions on FLR, describes its benefits and lists important key success factors. A part on diagnostics delivers comprehensive checklists to identify existing and missing key success factors for forest landscape restoration within a country or landscape by (i) selecting the "scope" within which to apply the diagnostic, (ii) evaluating whether or not key success factors for FRL are in place and (iii) Identifying strategies to address missing factors. The tool also contains case studies in South America and Africa that were conducted using the Restoration Diagnostics and provides examples on using the methodology*
	Scaling up Regreening: Six Steps to Success (2016) *Scope: Global, Landscape level, policy level* *Guideline laying out and describing six important main steps for successful FLR*

	implementation: (i) Identify and Analyze Existing Regreening Successes; (ii) Build a Grassroots Movement for Regreening; (iii) Address Policy and Legal Issues and Improve Enabling Conditions for Regreening; (iv) Develop and Implement a Communication Strategy; (v) Develop or Strengthen Agroforestry Value Chains and Capitalize on the Role of the Market in Scaling Up Regreening; (vi) Expand Research Activities to Fill Gaps in Knowledge About Regreening. "Scaling up Regreening" is a mix between a guideline and a tool as it involves guiding principles that are then accompanied by suggestions for implementation on the ground.

(2) INITIATIVES RELEVANT TO FLR	
The Bonn Challenge (multi-agency approach), global policy approach	**FLR Approach of the Bonn Challenge** Scope: global, landscape level, policy level. *The FLG approach of The Bonn Challenges includes forests landscapes: The approach comprises eight guiding principles: (i) Focus on landscapes; (ii) Restore functionality; (iii) Allow for multiple benefits; (iv) Leverage suite of strategies; (v) Involve stakeholders; (vi) Tailor to local conditions; (vii) Avoid further reduction of natural forest cover; (viii) Adaptively manage*
New York Declaration on Forests (NYDF)	**FLR Approach in the NYDF** Scope: global *The New York Declaration on Forests from 2014 includes a total of ten goals among which one goal is to (v) restore 150 million ha of degraded land by 200 and an additional 200 million ha by 2030. Further goals aim at enabling conditions such as the establishment of a strong international framework (vi, vii), better financing (viii, ix), and improved forest governance and secure forest and land tenure for local communities and indigenous peoples (x). The NYDF is supported by an action agenda and an assessment framework for monitoring.*
Global Partnership on Forest and Landscape Restoration (GPFLR)	**GPFLR Case studies** Scope: Global, Landscape level, case studies *Comprehensive collection of case studies on Forest and Landscape restoration providing an evidence base for FLR outcomes by (i) Illustrating the many variations of FLR interventions, pathways, and governance arrangements, (ii) guiding future interventions for scaling out and scaling up, (iii) establishing key linkages between local context, specific interventions and socio-environmental outcomes, (iv) serving as a foundation for a global FLR practitioner network*
African Forest Landscape Restoration Initiative (AFR100)	**Voluntary Guidelines for Forest Landscape Restoration under AFR100 (2017)** Scope: Regional (Africa), landscape level, policy level *Voluntary guidelines covering a so called FLR Options Framework and the following 8 FLR principles: (i) Restoring multiple ecosystems functions; (ii) Integrated management of landscapes; (iii) Restoration strategies supporting multiple interventions; (iv) Participatory decision making; (v) Protection of natural ecosystems to enhance resilience; (vi) Monitoring, learning and adapting; (vii) Policy coherence around national commitments and land use (viii) Nationally owned and driven*
	Guiding Principles for Measuring and Monitoring Progress on Forest and Landscape

	Restoration in Africa Scope: Regional: (Africa), landscape level, policy level and monitoring *Set of principles for monitoring activities focusing on the (i) definition of the scale of the FLR effort; (ii) selection on indicators based on AFR100 framework and on specific goals; (iii) selections of the resources with focuses on using cross-sectoral approaches and already existing monitoring networks. Guideline with emphasis on the inclusion of (i) socioeconomic, (ii) political, (iii) financial and (iv) biophysical aspects*
(3) OTHER COLLABORATIVE INITIATIVES ON FLR GUIDELINES AND TOOLS	
Darwin Initiative and the Royal Botanic Gardens	**Restoring Tropical Forests – a practical guide (2013)** Scope: Biome (tropics), forest level, implementation and application *Comprehensive practitioners guide with detailed descriptions of activities to be conducted in the field. Subdivided in the following the three parts (i) understanding and planning of FLR, (ii) Implementation in the field from nursing and planting over maintaining and (iii) setting up forest restoration research units for monitoring. Only tool in the current FLR context that provides an in-depth description of FLR measures beyond the assessment, planning and monitoring.*
Society for Ecological Restoration (SER)	**International Standard for the Practice of Ecological Restoration (2016)** Scope: Global, including terrestrial, freshwater, coastal and marine ecosystems *The standards include 6 key concepts: (i) based on an appropriate local reference ecosystem; (ii) pre-identification of the target ecosystem's key attributes; (iii) preference of natural recovery processes; (iv) highest and best effort progression towards full recovery; (v) drawing on all relevant knowledge; (vi) stakeholder engagement. A specific procedure is suggested for the development of targets and evaluation of six key ecosystem attributes including: absence of threats, physical conditions, species composition, structural diversity, ecosystem functionality, and external exchanges. Specific standard practices are given from the planning and design stage to the post-implementation maintenance.*
Forestoration Partners LLC	**Forest and Landscape Restoration Case Study Bank and Atlas: A Global Resource for Research, Policy and Practice (2019)** Scope: Global, landscape level, case study Planed but not yet implemented database data base for FLR case studies.

ANNEX 2: SUMMARY OF GUIDANCE FOR FINANCING FLR AND ECONOMIC EFFICIENCY

Forest restoration is a major effort that requires substantial resources to develop a vision and to subsequently conceptualize and implement it before arriving at a sustainability phase. The ambition is that, over time, the restored forest and mosaic landscapes will become sustainable from an ecological, social and financial perspective. The first three phases – visioning, conceptualization and implementation – typically require targeted funding. Examples of funding sources include national budget funding and international funding, including multilateral finance such as through the GCF, the GEF and multilateral development banks and also bilateral finance from donor countries and international foundations. Opportunities for private investment or blended finance (with shares of public and private finance) are expected to increase as FLR projects transition towards the sustainability phase.

Although forest degradation can take place over a short period, restoring forests and non-forest lands entails continuous effort over long timespans. There are two distinct development pathways for degraded forests: 1) towards a more intensively used, mosaic landscape that includes a variety of land-uses, from agroforestry to industrially managed forests; and 2) towards restored natural forest, including secondary forests, where the provision of multiple environmental services and biodiversity conservation are primary objectives, at least in the early stages of restoration.

Over time, industrially managed forest restoration in functional landscapes may, through economic diversification, avoided damages and new marketable products, create a net positive financial impact (private benefits) as well as net positive economic impacts (public benefits) relative to the status quo land use.

The economics of restored natural forest are not equally attractive for private investors. Significant financial resources are rarely available for the transformation of degraded forest to natural forest. In only a few cases, value chains for timber and NTFPs exist that generate marketable products early on. The core question is how to incentivize local land users and attract external investors to engage in a restoration pathway in which sustainable natural forest management will be the ultimate land use. Such efforts will only be long-standing if they provide social and ecological benefits and above that are economically attractive and financially viable, to the extent that they can provide sufficient incentives to outcompete alternative land uses.

Strategic landscape planning is recommended for both development pathways. Stakeholders need to be identified, and the expected monetary and non-monetary costs and benefits ensuing from the land over time need to be assessed. This will help anticipate the trade-offs likely to occur among competing interests in the course of landscape transformation. Moreover, modalities for achieving an equitable distribution of costs and benefits among the stakeholders need to be agreed in order to achieve lasting FLR. Strategic landscape planning processes require significant data, including on environmental and social outcomes and the financial benefits of forest goods and environmental services.

FLR processes also require conducive policies and financing models to ensure that it is economically competitive, in addition to equitably sharing benefits. This is particularly true when the objective is to restore natural forests rather than to create industrial forests in mosaic landscapes. An option could be to require investors pursuing an industrial forest pathway to earmark a certain percentage of the land under their jurisdiction for natural forest development. Alternatively, fiscal returns from industrially managed forests could be earmarked for investments in the restoration of natural forests.

REDD+ offers a possible funding stream that serves the purposes of FLR and helps mitigate climate change. Although there are many synergies between the two approaches, it is also important to recognize that they have different goals. REDD+ focuses on reducing carbon emissions and enhancing carbon sinks, and other benefits, such as enhancing ecological integrity and social wellbeing, are ancillary. FLR aims to improve ecological integrity and social well-being, including by enhancing carbon stocks and creating ancillary benefits. Nevertheless, aligning FLR processes and REDD+ strategies can create positive incentives and make these available for FLR interventions in the form of jurisdiction-level programmes and projects.

Guidance and recommended actions

Guidance on financing FLR

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

FLR needs considerable initial resources but returns may often only be realized in the mid to long term. 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.

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

Successful restoration projects need to address long-term funding, through multiple strategies tailored to the different phases of the restoration process. The portfolio can be broadened to include environmental services or to tap the potential of mechanisms such as biodiversity offsets[16] and climate funding, including carbon markets with results-based payments.

Recommended actions:

(1-1) **Develop a FLR financing strategy according to the FLR phases**. Consider multilateral finance for the initial readiness phases, blended public-private finance for intermediate stages and domestic and/or international private finance or blended public-private finance for the final sustainability phase.

(1-2) **Formulate FLR interventions, following the procedures of the main international agencies that provide financial incentives for FLR**, such as the Green Climate Fund (GCF), the Global Environmental Facility (GEF), the World Bank Climate Funds, the UNFCCC Adaptation Fund and others

(1-3) **Analyse the potential and develop schemes that allow payments for environmental services** (PES) at landscape level, including carbon, water, biodiversity and tourism

(1-4) **Develop REDD+ strategy at landscape/jurisdictional level** for results-based payments and evaluate its risks, costs and benefits and their implications for other land-use options

(1-5) **Encourage private-sector investments** (national and international), e.g. by providing guarantee funds.

(1-6) **Establish measures to ensure compliance** with agreed management and restoration procedures and performance standards for the private sector.

(1-7) **Tap on the new and additional sources of funding FLR**, as promoted by the Bonn Challenge, the SDGs, the UNFCCC, CBD, UNCCD, the New York Declaration on Forests among others

(1-8) **Create awareness amongst different stakeholders** within countries on the opportunities of financing and capacity building to develop sound proposals.

References and examples of good practices:

Sustainable financing for forest and landscape restoration (FAO-UNCCD 2015)
Cost-Benefit Framework for Analyzing Forest Landscape Restoration Decisions (Verdone 2015)
Towards effective national forest funds (FAO 2015a)
Generic guide and modular training package to assist countries in developing national forest financing strategies
Integrating diverse social and ecological motivations to achieve landscape restoration (Jellinek et al. 2018)
The economics of ecosystems and biodiversity (TEEB 2009)
Payments for Environmental Services in Latin America as a Tool for Restoration and Rural Development (Montagnini and Finney 2011)

[16] Biodiversity offsets are measurable outcomes for biodiversity conservation that are meant to compensate in full for biodiversity impacts or losses associated with economic development (Jellinek et al. 2018).

Guidance on economic viability of FLR investments

Economic and financial viability is essential for succeeding with FLR goals and objectives

FLR processes, programmes and projects can only be sustainable if they are economically and financially viable. If initial financial inputs through e.g. projects to FLR are high and the return is unsure and often in the distant future, investment will be difficult to justify.

Thus, it is important not only to focus on the financing of forest restoration, but about understanding the economics of the restoration process itself and the economic viability of investments, e.g. towards SFM. There is a need to create better tools and better data on costs and outcomes.

Recommended Actions:

(2-1) **Prepare cost/benefit analyses** of the planned FLR programmes and projects including non-monetary benefits and their values

(2-2) **Develop business cases for forest restoration investments** and communicate them to interested private sector stakeholders

(2-3) **Explore opportunities for market-based incentives** such as results-based carbon payments and transfer payment mechanisms for environmental services.

(2-4) **Determine how to gain added value for the goods and services provided through restoration activities**. These may include: developing adequate sources of income for the rural poor; eco-tourism; reducing wastage; improving the quality of products being marketed.

(2-5**) Conduct, at programme and project level economic analysis of pilot FLR initiatives** that can guide policy formulation more effectively in the use of incentives

References and examples of good practices:

FAO – CBD project: Cost/Benefit analysis for FLR investments
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)

Guidance on Investment Environment

Enable a favorable environment for investment in the restoration and sustainable management of degraded forests and landscapes

The economic challenge in FLR is to make the restored forest lands and other land-uses a profitable activity that is attractive to investors and competitive. In this respect it has to be noted that currently, most environmental services provided e.g. by natural forests, are unpaid for, and there are only a few functioning mechanisms for collecting payments for environmental services. Thus, creating the right conditions for investment and resource mobilization for FLR
is key.

Recommended Actions:

(3-1) **Provide framework conditions** (e.g. legal, policy, institutional, fiscal and tenurial) to attract investments to FLR (including simplified access to information)

(3-2) **Assess potential investors needs and concerns** regarding the investment environment

(3-3) **Promote simple and inexpensive technologies** that directly address investors' needs

(3-4) **Develop conflict resolution mechanisms** to handle trade-offs arising from competing land-use interests, particularly if new investment opportunities arise (e.g. mining in restored forest sites).

References and examples of good practices:

Sustainable financing for forest and landscape restoration: Opportunities, challenges and the way forward. FAO/UNCCD. 2015b
Global guidelines for the restoration of degraded forests and landscapes in drylands: building resilience and benefiting livelihoods (FAO 2014)
Coalition for Private Investment in Conservation' Blueprints: http://cpicfinance.com/blueprints/

Guidance on local income opportunities

Improved income opportunities for forest and agricultural products will provide an incentive for local stakeholders to participate in FLR

An ultimate aim of FLR is that local people may be able to generate significant incomes from restored forests and landscapes. Market demand and the prices paid for products often determine whether the chosen land-use concept is profitable and attractive to farmers and rural communities. Also, local processing of forest products adds value and may translate into higher prices for the raw materials.

Community managed forests are often seen as valuable to attracting sustainable investments, especially considering its risk management attributes.

The creation of alternative revenue generating activities and the promotion of viable small and medium enterprises can contribute to the success of landscape initiatives.

Recommended Actions:

(4-1) **Promote the local-level and value-added production and processing** of agricultural, wood and non-wood forest products.

(4-2) **Strengthen forest-producer organizations and locally based small and medium enterprises** and support their market access.

(4-3) **Promote forest-related income opportunities and market access for women** as important determinants of the local acceptability of FLR implementation.

(4-4) **Develop opportunities to partner with communities, projects or institutions** (public and private) with processing and marketing experience to strengthen efforts to gain access to markets.

(4-5) **Consider local opportunities for alternative income sources for the rural poor**, which are not based on land ownership and natural resources extraction.

(4-6) **Explore community-based forest management schemes** based on forest goods and services and develop investment strategies

References and examples of good practices:

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 and Oldekop 2018)
IUCN Gender responsive restoration guidelines

Guidance on sustainable supply chains from FLR

From its initial stage, FLR processes and interventions should seek to build sustainable supply chains for the

goods produced in restored forest landscapes

Sustainable supply chains comprise the organizations, activities and processes associated with all stages of the business processes involved in planning, sourcing, processing, manufacturing and delivering goods and services issues from forests and mosaic landscapes.

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, biosecurity, marginalized people, biodiversity and land use.

Recommended Actions:

(5-1**) Identify the potential to develop green-supply chains** for products produced in restored forest landscapes.

(5-2) **Build on existing sustainable supply-chain initiatives**, such as those associated with certification and timber legality, with the aim of making similar processes more accessible to local and indigenous communities and smallholder farmers.

(5-2) **Develop instruments to support financial returns for sustainable forest land-use options**, including mechanisms to provide payments for environmental services in restored landscapes

(5-4) **Scope potential marketing opportunities and value-chains for lesser-known timber and non-timber forest product**s, as appropriate

(5-5) **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.

(5-6) **Develop public–private partnerships** for sharing the incremental costs and ensuring the viability of initiatives to create sustainable supply chains in restored forest landscapes.

(5-7) **Assist local and indigenous communities and smallholder farmers** to develop sustainable supply chains for the goods they produce on restored forest lands, such as by improving transport and communication infrastructure, subsidizing the cost of product-tracking systems, instituting purchasing policies that favour sustainable smallholder production, and boosting marketing efforts.

References and examples of good practices:

The buzz on green supply chains – TFU (2018)
Is community forestry open for business (Greijmans and Gritten 2015) World Forestry Congress Durban
Topical at “Sustainable Supply Chain”: https://www.itto.int/economic_market/supply_chains/

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