Assessing the ITTO Guidelines for the

Restoration, Management and Rehabilitation of Degraded Secondary Tropical Forests

Case studies of Ghana, Indonesia and Mexico

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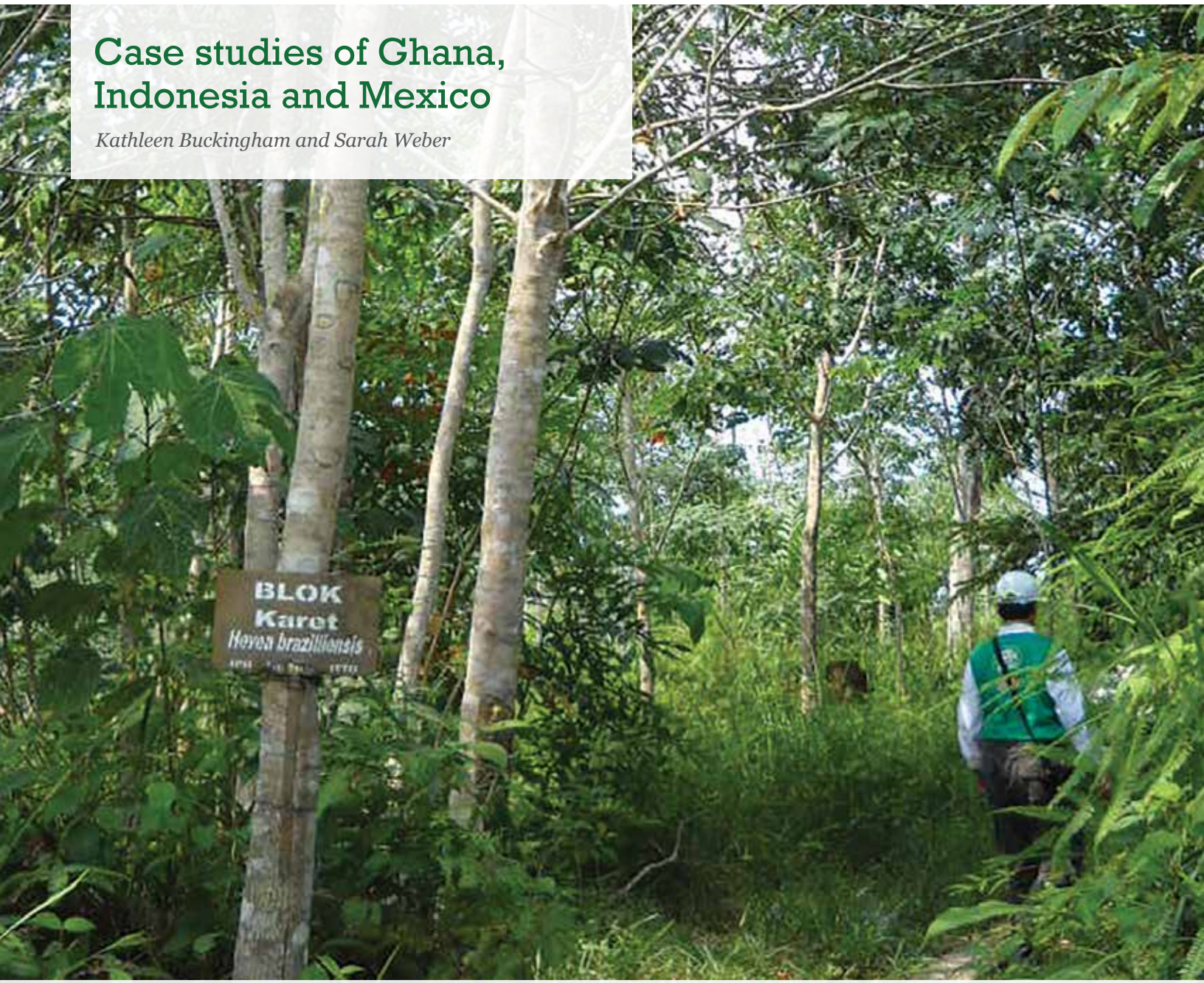

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INTRODUCTION: RESTORING LANDSCAPES

Restoring degraded lands and landscapes is essential for human livelihoods and well-being, long-term food security, climate stability, and biodiversity conservation. In order to counteract land degradation and improve livelihoods, we need to restore forests and increase the productivity of existing agricultural lands at the same time. Only then can we create landscapes that are diverse, productive, and resilient (Buckingham et al. 2015).

An international restoration movement has galvanized support for the Bonn Challenge—a commitment to begin restoring 150 million hectares by 2020. Already, more than 20 countries have committed to restore over 60 million hectares (nearly 150 million acres) into productivity (Sizer et al. 2015). The Bonn Challenge itself is an implementation vehicle for existing international commitments (Saint-Laurent 2015). It seeks to catalyze early action on Reducing Emissions from Deforestation and Forest Degradation (REDD+) under the UN Framework Convention on Climate Change (UNFCCC), as well as the Convention on Biological Diversity's Aichi Biodiversity Target 15, which seeks to restore at least 15 percent of the world's degraded ecosystems by 2020. Both agreements contribute to climate-change mitigation, adaptation, combating desertification, and land degradation (Maginnis et al. 2014; Laestadius et al. 2015).

In March 2015, government ministers gathered in Bonn for the second in a series of historic meetings—Bonn Challenge 2.0—aimed at building support for ambitious global targets for forest and landscape restoration. Achieving the restoration goal would generate $85 billion a year in net benefits from carbon sequestration, watershed protection, improved crop yields and forest products, as well as potentially reduce conflict in some fragile states (Sizer et al. 2015).

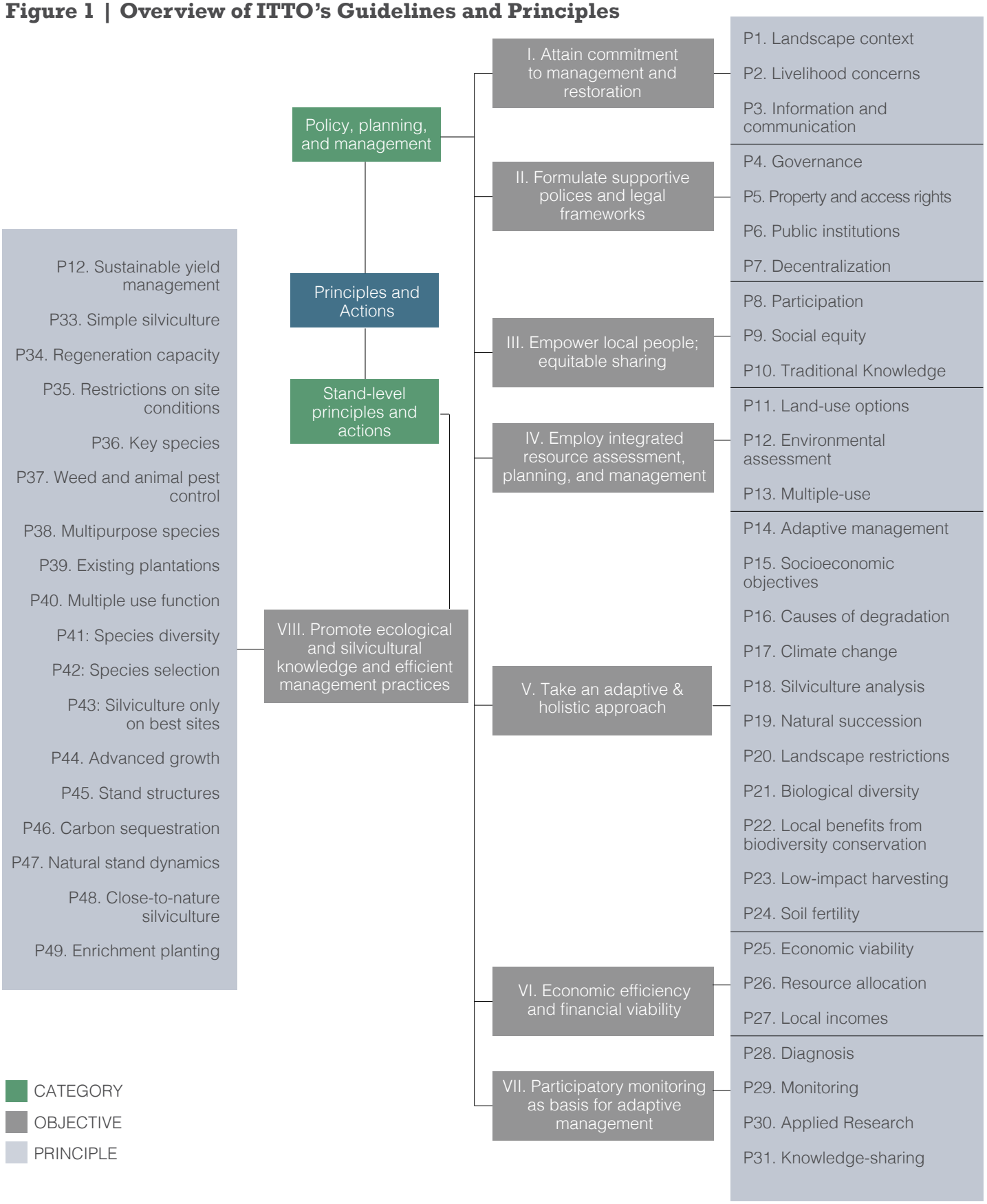
Prior to the Bonn Challenge, the International Tropical Timber Organization (ITTO) recognized the importance of addressing restoration. In 2002, ITTO published *Guidelines for the Restoration, Management, and Rehabilitation of Degraded and Secondary Tropical Forests*, which described a conceptual framework for restoration and recommend a set of actions and principles to guide those working in degraded or secondary forests (Douterlungne 2014) (Figure 1). The *ITTO Guidelines* defined degraded primary forests as those that have undergone changes in forestry and species composition due to wood and non-wood harvesting, wildlife management, and other uses. Secondary forests are forests that have largely been cleared of their original forest cover and have woody vegetation regrowing on the land. Degraded forest is considered land severely damaged by excessive harvesting of wood and/or non-wood products, poor management, repeated fire, and other factors (Blay et al. 2014).

These guidelines were prepared to highlight the increasing importance of the current and potential roles of degraded and secondary forests in tropical landscapes. With most of the primary forests gone in many tropical countries, degraded primary forests and secondary forests are becoming the predominant forest types in many tropical timber-producing countries. They are a major part of many rural landscapes, and their importance in the supply of goods and services is growing rapidly. If properly restored and managed, degraded primary forests and secondary forests can provide environmental benefits such as watershed and soil protection, land stabilization, biodiversity values, and carbon sequestration (ITTO 2002).

Scope: Application of *ITTO Guidelines* in Africa, Asia, and Latin America

This report presents a review of restoration activities in project sites in Africa, Asia and Latin America. ITTO tasked forestry professionals in Ghana, Indonesia and Mexico to assess sites according to the *ITTO Guidelines*. The report presents a summary of the main lessons learned and recommendations for the development of a revised framework.

Figure 1 | Overview of ITTO's Guidelines and Principles



Source: Based on Douterlungne 2014

CRITIQUE OF THE *ITTO GUIDELINES*

The *ITTO Guidelines* consist of 8 objectives, 49 principles and 160 recommended actions categorized in two sections: (1) policy, planning and management, and (2) stand-level principles and actions (Figure 1). The concepts covered in the *ITTO Guidelines* are complementary to those articulated by other restoration experts and reports (Sayer et al. 2013; GPFLR 2011), and are cross-disciplinary in nature (Douterlungne 2014).

However, the guidelines have had limited use due to a lack of awareness by forestry managers, professionals and practitioners at different levels.[1] For example, in Indonesia, out of the eight projects surveyed, only one project had consulted the guidelines in the formulation process, even though four were ITTO-funded projects. Experts agree that the guidelines need significant revision regarding their structure and presentation, as well as detail and user friendliness. The revisions seek to provide a simple structure, merge the overlapping principles and use simplified wording instead of scientific terminology. Moreover, the plethora of recommendations and criteria can often overwhelm managers (Douterlungne 2014). Since sustainable livelihood activities are a key focus of all restoration programs, the structure of the revised guidelines should aim to be directly applicable to stakeholders' needs and be presented in national languages (Sidabutar 2014). The recommended actions are very site-specific and therefore have limited utility across projects (Sidabutar, pers. comm., 2015). A short checklist of the most important issues or a simple plan would translate more effectively into restoration results (Douterlungne 2014).

This report provides an opportunity to update the guidelines and strengthen ITTO's comparative advantage within the Global Partnership for Forest Landscape Restoration (GPFLR).

The *ITTO Guidelines* were created over ten years ago. Since then, the restoration movement has gained momentum and many publications, frameworks and toolkits have tried to enable landscape restoration. This report provides an opportunity to update the guidelines and strengthen ITTO's comparative advantage within the Global Partnership for Forest Landscape Restoration (GPFLR). ITTO is an intergovernmental organization promoting the conservation, sustainable management, use and trade of tropical forest resources. Its members represent about 80 percent of the world's tropical forests and 90 percent of the global tropical timber trade. ITTO develops internationally agreed policy documents to promote sustainable forest management and forest conservation and assists tropical member countries to adapt such policies to local circumstances. ITTO then helps to implement them in the field through projects. In addition, ITTO collects, analyzes and disseminates data on the production and trade of tropical timber. It funds a range of projects and other action aimed at developing industries at both community and industrial scales (ITTO 2014). This network and skill set should be leveraged to produce complementary guidelines and fill gaps. Since the publication of the *ITTO Guidelines* in 2002, the *Restoration Opportunities Assessment Methodology (ROAM)* (Maginnis et al. 2014) has become a key publication on restoration. This has been supported by the Restoration Diagnostic (Hansen et al. 2015), which provides stakeholders with an indication of the challenges and opportunities faced in implementing restoration projects.

In the course of selecting assessment sites, Ghana was selected for Africa and Indonesia for the Asia-Pacific region. Both are ITTO member countries that have carried out many ITTO projects dealing with forest landscape restoration. In Latin America, Mexico was selected by BIRDLIFE International—an ITTO partner—for the assessment of forest

landscape restoration achievements in selected sites covered by BIRDLIFE International (using the *ITTO Guidelines* as reference).

Aside from Ghana, Indonesia and Mexico, there are a few other examples of the utilization of the *ITTO Guidelines* by government-related institutions. Other examples of their use include:

- The rehabilitation of forest lands degraded by artisanal mining activities in Liberia, with the leading position/involvement of the Forestry Development Authority (FDA).
- The rehabilitation of degraded forest lands in three tropical provinces (Guangdong, Hainan, and Yunnan) in the southern part of China through demonstration forest plots established by the local branches of the Chinese Academy of Forestry (CAF) with the involvement of local communities. The CAF's aim was to draw lessons that could be internalized and adapted in provincial-level policies to be developed for forest land restoration purpose in these three provinces.
- The rehabilitation of degraded ecosystems in different regions of Peru with the National Institute for Natural Resources (INRENA), which had implemented pilot projects referring to the *ITTO Guidelines*. INRENA used to be in charge of the implementation of forest policies in Peru.

In order to address the perceived shortcomings of the *ITTO Guidelines*, a simplified framework of key needs was created. This proposed framework is based on input from ITTO reports and discussions regarding the implementation of the *ITTO Guidelines* and aims to provide a more intuitive categorization of the key elements of restoration. It forms the basis of the country case study summaries. A brief definition is described below (Figure 2). It has been mapped to the principles of ITTO to demonstrate the scope of the new framework and potential for adaptation (Figure 3). The further development of the framework will be discussed in the recommendations. The following section adopts the framework for the country case study summaries.

[1] For example, in Indonesia, out of the 8 projects surveyed in Indonesia, only one project had consulted the guidelines in the formulation process, even though 4 were ITTO funded projects.

Figure 2 | A framework of key needs to simplify the principles of the ITTO Guidelines

	Key needs framework	Description
1	**Integrated management systems**	• Enabling active management of a variety of productive systems within the landscape matrix considering the landscape context, sources of degradation, needs, restrictions, adaptive management requirements, sustainable yields and available livelihood options Ensuring landscape integrity with a focus on increasing ecosystem function for biodiversity, regeneration and carbon values
2	**Benefits & incentives**	• Providing stakeholders with social, ecological, cultural and economic drivers to participate in restoration
3	**Stakeholder platforms**	• Facilitating opportunities for engagement, participation, inclusion, communication, knowledge, information sharing and capacity building
4	**Effective governance**	• Considering the opportunities and challenges faced by existing regulations and complementary and contradictory policies with particular focus on property and access rights • Focusing on the structure of institutions, opportunities for decentralization, transparency and accountability
5	**Financial viability**	• Ensuring costs are covered and resources are allocated for affective results and sustainability
6	**Monitoring and evaluation**	• Providing an effective monitoring and evaluation framework and baseline assessment, as well as a cost-efficient ecological restoration strategy

Figure 3 | ITTO principles mapped out to proposed framework of key needs

	Key needs framework	ITTO Principles			
		Principle	Mutually exclusive categories	Principle	Overlapping categories
1	Integrated management systems	1.1.	Landscape context	5.14.	Causes of degradation
				5.20.	Landscape restrictions
				8.35.	Restrictions on site conditions
		3.10	Traditional knowledge		
		4.11.	Land-use options	8.32.	Multiple-use
				8.38.	Role of multi-purpose species
				8.39.	Role of existing plantations
				8.40.	Multiple-use function
		4. 13.	Adaptive management	8.34.	Forests and climate change
				8.37.	Weed and animal pest management
		5.16.	Sustainable yield management	5.18.	Silvicultural analysis
				5.23.	Low-impact harvesting
				5.24.	Soil fertility
				8.43.	Silviculture only on best sites
				8.48.	Close-to-nature silviculture
		5.17.	Regeneration capacity	5.19.	Natural succession
				8.49.	Enrichment planting
		5.21.	Biological diversity	8.36.	Key species
				8.41.	Species diversity
				8.42.	Species selection
				8.45.	Stand structures
				8.47.	Natural stand dynamics
				8.44.	Advanced growth
		8.46.	Carbon sequestration		
2	Benefits & incentives	5.15.	Socioeconomic objectives	6.27.	Low-income opportunities
				1.2.	Livelihood concerns
				5.22.	Local benefits from biodiversity conservation
				3.9.	Social equity
3	Stakeholder platforms	1.3.	Information/communication		
		3.8.	Stakeholder participation		
		7.31	Knowledge sharing		
4	Effective governance	2.0	Policies		
		2.5.	Property and access rights		
		2.4.	Governance		
		2.6.	Public institutions		
		2.7.	Decentralization		
5	Financial viability	6.25.	Economic viability		
		6.26.	Resource allocation		
6	Monitoring & Evaluation	4.12.	Environmental assessment		
		7.28	Diagnosis		
		7.29	Monitoring		
		7.30	Applied research		

GHANA

Ghana has 9,337,000 hectares of forests, covering 41 percent of the country (FAO 2015). Pressure on the land is intense. Ghana has one of the highest deforestation rates in the world at 2 percent (FIP and MLNR 2012). In rural areas, about 60 percent of the population relies to some extent on land or forest resources. Moreover, the land is vulnerable to degradation, with about 69 percent of the total land surface area estimated as being prone to severe or very severe soil erosion (PROFOR 2011). Approximately 1,075,000 hectares of forest land have been degraded, but are potential areas for plantations and restoration activities (FC and MLNR 2013).

This study summarizes nine restoration project sites in Ghana. The sites represent degraded areas with infertile soils within protected areas, in addition to community agricultural lands within different ecological zones—namely guinea savannah, dry semi-deciduous and wet evergreen forest zones (Blay et al. 2014). The restoration projects were successful in cases where traditional leaders were involved in all stages of the restoration process. Activities that cause severe degradation— such as gold mining and slash-and-burn agriculture—are highly profitable in Ghana, or allow for short-term profits in the form of overgrazing, firewood gathering and illegal logging. Alternative livelihoods (particularly during tree-growth periods) are thus crucial to the sustainability of restoration projects.

1 | Integrated management systems

In the practice of shifting cultivation—both the leading cause of deforestation and the primary source of food and income security—repeated clearing, burning, and farming, coupled with heavy exploitation of timber trees, has led to extensive degradation (Appiah 2012, 2015). Consequently, agricultural yields have declined drastically over the years. In an effort to increase agricultural yields, farmers have been learning to restore productivity on the same land through integrated management systems. Specific restoration interventions include agroforestry, fish farming, apiculture, snail farming, woodlots and using high-value tree species (Blay et al. 2014). There has also been an increasing national move toward utilizing selected indigenous timber species for restoration and rehabilitation activities, as well as a focus on increasing biodiversity within agroforests. Integrated management systems have met multiple needs of the local people and led to broad-based local recognition of degraded areas as part of a land-use system (Appiah 2013).

2 | Benefits & incentives

Clear and tangible benefits are important for ensuring the success of restoration projects. Alternative livelihood programs were introduced as short-term income generating activities, thus enabling community members to wait for trees to mature. These have offered substantial incentives for local people to put their forest land under proper management (Blay et al. 2014). Furthermore, benefit sharing was explicitly addressed at the beginning of these projects. Government forestry institutions partnered with local people and introduced incentives, including free seedlings, extension services, and project equipment. Different tree species provided socioeconomic values for timber, spices, medicine, fodder, seedlings, fuelwood and seed oil, as well as environmental values such as organic matter, soil health, erosion control, fence/wind breaks and carbon sequestration (Blay et al. 2014).

The government of Ghana—in collaboration with other organizations such as ITTO, the U.S. Department of Agriculture (USDA) Forest Service, and the UK Department for International Development (DFID) etc.—is engaged in restoration

activities, including establishing forest plantations at a rate of 20,000 hectares annually to develop potential carbon markets and a carbon monitoring methodology.

There is insufficient quantitative information to identify how livelihoods have changed due to restoration projects, but it is clear from environmental studies that after eight years, biodiversity on a large scale has returned. Discontinuing incentives can risk the sustainability of projects. For example, committees were reluctant to work on communal woodlots once the boots and tools promised to them stopped arriving (Blay et al. 2014).

3 | Stakeholder platforms

Having a stakeholder-driven communication process involving traditional leaders has been key to the success of restoration projects in Ghana. In the pre-implementation period, key leaders met and formed a steering committee. Start-up workshops sought to introduce the project to communities and ensure that all actors and stakeholders understood the project concept, opportunities, and challenges, as well as the roles and responsibilities of the various actors. They also sought to enable the project team to capture preliminary data that would be useful for planning detailed field activities, facilitating maximum participation of stakeholders, and determining how participation could be sustained throughout the project cycle (Blay et al. 2014).

Implementation workshops monitored progress, which provided important reference points for dialogue between committee and community members to assess challenges and opportunities.[2]

Plantain-mixed tree planation system at Dormaa
Photo credit: Dominic Blay

As some of the underlying causes of reluctance to participate, community members highlighted (a) the inequitable sharing of benefits from timber royalties, (b) poverty, (c) the noninvolvement of local communities in forest resources policy formulation, and (d) the failure of the Forestry Commission to educate local communities on updated forest polices and legislation (Blay et al. 2014).

The capacity of local farmers was strengthened in a number of key areas, including fire management, nurseries and plantation establishment. In Ghana, wildfires have caused environmental damage to important ecosystems and severely reduced the productive capacity of many forests. Ensuring local participation in fire management training has been effective in reducing the spread of wildfires (Appiah et al. 2010). Training also focused on community and individually owned tree nurseries, which were established to support the production of seedlings for plantation

Fundamentally, practices built on traditional methods and experiences, using simple and inexpensive techniques and technologies, aided the sustainability of restoration activities.

Plantain harvest
Photo credit: Dominic Blay

establishment and for sale to other agencies and farmers. Fundamentally, practices built on traditional methods and experiences, using simple and inexpensive techniques and technologies, aided the sustainability of restoration activities.[3]

While considerable effort went into training and communicating these ideas, some harvesting schedules were difficult to implement because the local people didn't understand them. In future projects, the needs and aspirations of all stakeholders, including forest fringe communities, need to be properly assessed and taken into account in project objectives during start-up workshops and subsequent consultations to elicit adequate participation (Blay et al. 2014).

4 | Effective governance

Effective governance has been instrumental in the success of projects in Ghana. In order to manage demarcated areas, community leaders formulated local rules and regulations based on traditional norms and values. The rules and regulations included access to land, rights and responsibilities, bush-fire management, harvesting of trees, species protection and unauthorized encroachment. As a result, the vegetation in forests has increased.

The drivers of degradation also were addressed. For example, fire management was addressed through communication strategies and prohibition of fires in certain areas; miners were trained in reclamation techniques; illegal logging was addressed through Forest Law Governance and Trade (FLEGT) training; overgrazing was controlled through seasonal grazing; and firewood collection was managed through encouraging community wood lots.

Role sharing and decentralization were keys to the success of effective governance. Communities were trained and organized into natural resource management committees (CONARs) to represent themselves in all matters related to traditional energy planning, natural forest management (on and off-reserve), and wood-lot establishment and maintenance. CONARs mobilized the rest of the communities to plant trees, patrol forest reserves, and enact and enforce bylaws to guide natural resource management and utilization in respective communities (Blay et al. 2014).[4]

Land tenure remains a challenge in Ghana. To combat this, projects worked toward security of land tenure for migrant farmers to reduce their incentive to clear forest land. Community members were allocated land to manage until the trees had time to grow. Because this land is owned by the government, farmers expressed confidence in the system. Recently, most of the farmers have had their land mapped, so there is now digitized information on boundaries. However, land tenure still remains an issue in some areas, limiting private initiatives in wood-lot establishment and management (Blay et al. 2014).

The government passed a benefit sharing law, which entitles anybody who establishes a plantation on government land to 40 percent of

the plantation benefits. This law also allows any person who plants outside government land entitlement to those trees (Appiah 2015). Benefit sharing for natural forest timber revenue, including royalties and social responsibility agreements, has given forest communities a financial stake in commercial timber operations. In addition, timber permit holders are now required to negotiate social responsibility agreements with local communities (PROFOR 2011).

The lack of written agreements in Ghana is thought to create the potential for misinterpretations. Land ownership can be claimed from "long use and association" with communal land. Tree planting, which is the main component of forest carbon or reforestation projects, is considered to be one of the acts that can guarantee "long use and association" with a piece of land. As a result, tenant and subtenant farmers are often discouraged by landowners from planting trees (Appiah 2015).[5]

There is political will in Ghana for action, but many policies do not reflect that reality on the ground. Many policies and plans have been created to enable sustainable forest management, such as the Forestry Development Master Plan (1996–2020) (PROFOR 2011). However, it is difficult to address the underlying causes of degradation such as mining because the government does not always have access to traditional communities, who often perceive more economic opportunities from selling land into mining.

Formal mining generates approximately 40 percent of gross foreign exchange in Ghana and accounts for about 6 percent of its GDP (Hirons 2015). Ghana also has a growing artisanal and small-scale mining sector and an informal gold mining economy known as "galamsey" (gather, then sell). There have been accusations of corruption with Chinese operators since 2005, with as many as 50,000 gold prospectors having left China for Ghana. Legislation is a key issue and effective regulation is needed, but due to the high demand for gold-bearing land, aspiring licensees are competing with wealthy Chinese entrepreneurs (Hilson et al. 2014). Furthermore, the current regulatory framework discourages legalization for indigenous small-scale miners to operate within the industry. Without reasonable opportunities to mine, artisanal miners disregard the law in order to secure their livelihoods.

Newly Planted Degraded Forest Restoration at Pamu-Berekum
Photo credit: Dominic Blay

5 | Financial viability

Most forestry and restoration projects in Ghana are externally funded by international donors. The perception of restoration finance needs to change to create a mindset of generating internal funds to attract private sector support, rather than relying on external donors.[6] Private investment, which is present in the renewable energy sector, is needed for restoration (Blay et al. 2014).

6 | Monitoring & Evaluation

All of these restoration projects have monitoring systems and have created baselines beginning with the physical measurement of farm size. Farmers were trained to use GPS to trace their farm boundaries and take subsequent measurements. The project initially undertook an inventory of farmers, their land holdings, and their crops. However, beyond the project boundaries there are constraints regarding the continuation of extension services as well as monitoring and evaluation (Blay et al. 2014).

[2] There was improved awareness about the causes and impact of forest degradation, which included the loss of Non-Timber Forest Products (NTFPs), especially bush-meat, loss of soil fertility (which was leading to a decline in crop yields and reduced income), as well as reduced flow and sometimes complete drying up of streams and ponds.

[3] Simple techniques such as using GPS to trace their farms' boundaries, forest inventory techniques, low-impact harvesting, management plan design and skill development in areas such as bee keeping and snail farming have been instrumental in project success (Blay et al. 2014).

[4] Local farmers were the managers of trees on their farmland and have the responsibility of implementing all field activities including reforestation and agroforestry practices. The chiefs and elders, who are traditionally the landholding authorities, were responsible for organizing the farmers and ensuring their collaboration.

[5] At the national policy level, although communities have rights to manage their own lands, the Forestry Department allocates tree-felling rights, collects royalties and shares them with landowners excluding local farmers who are actually working the land (Appiah, 2001). This policy gives local people no incentives or rights to prevent others from cutting down the trees which are found on lands under their management (Blay et al. 2014).

[6] One example of private investment in Ghana is between Dalhoff Larson and Hornman and one of its business partners in Ghana, Ghana Primewood Products Ltd who set up a joint forest management project with the DANIDA private Sector Development Programme – the first restoration project was financed at $600,000 (Blay et al. 2014)

INDONESIA

Indonesia has 91 million hectares of forestland covering 53 percent of the country (FAO 2015). The extent of degraded forests and lands in 2012 was estimated at 27.3 million hectares (Walsh et. al. 2013).

These restoration case studies were drawn from two primary sources: 1) ten projects implemented in ten different provinces of Indonesia examined by Nawir, et.al. (2007); and 2) five ITTO-assisted projects implemented after 2002 (Sidabutar 2014). Restoration projects have generally improved project site conditions regarding land productivity, ecological conditions, livelihoods, access rights, conflict resolution, participation and the adoption of new technologies. Those projects implemented on non-state lands tended to have a higher success rate than those on state forest lands mainly due to clear land ownership, aligned government policies and incentives to plant trees through guaranteed access rights to harvesting trees. Major obstacles were inconsistent policy frameworks, conflict over use rights and unsupportive communities and institutional arrangements (Sidabutar 2014).

1 | Integrated management systems

Integrated management systems are needed in Indonesia in order to counteract the drivers of degradation. Since the 1990s, there has been an urgent need to address over-logging, forest fires, forest conversion, population pressure and encroachment. A number of restoration initiatives have been created in Indonesia - including developing demonstration units for natural resource conservation and sedentary demonstration units for farming, community forests, mangrove forests, community seed centers, natural silk, honey-bee farming, tree seed centers, and soil and water conservation programs. There are also opportunities from non-wood forest products (NWFPs). The NWFPs are categorized into 1) non-woody plants such as rattan, bamboo, roots, fruits and medicinal plants; 2) resins and gums (for example pine resin); 3) Essential oils obtained from leaves, roots, barks, fruits and flowers or by chemical extraction, and, 4) Wildlife (income can be derived from nature-based tourism) (Sidabutar 2014).

At most restoration sites, an increase in floral diversity and carbon stock were observed as a direct result of tree planting, but the most noticeable results were found in watershed protection projects. In promoting large-scale commercial forest plantations on degraded lands, genetically improved planting materials and appropriate silvicultural techniques have played an essential role.

Major obstacles included weak capacity in seedling production, untimely planting of seedlings and maintenance of young trees, as well as inadequate tree selection processes (Nawir et al. 2007). The rehabilitation of over-logged areas was considered a failure due to the lack of plantation maintenance and conflict with other forest concession holders due to inconsistent central government policy on forest concession rights (Sidabutar 2014).

2 | Benefits & incentives

Clear benefits are needed in order to provide alternative livelihoods to the drivers of deforestation and degradation in Indonesia. In these case studies, benefits varied between state and non-state lands. It was easier for communities involved in projects implemented outside state forest areas to generate income after the first five years and beyond because the communities could continue replanting activities after the project had completed. Projects implemented inside state forest areas were less likely to generate significant income for local people even after the first five years. In the long-term, local people used the forest and its products to meet their subsistence needs only and in the project sites did not have any formal rights to harvest trees planted inside state areas.[7]

On the whole, restoration projects also had a positive impact on access to public facilities including healthcare, clean water, electricity, education and availability of information. Projects implemented inside state forest lands developed various kinds of infrastructure, local governments, NGOs and participating communities.

On degraded lands specifically, local communities usually plant seasonal agriculture cash crops such as peanuts, corn, and other vegetables which are sold for income. Depending on the

land and soil conditions, degraded lands may be planted with perennial cash crops such as rubber and palm oil that are harvestable from year 5 to 25 and generate a stream of income. There are many long-term benefits from restoration activities with land planted with rubber.[8]

However, in many cases, restoration projects only allow the planting of timber trees. In general, the opportunity cost of restoration initiatives is too high for local communities to sacrifice potential income from commodities such as rubber and palm oil.[9] Many communities are not content to just meet subsistence needs, therefore cash crops and collecting NTFPs are no longer fulfilling. Harvesting palm oil and rubber on state-owned lands is a more attractive option, regardless of the risks involved. While the risk is high (which could involve confiscating the produce of the land), poor law enforcement means numerous households have enjoyed lucrative income from illegally occupied state lands. This presents a great challenge in restoration – how can farmers reach higher living standards from degraded forests with the level of income they aspire to earn (Sidabutar 2014)?

Indonesia ITTO project site
Photo credit: Subarudi

3| Stakeholder platforms

The success of these projects was dependent on active participation of local communities. The main purpose of these activities was to discuss the primary objectives to be achieved, relevant interventions to be implemented and key challenges to be addressed. Employment of local community leaders and NGOs in carrying out the participation processes proved to be effective due to their better familiarity with local conditions and competence in communicating with local people. To allow for active participation, local communities must be equipped with needed skills. For example in Java, training local communities on the application of soil conservation techniques has enabled the project to increase forest cover, reduce soil erosion and sedimentation while at the same time augmenting income in participating communities (Sidabutar 2014).

While adoption of a participatory approach in restoration has been widely promoted, this is not always followed in the planning process. Most of the projects employed mass mobilization[10] instead of interactive participation because it was thought to be more practical and less time consuming. This top-down design, in turn, tended to be less successful in promoting community involvement over the long term. There has been a failure of the state to recognize the dynamics of the local communities and to empower local institutions at the local and regional levels (Nawir et al. 2007).[11]

4| Effective governance

There has been a long history of forest 'rehabilitation' in Indonesia since the 1950's. Since the 1980's, the

Degraded lands rehabilitated using turi species and tobacco under an agro-forestry system in Gunung Kidul, Yogyakarta
Photo credit: Subarudi

predominately top-down approach to rehabilitation has been replaced by a new understanding of restoration. The Ministry of Forestry (MOF) defines forest ecosystem restoration through the ministerial decree No. P.61/2008 as "the efforts for improving biotic and abiotic elements inside a production forest that aims to recover biological balance." Such restoration efforts are focused on degraded forest cover and land in order to preserve their carrying capacity, productivity and role as a life supporting system. The regulation also distinguishes between forest rehabilitation, reclamation and revegetation.[12] A supporting regulation, Article 22 of the forestry ministerial decree No. P.39/Menhut-II/2010 stipulates that forest and land rehabilitation activities are to be carried out on both community owned and state lands, private lands and other public areas such as mangroves and coastal forests.[13] The Indonesia National Working Group created 10 principles and 34 guidelines for restoration which has enabled a framework for guiding projects.

Development of participatory contractual agreements on collaborative forest management and strong commitment of the local governments and communities to their implementation helped ensure the effective operation of restoration projects. The agreements significantly raised income of local communities while reducing the forest service's operational cost of forest management.[14] Under certain projects, community rights were more secure after the first five years as a result of participatory processes at the village level that clarified the different classifications of land use. However, conflicts of interest amongst stakeholders, forest encroachment due to weak law enforcement and disagreements over land boundaries still exist.[15]

There continues to be land boundary conflicts between Forestry Services, estate crop companies, local communities and other local interest groups. Access to harvest the trees planted on community land is still not insured by the government. There has also been weak law enforcement in terms of political support, policy frameworks, human resources and operational facilities. Weak support of district government on restoration initiatives is evident by the fact that many district spatial plans are biased towards economic development for immediate tangible benefits. There have been inconsistent policies between central and local governments as regards tree selection.

Some local institutions assigned to carry out particular activities do not fully understand their responsibilities or have the capacity to undertake the tasks assigned to them. Weak law enforcement by local governments has also jeopardized sustainability of many restoration projects mainly due to weak institutional coordination, inadequate strategies and lack of required resources. Policy initiatives of many district governments do not facilitate local forest industry development by allowing trans-border log trading. At many project sites, illegal mining is taking place, which

prevents the success of projects. Conversion of forest lands to other non-forest uses is progressing even within project boundaries.

Development of participatory contractual agreements on collaborative forest management and strong commitment of the local governments and communities to their implementation helped ensure the effective operation of restoration projects.

In general, security of tenure has not been adequately addressed by restoration projects in Indonesia. Field observations showed that security of tenure strongly influenced the success and long term sustainability of restoration projects. According to community members, restoration projects generally had little positive impact on institutional capacity, representation of communities in forest management and social cohesion (Sidabutar 2014).

5| Financial viability

In most restoration projects, the main source of income was wages from labor activities on restoration sites. Beyond the project periods, sources of income included earnings of agricultural crops, ecotourism and nursery development. Incomes generated from restoration activities played a less important role in total household earning than other sources such as the sale of agricultural and non-agricultural products. Most projects had difficulty in strengthening the local economic institutions established due to the lack of start-up capital, insufficient business acumen and lack of a business network.[16]

Continuity of funding must be secured by putting in place a practical investment mechanism through adoption of appropriate government policy initiatives. Using a single year budget appropriation system has resulted in ineffective operations of restoration projects. Multi-year budgeting allows for flexibility of funds and avoids delays in implementation activities that are affected by climate and weather conditions, which have implications for land preparation, tree planting and tree survival rates. Complicated procedures for approval of operational plans and associated budgets have inevitably delayed inception and hampered effective implementation of many restoration projects such as those experienced by the projects in Riau and East Kalimantan (Sidabutar 2014).

6| Monitoring & Evaluation

During the inception stage, restoration projects need to develop a sound monitoring plan establishing measurable indicators, timing and parties responsible for implementing the plan, such as those practiced by the ITTO project in Jambi. There is an urgent need to improve planning processes by using reliable data on project sites and undertake participatory monitoring and evaluation to guarantee sustainability. Long-term management plans, monitoring and evaluation plans and feedback mechanisms for many restoration projects are missing in Indonesia. Inadequate long-term planning has resulted in project area encroachment and forest fires. Poor baseline data resulted in employment of inappropriate land treatment techniques and improper species-site matching (Nawir et al. 2007). Monitoring is usually assigned to government organizations with questionable objectivity, and many projects are not sustainable due to weak strategic planning, unclear exit strategies and weak commitments to implementing exit strategies (Sidabutar 2014).

[6] There are two classifications of state forest which do allow for legal harvesting of trees and NTFP – Protection forest (NTFP harvest allowed), and Production forest (selective logging as well industrial timber plantations).

[7] When properly managed, rubber plantations can yield up to 650kg/ha/year for about 20 years starting from year 5. Assuming an average price of US$1-2kg the latex can generate an annual income of around 6,500-13,000/ha/year. This compares with annual gross incomes in Java of planting a variety of trees from teak to medicinal plants at between US4500-700 ha/year.

[8] For example, projects in West Kalimantan provided insufficient monetary incentives for local communities to maintain planted trees. Tree species chosen did not meet the preferences of the communities (Nawir et al. 2007).

[9] For example, in Meru Betiri National Park in East Java, conflict between the national park authority, local NGOs and local communities was difficult to resolve due to: i) the lack of good communication between parties, ii) unfair agreements between the park and local communities, and iii) poor coordination between the park authority and local government (Nawir et al. 2007).

[10] Forest reclamation is an effort to improve and restore degraded forest cover and land in order to optimally function in accordance with their designation; Revegetation is an attempt to repair and restore degraded vegetation through tree planting and nursing on formally utilized forest areas. Both are a rehabilitation effort aimed at improving productivity of degraded forest and land. This regulation and its parent regulation, (Government Regulation No. 6/2007) have provided opportunities to business entities to apply for ecosystem restoration concessions. The licensees are entitled to receive benefits from non-wood forest products and ecosystem services and timber at a later stage after restoring and/or while maintaining forest ecosystem functions.

[11] Based on the forestry ministerial decree No. 32/Menhut- II/2009, there are five categories of land degradation status: slope, erosion hazard level, productivity and management. The regulation of Directorate General of Watershed Management and Social Forestry No. 4/V-SET/2013 has detailed each of these parameters using a weighted 5 tier scoring system classifying lands as critical to non-critical. Based on this scoring system, the MOF has established a national map showing critical lands in the restoration planning process. Watershed areas have been designed according to priorities 1, 2 and 3 based on their degradation level.

MEXICO

Mexico has over 66 million hectares of forest covering about 34 percent of the country (FAO 2015). Restoration and conservation are a high priority in Mexico as it is a mega-biodiverse country. Due to its location at the junction of the Nearctic and Neotropical biogeographical regions, its geologic history and heterogeneous topography, Mexico´s flora and fauna is estimated to include around 12 percent of global diversity. Despite this biodiversity, Mexico has an annual deforestation rate of 0.3 percent (FAO 2012). However, this is still considerably lower than the average Central American deforestation rate (Douterlungne 2014).

This study summarizes two ongoing restoration projects in the buffer zone of the highly biodiverse Biosphere Reserve "El Ocote" located in the south of Mexico. The Ocote learning site encompasses different forests ecosystems, from thorn woodland to highland oak-pine. Two restoration strategies have been assessed: 1) a participative payment for carbon sequestration program; and 2) a holistic and participative restoration approach which rely on financing other than carbon. Having effective monitoring and evaluation mechanisms was key to producing baselines for carbon accreditation systems to enable farmers to benefit from payment systems. The local system of secure land tenure enabled restoration opportunities and provided a strong governance structure. However, alternative livelihood options such as raising cattle and sugarcane, as well as the relative low value of carbon credits, still pose challenges to restoration projects (Douterlungne 2014).

1 | Integrated management systems

Population growth, encroachment, illegal hunting, small scale extraction of forest products, poorly managed shifting cultivation, the development of the logging industry and illegal logging in the absence of effective environmental legislation are the leading causes of land degradation in Mexico. Invasive species and catastrophic forest fires have also led to arrested succession. To address this, an integrated approach has been key for assessing existing land uses and developing alternative options. Degradation processes and environmental characteristics were assessed and conceptual vegetation succession models with most probable states and pathways for four common ecosystems in the region were mapped. The region was divided into three subzones and was mapped and classified according to geographical and vegetation features.

The Plan Vivo System is a framework for community-based sustainable land-use projects which allow small landowners to access payments for ecosystem services (PES). Different carbon sequestration strategies are eligible under the Plan Vivo System: a) agroforestry, and small-scale timber, fruit or food fuel plantations (native and naturalized species); b) restoration of degraded or damaged ecosystems such as woodlands and; c) conservation of forests and woodlands under threat from deforestation. Such incentive mechanisms encourage smallholders to increase carbon sinks and to switch to more sustainable land management systems. There is growing interest in planning restoration based on bio-geographical units such as watersheds, instead of political boundaries.

Implementation of technical restoration activities face a number of challenges. Succession rates in degraded sites are often slow and arrested as a result of severe water shortages, illegal extractions, very shallow soils and emerging karst rocks, infestation of invasive species, and no or few large remnant trees, inadequate planting techniques as well as damage caused by foraging cattle are all factors which limit the success of restoration.

2 | Benefits & incentives

The underlying causes of environmental degradation are closely related to the economic conditions of rural livelihoods. Lack of sustainable

alternatives has led to forests being converted into unsustainable farmlands and pastures. Restoration projects are often closely linked with livelihood concerns, for example REDD+, where reforestation is often initiated as an agroforestry option which allows for the maintenance of croplands for an additional 5 to 10 years. Currently, no REDD+ projects have been implemented. Local feasibility studies are currently paving the road. The Plan Vivo is a Payment for Ecosystem Services scheme funded by voluntary donors which is independent from REDD+.

As implemented by AMBIO (a local NGO) the Plan Vivo system aims to provide long-term carbon storage in combination with biodiversity and poverty reduction. The payments for ecosystem services projects work like a microfinance scheme by aggregating the efforts of large numbers of small-scale farmers and forest user groups through community trust funds or similar transactional structures. The carbon to be sequestered is calculated for the next 100 years, while its value in carbon credits is paid during the first five years. However, if the economic revenue of additionally sequestered carbon remains under the potential incomes of less sustainable land uses (such as livestock breeding), smallholders are unlikely to jeopardize their incomes and switch to long-term forestry options. The actual price of carbon remains under the potential price, yet given the waiting list for participation, the economic incentive still represents a significant complementary income[15] in localities with potential for significant carbon sinks.

Degraded landscapes with poor retention of soil humidity
Photo credit: David Douterlungne, PRONATURA

As the common vocation of many community members is cattle breeding, forestry and restoration activities often face strong cultural resistance and adoption rates remain low. Although local participation is a cornerstone of projects, with no sources of income, migration rates of young men to other countries from local communities are very high. Some of the community promoters and leaders left the project and went in search of employment in the US.

3 | Stakeholder platforms

Creating the opportunity for stakeholder participation has been key to the success of projects in Mexico. Community members created restoration plans with the help of experienced facilitators during workshops. Each plan included a brief review of the local degrading factors and described the restoration goals and activities proposed to mitigate degradation. During an intensive certified education program at a local NGO - PRONATURA's environmental education center- community members received social and ecological training related to sustainable land uses. In addition, the participants were trained in administrative skills and were required to submit small agricultural and conservation project proposals to funding institutions. As a result of the capacity building courses, community leaders returned to their local communities and presented the proposals in front of local assemblies. Community leaders continue to receive workshops on topics such as forest conservation, watershed management, reforestation and community infrastructure.

Community run tree nursery for native tree species
Photo credit: David Douterlungne, PRONATURA

Collaborative planning allowed local farmers to incorporate their traditional or local management techniques into project design. While farmers were in the best position to identify local priorities, project coordinators checked the viability of proposed planning. Institutional collaboration between the government, academics and NGO sector allowed for extensive participative planning, capacity building and relevant expertise across rural development. With the right multidisciplinary facilitation, participatory mapping can promote locally driven spatial decision-making processes and community empowerment (Douterlungne 2014).

Collaborative planning allowed local farmers to incorporate their traditional or local management techniques into project design.

4| Effective governance

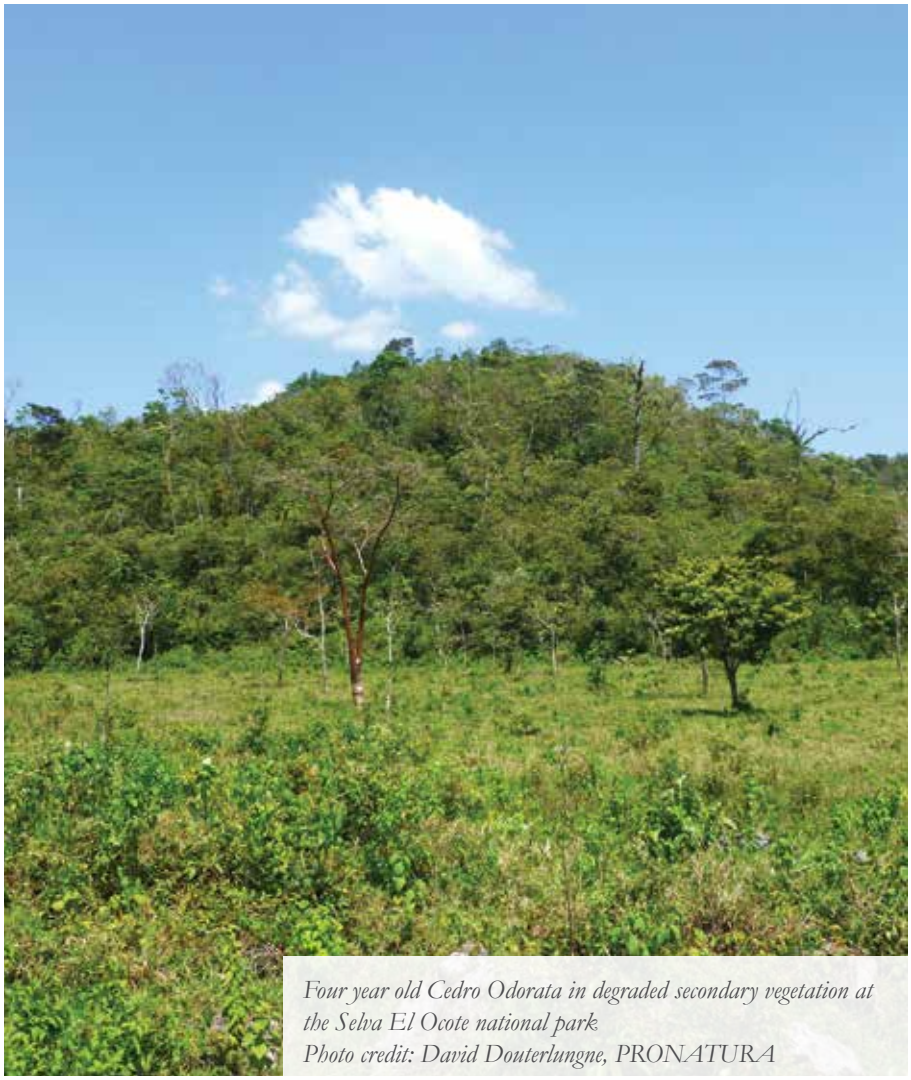
Land is, in principle, a communal resource under 'ejidos,' settlements. Within each ejido there is an agreed division of land uses with defined areas for permanent agriculture and for shifting cultivation, as well as areas of forest. Forest is usually managed communally, although in some ejidos, an informal privatization of the common land has occurred with each 'ejidatario' managing several parcels (Morales-Barquero et al. 2015). Detailed restoration plans were created to guide activities and increase coherence of different project components. Close collaboration with leading forestry institutions and governmental agencies are indispensable to open new market chains. There are many incentives for participation, however there is little effective inter-institutional coordination. There are also many participating institutions (NGOs, academic and government institutions) with contrasting goals. For example, while the environmental agencies promote organic farming, the agriculture agency delivers packages of agrochemicals to the same land users. In addition, the high migration rates of men actively taking part in the restoration programs makes it difficult to fulfil certain commitments and mid-term planning.

Mexico's political structure and strategies face structural reforms with each new governor or president. Once every six years, the change of regime hampers the execution of restoration projects in different ways.[16] In most cases this implies also a change of long-term goals and resource allocation, undermining long-term restoration projects and their funding. Decisions regarding forest landscapes within national parks can pass through up to five federal institutions, and each state can also have its own institutions. In addition, different environmental incentive programs require different application documents that must be submitted by different deadlines. In a diverse country like Mexico with different economic, cultural, and environmental concerns, it is impossible to issue environmental guidelines that fit all conditions, particularly when details and concrete instructions are necessary to allow easy implementation under different field conditions.

The land context of Mexico, with the majority of the indigenous communities and ejidos being the legitimate landowners, makes it an

example to follow regarding land tenure and access rights. It is also an effective way to make communities aware of their responsibility of the land uses. On the other hand, it challenges the implementation of large scale landscape projects which depends on the participation of thousands of small-scale landowners that often have territorial and religious disputes.

The Plan Vivo strategy takes advantage of participatory tools and therefore avoids some of the major pitfalls of PES programs such as land tenure and external control on land-use options. Agreements established in the Plan Vivo include fining illegal forest product extraction or hunting, assistance to assemblies or vigilance activities although they are not always fulfilled. Internal community agreements are a cornerstone of the Plan Vivo strategy and if not met on a regular basis can seriously undermine the outcome of the Plan Vivo projects.



Four year old Cedro Odorata in degraded secondary vegetation at the Selva El Ocote national park
Photo credit: David Douterlungne, PRONATURA

5| Financial viability

Many of the causes of degradation, such as breeding cattle, are related to the financial needs of land owners. The Fund for National Protected Areas (*Fondo para Áreas Naturales Protegidas*) (FANP) initiative implemented by PRONATURA combines several strategies to increase financial viability. Plantation establishment and maintenance were financed in collaboration with CONANP (Mexico's National Council of Protected Natural Areas) through temporary employment programs. The Plan Vivo implemented by AMBIO is based on Volunteer Corporation funding. The initiative generates economic returns starting from the first year of the project implementation through private funding. Carbon credits are paid in advance before additional carbon is sequestered, while safeguards must guarantee that emitted carbon credits do correspond with the actual additional carbon.

Many target sites selected were in challenging locations with no access roads, drastically increasing the cost of restoration. As sites were selected during participatory planning, landowners often prefer to utilize their least productive land for restoration. In contrast, ecologists prefer sites which are less costly to intervene in key-locations (connecting conserved fragments, riparian strips, etc.). Project managers selected sites based on a compromise of the two selection methods, while avoiding rejection of local landowners and high implementation costs. The FANP-initiative created a territorial strategy –whereby productive projects were implemented in exchange of lands to be restored. Labor opportunities on the project sites also provided employment. In addition, the

Community run tree nursery for native tree species at the community General Lazaro Cárdenas
Photo credit: David Douterlungne, PRONATURA

government provided funding for small productive projects such as a community run tree nursery made possible by training local leaders in project proposals.

The necessary initial investment, infrastructure and capacities to store products and add values was often absent. Small communities were not prepared to commercialize large volumes of forest products, which make it hard to attract buyers or enter into a formal commercialization process.

6 | Monitoring & Evaluation

Collaborative biological monitoring between taxonomists and trained local community members encouraged: 1) local young people to continue to study biology in college or university, 2) Better identification of animals, particularly poisonous and non poisonous species, 3) exchange of traditional and scientific knowledge.

Carbon accounting and baseline scenarios were calculated by a combination of collecting field data in 84 sample plots following the Winrock International methodology. Despite the growing body of academic literature, the science of quantifying carbon in natural and managed ecosystems is still in its infancy. It is unrealistic to create site-specific algometric equations for each site which result in less accurate carbon estimates. Potential risks that jeopardize carbon sequestration rates through unplanned land-use changes were managed with a four-step method: a) identifying focal areas, b) evaluating potential problems in those focal areas c) projecting potential results as well as d) assessing negative impacts, risks and mitigation options.

For the FANP strategy, environmental assessments exist at the regional level but not at the site level. Site level assessments linked with tree plantations can be useful to increase survival rates of planted species selection or propose alternative less costly restoration activities like active or passive regeneration. Despite the sound scientific base of planning documents and vegetation classification, they were of limited use due to their complexity. It was important to shift towards less complex territorial classification and more active participation (Douterlungne 2014).

Conclusion: Taking on industry—Gold, bauxite, oil palm, rubber, sugar and beef

These case studies are summarized using the key needs framework in Figure 4. They highlight a number of enabling factors, principally the six key needs of restoration: (1) integrated management systems; (2) benefits and incentives; (3) stakeholder platforms; (4) effective governance; (5) financial viability; and (6) monitoring and evaluation. In all of the case studies, strong stakeholder platforms and community involvement allowed for informed and sustained engagement in restoration activities.

The three key challenges this study has highlighted are the entwined aspects of how to effectively link benefits and incentives, effective governance and integrated management systems. Providing economic alternatives to

industry is currently a huge challenge to effective restoration efforts. Legislation is not effectively implemented, leading to those engaging in industry pursuits to take risks in illegal industries. This causes degradation and gives no fundamental incentive to change practices.

Considering that demand for global industries in gold, bauxite, oil palm, rubber, sugar and beef are only increasing, it is essential to consider how economically more attractive integrated management systems can be developed and facilitated by effective legislation, institutions and governance.

In Indonesia, for example, oil palm is a major challenge to restoration efforts. Expansion of oil palm occurs mainly at the expense of rubber plantations and other plots of agroforestry, highly logged secondary forests and select primary forests (Gunarso et al. 2013). Demand for palm oil will continue to increase in response to a growing and increasingly affluent population. Palm oil is one of the most profitable land uses in the humid tropics. Native biodiversity within oil palm plantations is far lower than the natural forests they often replace, yet oil palm plantations store more carbon than alternative agricultural land uses (Sayer et al. 2012). It is therefore important to consider the role of oil palm in integrated management systems. In Ghana, gold and bauxite mining—and in Mexico, cattle ranching and sugarcane plantations—present similar challenges.

Women involved in capacity building regarding the administration of a nursery.
Photo credit: David Douterlungne, PRONATURA

In all case studies, shifting cultivation is a source of livelihoods for many smallholder farmers and represents the primary source of food security for many rural households. In many circumstances, prohibiting shifting cultivation and promoting a transition to a combination of intensified permanent agriculture systems and protected forest land is not socially or environmentally desirable. Deforestation factors into this equation as well. Ending deforestation—while at the same time protecting local tenure rights for the smallholder farmers and also meeting the growing demand for commodities—are all sides of the same coin. Governments, private sector leaders, and civil society need to work together in order to adapt supply chain management practices, regulations and incentives for stopping deforestation and entering restoration (Pacheco 2015). Targeting livelihood restrictions of livestock browsing and certain areas of shifting cultivation could help this (Morales-Barquero et al. 2015). Shifting cultivation is considered to cause forest degradation rather than deforestation because its cycle of operation involves clearance followed by regrowth of forest that creates a landscape with lower biomass density that still qualifies as forest (Morales-Barquero et al. 2015). It will be important moving forward to consider what role landscape matrixes play in providing sustainable land-use options for the environment, society and the economy. A landscape approach is therefore essential in order to facilitate sustainable land-use and management.

[15] Regional community nurseries provide many benefits, including (1) generating local income by commercializing the production of trees, (2) extending knowledge of tree propagation techniques with modern nursery techniques, (3) guaranteeing the provision of locally produced trees and (4) strengthening local organizations.

[16] For example, Chiapas's forestry institution, COFOSECH—an independent governmental institution founded 10 years ago—was dismantled in March 2014 and forestry issues are now handled by the state's secretary of environment and natural history.

Figure 4 | Summary of the case studies regarding the key needs framework

Key Needs Framework	Ghana
Integrated management systems	Interventions include apiculture, snail farming, fish farming, agroforestry and woodlots.
Benefits & incentives	Short-term income generating activities were created while waiting for trees to mature. Participation was often dependent on free project equipment.
Stakeholder platforms	Traditional leaders engagement is key – without adequate knowledge of restoration, they have often sold land into mining.
Effective governance	Role sharing and decentralization was key. Natural Resource Management Committees (CONARs) have mobilized committees to plant, patrol, enforce laws and guide natural resource management. However, land-ownership can be claimed through 'long use and association' which deters tenants from allowing sub-tenants to engage in restoration activities.
Financial viability	Most restoration projects are funded by donors. More needs to be done to engage the private sector.
Monitoring & Evaluation	Farmers trained in simple GIS techniques to trace their farm boundaries. Initial farm inventories were conducted including land holdings and crops.

Indonesia	Mexico
Interventions include sedentary demonstration units, Non Wood Forest Products and nature based tourism.	A local Payments for Ecosystem Services program enabled restoration of agroforestry, woodlands and the conservation of forests.
Non-state forest areas can generate income beyond project completion. In general, the opportunity cost of restoration is too high compared to rubber and palm oil.	If less sustainable land uses (such as livestock breeding) remains more profitable than carbon, smallholders are unlikely to switch to long-term forestry options.
Active participation was important - Most projects employed 'mass mobilization' instead of interactive participation - it was considered less time consuming, however this discouraged community involvement in the long-term.	Training engaged communities - Community members received social and ecological training on sustainable land use. Collaborative planning allowed local farmers to incorporate traditional techniques into project design.
Land boundary conflicts are rife. Weak law enforcement by local governments jeopardizes the sustainability of projects due to weak institutional coordination, inadequate strategies and lack of required resources. Conversion of forest lands to other non-forest uses and illegal mining exits even within project boundaries.	Clear land tenure and allocation was important - Land is a communal resource under 'ejidos,' settlements. Ejido's have agreed division of land uses for permanent agriculture, shifting cultivation and forest. However, institutions are complex. Mexico's political structure face structural reforms every six years, hampering the execution of restoration projects.
The main source of income was wages from labor activities on restoration sites. Continuity of funding is a challenge.	Carbon credits are paid in advance, however carbon prices were lower than expected. Small communities need investment and economies of scale to attract commercial buyers.
Long-term management plans, monitoring and evaluation plans and feedback mechanisms for many restoration projects are missing. Poor baseline data resulted inappropriate restoration techniques.	The science of quantifying carbon is still in its infancy. It is unrealistic to create site-specific equations for each site which result in inaccurate carbon estimates.

ITTO RECOMMENDATIONS

1 | Identify ITTO's comparative advantage within the Global Partnership for Forest and Landscape Restoration (GPFLR) and utilize this to fill gaps in restoration methodologies and toolkits

The ITTO Guidelines have two functions: (1) policy planning and management; and (2) stand-level principles and management (Figure 1). Currently many of the topics featured in the guidelines are similar to those covered under the Restoration Diagnostic (Figure 5); however, some stand-level forestry principles and governance indicators are not adequately covered in the ROAM methodology (Figure 6). *Restoration Opportunities Assessment Methodology (ROAM)*. ROAM includes a package of (1) stakeholder input, (2) geospatial mapping, (3) economic analysis, (4) carbon analysis, (5) enabling conditions and (6) financial analysis (Maginnis et al. 2014). It is currently classified as a "road-test edition," acknowledging that it is not yet an adequate holistic framework for restoration. In this respect, it is recommended that ITTO fund research into the three main challenges faced by restoration—effective governance, benefits and incentives and integrated management systems. This could take the form of separate toolkits or collaborative projects with other GPFLR partners.

ITTO is well-positioned to focus on governance. Its 72 members represent about 80 percent of the world's tropical forests and 90 percent of the global tropical timber trade. The organization develops internationally agreed policy documents to promote sustainable forest management and forest conservation and assists tropical member countries to adapt such policies to local circumstances as well as implement them in the field through projects. ITTO is positioned to focus on benefits and incentives: it collects, analyzes, and disseminates data on the production and trade of tropical timber and funds a range of projects and other action aimed at developing industries at both community and industrial scales. ITTO is also is well-positioned to focus on integrated management systems. The United Nations International Tropical Timber Agreement (ITTA) in 2006 laid out 19 objectives for ITTO, including to promote and support research and development with a view to improving forest management and efficiency of wood utilization, as well as increasing the capacity to conserve and enhance other forest values in timber producing tropical forests (ITTA 2006).

2 | Align revision of restoration guidelines with global emerging issues and priorities

The ITTO Principles are mapped out in the proposed key needs framework. The current categories of the ITTO Guidelines are not mutually exclusive, and the categories are not necessarily intuitive, so there needs to be a simplification and alignment of the principles. This report aims to be the first step in addressing a critical need for revised ITTO Guidelines. The figures in this report are not adequately developed to be used other than to inform future efforts. It is very timely for ITTO to reassess their framework considering the global drive for restoration commitments (Figure 7). It is important that such targets and priorities are taken into consideration in the revision of the ITTO Guidelines.

3 | Utilize the Global Partnership for Forest and Landscape Restoration (GPFLR) to create visibility of the ITTO Guidelines and to support the implementation of the global landscape restoration initiatives

The GPFLR is undergoing a restructuring. It seeks to have all members provide information regarding their organizations' unique perspectives, resources, skills, role in restoration activities and contribution to the GPFLR (GPFLR 2011). This presents an opportunity for ITTO to identify research and implementation partners for the guidelines. This will allow for greater opportunity to utilize the revised guidelines and create a platform for greater visibility of the guidelines.

Figure 5 | The Restoration Diagnostic (Hansen et al. 2015)

The Restoration Diagnostic is a three-step process for developing strategies to increase the likelihood of achieving successful forest landscape restoration

IN PLACE
PARTIALLY IN PLACE
NOT IN PLACE

Theme	Feature	Key success factor	Status
Motivate	Benefits	Restoration generates economic benefits	
		Restoration generates social benefits	
	Awareness	Restoration generates environmental benefits	
		Benefits of restoration are publicly communicated	
	Crisis events	Opportunities for restoration are identified	
		Crisis events are leveraged	
	Legal requirements	Law requiring restoration exists	
		Law requiring restoration is broadly understood and enforced	
Enable	Ecological conditions	Soil, water, climate, and fire conditions are suitable for restoration	
		Plants and animals that can impede restoration are absent	
		Native seeds, seedlings, or source populations are readily available	
	Market conditions	Competing demands (e.g. food, fuel) for degraded forestlands are declining	
		Value chains for products from restored areas exist	
	Policy conditions	Land and natural resource tenure are secure	
		Policies affecting restoration are aligned and streamlined	
		Restrictions on clearing remaining natural forests exist	
		Forest clearing restrictions are enforced	
	Social conditions	Local people are empowered to make decisions about restoration	
		Local people are able to benefit from restoration	
	Institutional conditions	Roles and responsibilities for restoration are clearly defined	
		Effective institutional coordination is in place	
Implement	Leadership	National and/or local restoration champions exist	
		Sustained political commitment is in place	
	Knowledge	Restoration “know how” relevant to candidate landscape exists	
		Restoration “know how” transferred via peers or extension services	
	Technical design	Restoration design is technically grounded and climate resilient	
		Restoration limits “leakage”	
	Finance and incentives	Positive incentives and funds for restoration outweigh negative incentives	
		Incentives and funds are readily accessible	
	Feedback	Effective performance monitoring and evaluation system is in place	
		Early wins are communicated	

Figure 6 | Possible future key areas of focus for ITTO's guidelines and principles

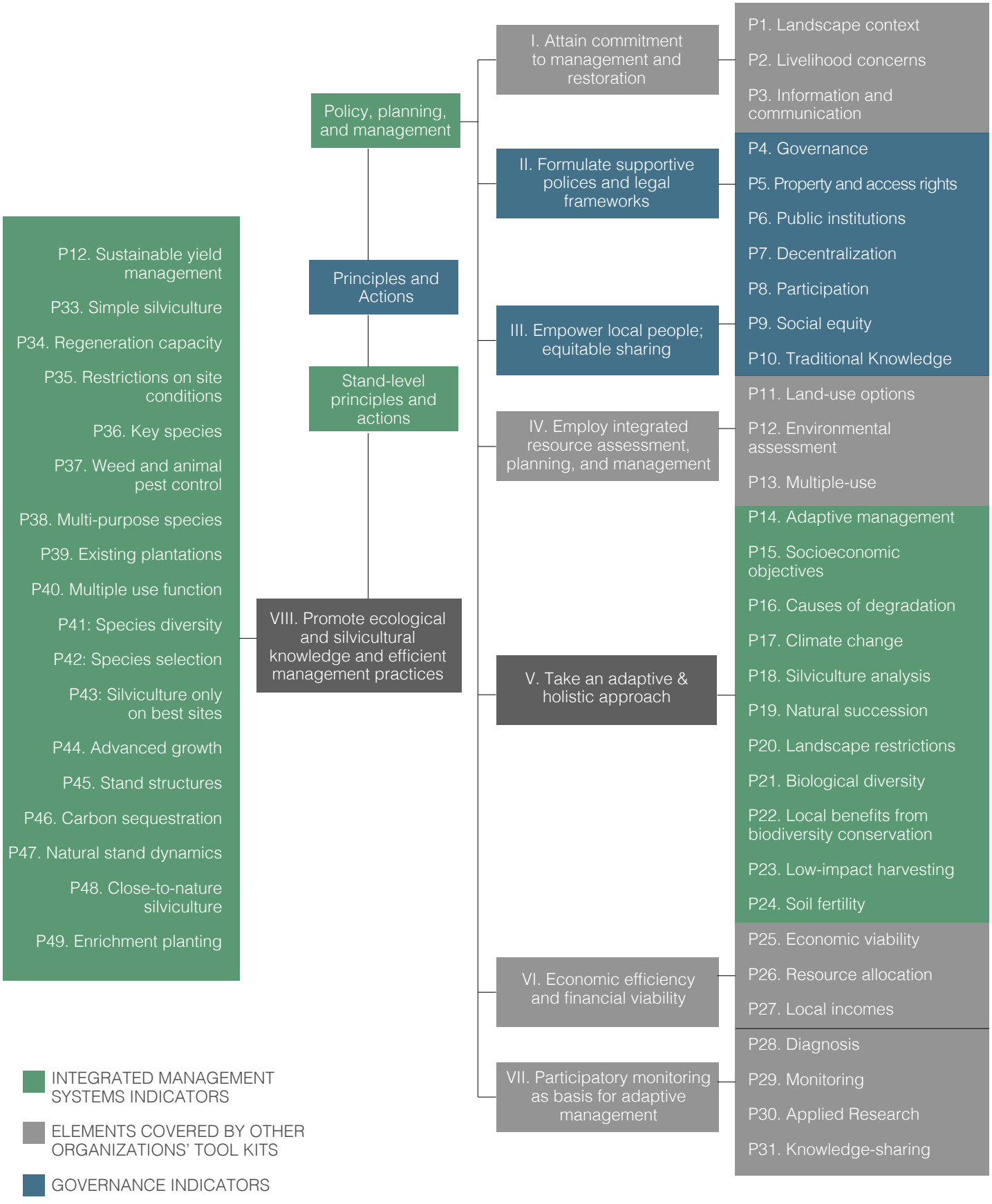


Figure 7 | Restoration targets and priorities to be incorporated into the revision of the ITTO Guidelines

Restoration target or priority	Description	Steward or driver
Aichi Biodiversity Targets	Target 5: By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced. Target 15: By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.	United Nations Convention on Biological Diversity (2011-2020)
The Bonn Challenge	By 2020, 150 million hectares of land will be under restoration activities globally.	International Union for the Conservation of Nature (IUCN) & Global Partnership on Forest and Landscape Restoration (GPFLR) (2011-2020)
Initiative 20x20	By 2020, 20 million hectares of land will be under restoration activities in Latin America.	Latin American Countries & World Resources Institute (WRI) (2014-2020)
New York Declaration on Forests	Have 150 million hectares of degraded landscapes and forestlands under restoration by 2020 and significantly increase the rate of global restoration thereafter, which would put at least an additional 200 million hectares under restoration activities by 2030.	United Nations Climate Summit (2014-2030)
AFR100	The AFR100 is a pan-African, country-led restoration effort to bring 100 million hectares of degraded landscapes in Africa under restoration by 2030.	African Countries & World Resources Institute (WRI) (2015-2030)
Reducing Emissions from Deforestation and Degradation (REDD+)	REDD+ is a mechanism to reward developing countries for reducing emissions from deforestation and forest degradation. It aims to create an incentive for developing countries to protect, better manage and wisely use their forest resources, and in so doing contribute to conserving biodiversity and to the global fight against climate change.	United Nations United Nations Framework Convention on Climate Change (new strategy 2016-2020)
Sustainable Development Goals	SDG 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.	United Nations (2015-2030)

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