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REVISED ITTO GUIDELINES FOR THE SUSTAINABLE MANAGEMENT OF NATURAL TROPICAL FORESTS

Prepared for ITTO

by

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PART 1 The sustainable management of natural tropical forests

Background

How to use these guidelines

PART 2 Overview of principles and guidelines

Framework principles for the sustainable management of natural tropical forests

Management principles in natural tropical forests

Principle 9: Well established and defined Forest Management Unit (FMU)

Principle 10: Management planning

Principle 11: Yield regulation and control

Principle 12: Harvesting operations

Principle 13: Silviculture

Principle 14: Forest Protection

Principle 15: Biodiversity conservation at FMU level

Principle 16: Community involvement in sustainable forest management

Principle 17: Working conditions and capacity development at the FMU level

Principle 18: Monitoring, evaluation, research and communication

PART 3: Principles, guidelines and recommended actions

(Detailed presentation of each principle, guidelines and recommended actions to each guideline, to be provided)

ADDENDUM: Climate change mitigation and adaptation at FMU level

Glossary of major terms used

References and further reading

PART I The sustainable management of natural tropical forests

Rationale

This publication updates and replaces the original *ITTO Guidelines for the Sustainable Management of Natural Tropical Forests*, published in 1990 as ITTO's first policy guidance document on the management of the natural tropical forest estate. In 2007 the International Tropical Timber Council decided to update these guidelines [1] in the light of increased knowledge and the emergence of a wide range of new challenges and opportunities for tropical forest management.

There have been many significant developments in international policies related to tropical forests and forest management since 1990. These include the adoption, in 1993, of the Convention on Biological Diversity (CBD), the Convention to Combat Desertification (UNCCD) and the Framework Convention on Climate Change (UNFCCC); adoption of the Kyoto Protocol in 1996; the UNFCCC 'Cancun' decision on REDD+[2] in 2010; and the 2007 agreement on the Non-Legally Binding Instrument on all Types of Forests (NLBI; Resolution 62/98 of the United Nations General Assembly), which includes four globally agreed objectives on forests. There has also been a general shift in tropical forest management from a focus on timber towards holistic multi-purpose approaches that place increasing emphasis on forest services. Box 1 summarizes some of the general trends that have affected the management of natural tropical forests since 1990.

BOX 1 Trends that have affected the management of natural tropical forests since 1990

- Increased societal demands and expectations on forests and environmental and social awareness about tropical forests.
- Increased recognition of the role of tropical forests in delivering 'global' ecosystem services, including those related to biodiversity, carbon and water.
- Increased recognition of the rights of indigenous peoples and forest communities over forests and forest use, and the need to safeguard those rights.
- Increased decentralization of control over forests.
- Emergence of forest certification as an important driver of SFM.
- Increased awareness of illegality and corruption as major impediments of SFM.
- Increased role of the informal sector and its lack of visibility in national statistics and development plans.
- Increased role of non-governmental organizations (NGOs) in forest management and forest policy development.
- Loss of silvicultural knowledge and practice and a lack of research, leading to over-optimistic cutting cycles and a lack of silvicultural management.
- Increased vulnerability of tropical forests to abiotic and biotic threats attributed to climate change and climate variability
- Development of REDD+ as part of a global climate change agenda, which has raised the visibility of tropical forests to the highest political level.
- Increased demand for wood and wood products, even as the international market for tropical timber diminishes.
- Increased role of planted forests in meeting demand for wood products.
- Increased demand for renewable energy, including forest-based energy.

Influenced by such trends, approaches to forest management have evolved considerably in most of ITTO's producer member countries since 1990. This is reflected in the (continued) development of an important spin-off of the original guidelines—criteria and indicators (C&I) for

[1] Decision 2(XLIII) - ITTO Biennial Work Programme for the years 2008-2009

[2] Policy approaches and positive incentives on issues related to reducing emissions from deforestation and forest degradation in developing countries; and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries. *From the Bali Action Plan of the UNFCCC.*

sustainable forest management (SFM). All ITTO member countries have acknowledged the importance of C&I as a tool for defining forest management and for monitoring progress in and challenges to SFM.

These revised guidelines for the sustainable management of natural tropical forests take all these developments and others into account and bring together all the requirements for achieving SFM in natural tropical forests. They are designed to assist forest managers, policymakers and other stakeholders to manage, conserve and sustainably use some of the planet's most valuable resources—natural tropical forests.

Scope

These revised guidelines constitute an international reference document for the development or improvement of national and subnational guidelines for the sustainable management of natural tropical forests. They also provide a reference on technical issues at the macro or landscape scale and the micro or forest management unit (FMU) scale.

The notion of permanence is a necessary condition for SFM. The permanent forest estate (PFE), as defined in ITTO (2005), comprises land, whether public or private, secured by law and kept under permanent forest cover. It 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 fulfill a combination of these functions. Although the guidelines can be applied to the sustainable management of all natural tropical forests, the focus is on the PFE and the multiple-use roles of forests, including timber production.

The production PFE is PFE where timber harvesting and other forms of resource exploitation are permitted, albeit subject to certain conditions. The protection PFE is PFE where such exploitation is generally not permitted. These guidelines are designed to be applied in the management of the production PFE, although many of the principles, guidelines and recommended actions can and should be applied in the protection PFE.

BOX 2 ITTO policy documents with implications for the sustainable management of natural tropical forests

- ✓ ITTO (1990). ITTO Guidelines for the Sustainable Management of Natural Tropical Forests. ITTO Policy Development Series No 1.
- ✓ ITTO (1992). Criteria for the Sustainable Management of Natural Tropical Forests. ITTO Policy Development Series No 3.
- ✓ ITTO (1993). ITTO Guidelines for the Establishment and Sustainable Management of Planted Tropical Forests. ITTO Policy Development Series No 4.
- ✓ ITTO (1993). ITTO Guidelines for the Conservation of Biological Diversity in Tropical Production Forests. ITTO Policy Development Series No 5.
- ✓ ITTO (1997). ITTO Guidelines for Fire Management in Tropical Forests. ITTO Policy Development Series No 6.
- ✓ ITTO (1998). Criteria and Indicators for Sustainable Management of Natural Tropical Forests. ITTO Technical Series No 7.
- ✓ ITTO (1999). Manual for the Application of Criteria and Indicators for Sustainable Management of Natural Tropical Forests. ITTO Policy Development Series No 9.
- ✓ ITTO (2002). ITTO Guidelines for the Restoration, Management and Rehabilitation of Degraded and Secondary Tropical Forests. ITTO Policy Development Series No 13.
- ✓ African Timber Organization/ITTO (2003). ATO/ITTO Principles, Criteria and Indicators for the Sustainable Management of African Natural Tropical Forests. ITTO Policy Development Series No 14.
- ✓ ITTO (2005). Revised ITTO Criteria and Indicators for the Sustainable Management of Tropical Forests including Reporting Format. ITTO Policy Development Series No 15.
- ✓ ITTO (2009). ITTO/IUCN Guidelines for the Conservation and Sustainable Use of Biodiversity in Tropical Timber Production Forests. ITTO Policy Development Series No 17.

All documents can be downloaded at www.itto.int.

These revised guidelines complement other ITTO guidelines on various aspects of tropical forest management (Box 2), especially the *Revised ITTO Criteria and Indicators for the Sustainable Management of Tropical Forests* (2005) and the *ITTO/IUCN Guidelines for the Conservation and Sustainable Use of Biodiversity in Tropical Production Forests* (2009).

These revised guidelines are designed to encourage multi-purpose forest management practices that, if applied over the long term, will sustain the yields of multiple products from, maintain the provision of services by, and safeguard the values of tropical forests for the benefit of multiple stakeholders. While conceptualizing SFM at a broad policy level, the guidelines should also be useful to a wide diversity of forest managers working under a variety of management and tenure arrangements. The guidelines also present an adaptive and collaborative forest management concept that can be applied at multiple scales. They particularly provide guidance on tradeoffs in forest management decision-making and cross-cutting issues such as forest governance, land-use planning, institutional issues and inter-sectoral linkages. It is intended that these guidelines form a basis for the development of specific guidelines at the national or sub-national levels.

Objectives

The objectives of the *Revised ITTO Guidelines for the Sustainable Management of Natural Tropical Forests* are to:

- *Identify the framework conditions* for the application of forest management guidelines in natural tropical forests for the sustainable delivery of forest goods and ecosystem services.
- *Provide guidance for addressing the policy, legal, institutional, ecological social and economic issues* that need to be taken into account in the planning, implementation and evaluation of SFM.
- Help forest owners and managers to *implement SFM at the local and landscape levels*.
- *Stimulate the adoption of appropriate and adaptive management practices* to maintain the capacity of natural tropical forests to sustainably deliver multiple goods and ecosystem services.
- *Inform international processes* that deal with globally relevant issues, such as climate change, water, biodiversity and desertification, about the role that the sustainable management of natural tropical forests can play in such issues.

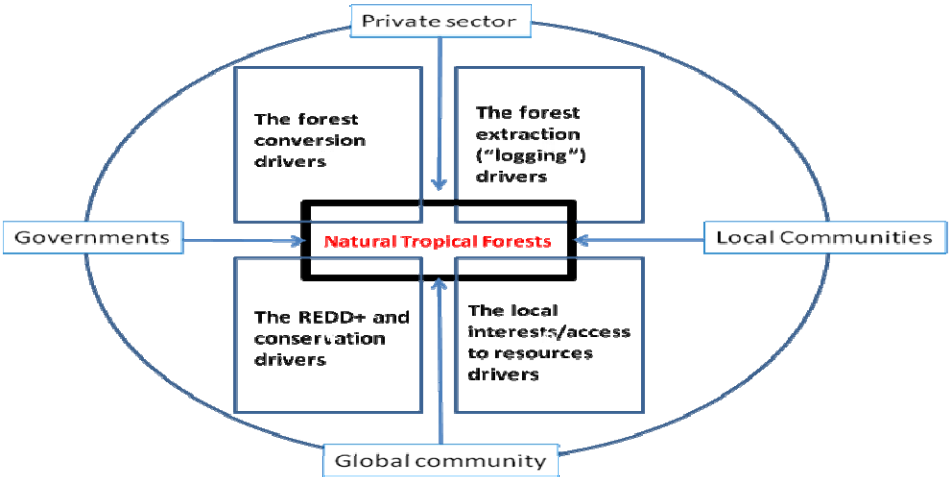
Who should use these guidelines

Many actors have interests in forests (Figure 1). While some of these interests are compatible, some are not. At one extreme, there are stakeholders who aim to preserve forests (even though interpretations of the term ‘preserve’ may vary), while, at another, there are stakeholders who would like to clear the forest to better exploit its soil or sub-soil. In between these two is a wide range of actors with a broad set of uses for tropical forests.

The **target groups** of these guidelines are those involved in the management and protection of tropical natural forests, including:

- Forest managers, such as state and local forestry agencies, timber companies, producer associations, natural-forest smallholders and rural and forest communities.
- Policymakers, such as political parties, government agencies dealing with forests, conservation, the environment and land-use planning, development and extension agencies, and civil-society organizations.
- Agencies, institutions and firms interested in the ecosystem services provided by natural tropical forests.
- Forest research, education and training institutions.
- International funding and development agencies.

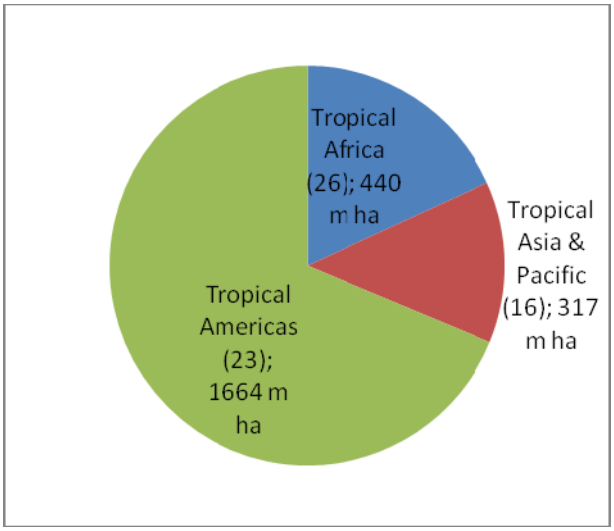
Figure 1 The various influences on the use and management of natural tropical forests



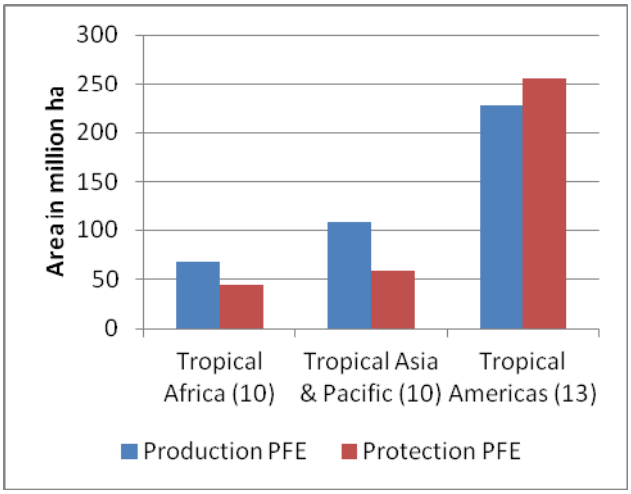
Background

Natural tropical forests extend over about 1664 million hectares in 65 countries, 1421 million hectares (85%) of which are in the 33 ITTO producer member countries (ITTO 2011). In total, the 33 ITTO producer member countries have an estimated natural-forest PFE of 761 million hectares, comprising 403 million hectares of production PFE and 358 million hectares of protection PFE (Figure 2).

Figure 2 Distribution of natural tropical forests worldwide, and PFE in ITTO producer member countries



Total tropical forest area, 65 countries, by region (figures in brackets = number of countries)



Natural tropical PFE by region, 33 ITTO producer member countries (figures in brackets = number of countries)

Source: FAO (2010), ITTO (2011).

Sustainable forest management

Defining SFM

A definition of sustainability is elusive, but it involves ways of using biological systems that do not impair their capacity to meet the needs of future generations. Sustainability has become a political priority globally and, for forests, SFM has developed into an essential tool.

This document uses ITTO's definition of SFM (see below). Nevertheless, there are many other definitions that vary widely, sometimes because of specific field circumstances and sometimes because of the particular purpose to which a user believes a given forest should be put (Douglas and Simula 2010). The concept of sustainability in forest management has evolved from sustained yield and single-use management for timber, to one reflecting the wide range of goods, ecosystem services and values generated or otherwise provided by forests. The term SFM was coined to reflect management for this wider set of purposes and the enabling policy and institutional environments, and wording on it was adopted by the United Nations in 2007 (Box 3). In general, SFM involves the application of the best available practices based on current scientific and traditional knowledge that allow multiple objectives and needs to be met without degrading the forest resource. SFM also requires effective and accountable governance and the safeguarding of the rights of forest-dependent peoples.

BOX 3: United Nations definition of SFM

The Non-legally Binding Instrument on All Types of Forests defines SFM as "a dynamic and evolving concept, [that] aims to maintain and enhance the economic, social and environmental values of all types of forests, for the benefit of present and future generations".

United Nations General Assembly Resolution 62/98, New York, December 2007. Available at http://www.un.org/esa/forests/pdf/session_documents/unff7/UNFF7_NLBI_draft.pdf.

It is generally recognized that the concept of SFM will change over time in response to the dynamic and evolving needs of society, and this may be partly the reason for the acknowledged lack of precision in its definition, particularly in regard to (WCFSC 1999):

- what needs to be sustained—i.e. the objectives of SFM
- the values attached by different stakeholders to various SFM objectives
- the uncertainties associated with interventions in complex forest ecosystems
- the timeframes and spatial boundaries involved.

WCFSC (1999) concluded that SFM "must be a flexible concept that accepts changes in the mix of goods and services produced or preserved over long periods of time and according to changing values signaled by various stakeholder groups", and that it "should be viewed as a *process* that can be constantly adapted according to changing values, resources, institutions and technologies".

SFM embraces the view that forests yield many products and provides many ecological services. It will therefore produce an array of products and services that may—and may not—include timber. SFM therefore relates to the *multiple use* of the forest (Pearce et al. 1999). SFM refers not just to the flow of goods and services but also to maintaining forest ecological processes essential for maintaining ecosystem resilience—the capacity of a forest ecosystem to recover following disturbance (Thompson et al. 2009).

An important dimension of SFM is the scale at which it is applied—global, national, sub-national, FMU and stand. SFM should be addressed at all levels.

- *A*t the ***global and national levels,*** the concept of SFM has evolved in the past 20 years as an approach that balances environmental, social (including cultural) and economic management objectives in line with the 'Forest Principles' adopted at the United Nations Conference on Environment and Development in 1992. The guiding objective is to contribute to the management, conservation and sustainable development of all types of forests and to provide for their multiple and complementary functions and uses. The global ecosystem services provided by forests, such as those related to the carbon cycle and biodiversity, should be addressed at the international level because all people have an interest in their maintenance; global payment mechanisms for such services are now being discussed in international forums. Much of the policy development on SFM initiated at the international level, including ITTO's work on C&I and various guidelines, has influenced policies at the national level.

- At the ***sub-national or landscape level,*** the objective of maximizing wood yields has traditionally been overwhelmingly important. Growing awareness of the broad role of forests, however, has led to new approaches to SFM that give weight to the full range of environmental, social and economic factors. At the landscape scale, tradeoffs will almost always have to be made in the mix of products, ecosystem services and values offered by forests. Ideally, such tradeoffs are agreed in a planning process involving all stakeholders and express a consensus view on what constitutes SFM in that particular landscape within physical and other constraints. Questions to be addressed in such processes include: How much forest do we need or want? What kinds of forest should there be? Where should it be situated? How should it be conserved and managed?

- *At* ***the FMU level****,* SFM has three elements: the management of forests for multiple objectives to meet the needs and demands of concerned stakeholders; achieving a balance among outputs (of goods and ecological services), rather than the maximization of any single one; and designing and implementing management practices that are compatible with the ecological and social processes that sustain forest resources and ecosystems. Within an FMU, the management of ***forest stands*** may vary (for example, some stands may temporarily have low or no tree cover, while others at different growth stages are full stocked) and still be compatible with SFM.

In summary, the essential aim of SFM is to maintain and enhance the potential of forests (at all scales) to deliver the goods and services that people and societies require of them over time. Thus, the use of forests should be planned at the national, landscape and FMU scales, and each FMU should be managed sustainably for the purposes for which it is intended in the landscape. Management should be applied consistently with the aim of maintaining ecosystem resilience, including by emulating natural disturbances, and the effects of management should be monitored so that management can be adapted over time as conditions change (see 'adaptive management' below).

ITTO's definition of SFM

The original (1990) version of the *ITTO Guidelines for the Sustainable Management of Natural Tropical Forests* recognized that managing forests sustainably is about achieving a balance among the different uses of the forest while ensuring continued ecological functioning and the provision of benefits and functions into the future; key ingredients were seen to be knowledge, its application in forest management actions, and the evaluation of practices to assess outcomes compared with expectations. ITTO (1992) elaborated on this discussion by defining SFM as:

> "the process of managing forest to achieve clearly specified objectives of management, with regard to the production of a continuous flow of desired forest products and services, without undue reduction in the forest's inherent values and future productivity, and without undue undesirable effects on the physical and social environment".

This definition implies the following objectives of SFM:

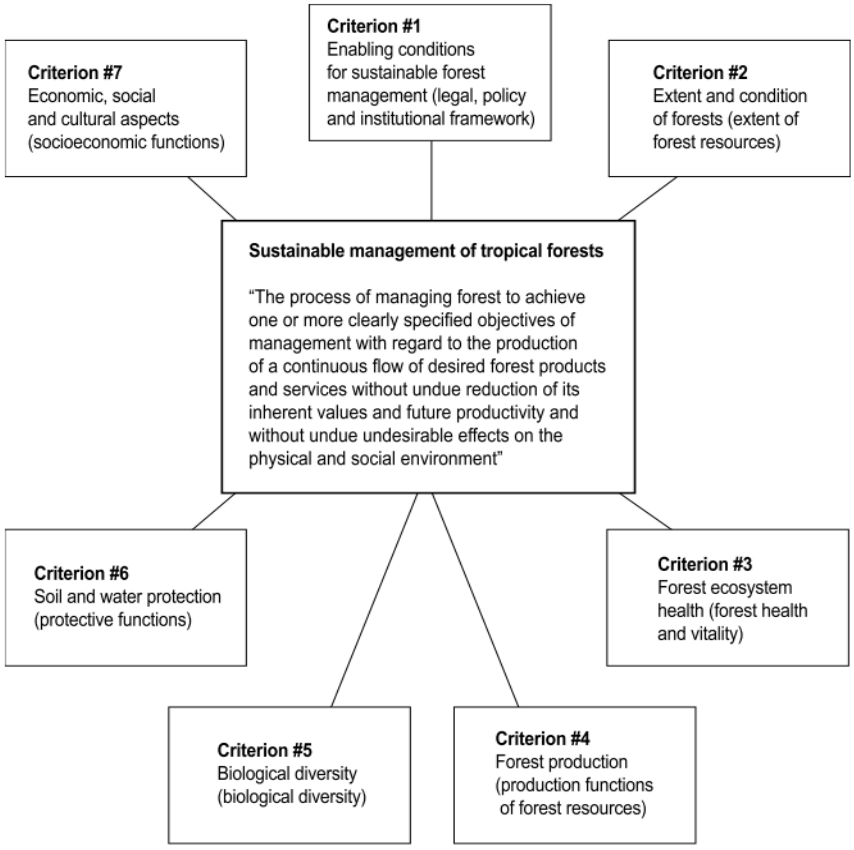
- continuously satisfying the needs for goods and services provided by forests
- ensuring the conservation of forest soils, water and carbon stocks
- conserving biological diversity
- sustaining the resilience and renewal capacity of forests, including carbon storage
- supporting the food security and livelihood needs of forest-dependent communities
- assuring an equitable sharing of the benefits from forest uses.

ITTO's criteria and indicators

To assist in the monitoring, assessment and reporting of SFM at the national and FMU levels, ITTO developed in 1992, and subsequently revised in 1998 and 2005[3], a set of seven C&I for SFM that can be used to guide forest management and assess its sustainability (Figure 3).

The ITTO C&I were not formulated for application in forests managed strictly for protection, where forest goods are usually not extracted. Nevertheless, they can still be applied in such forests, even though the extraction of timber and non-timber forest products (NTFPs) should be zero, or close to zero.

Figure 3 Schematic representation of the revised ITTO criteria for the sustainable management of tropical forests



Note: Text in parentheses refers to the corresponding internationally agreed common thematic areas of SFM.

The seven criteria, as described in Table 1, have been harmonized with other C&I schemes and constitute the basis for the assessment of SFM. The *Revised Guidelines for the*

[3] ITTO (2005). *Revised Criteria and Indicators for the Sustainable Management of Natural Tropical Forests.* Policy Series No 15. ITTO, Yokohama, Japan.

Sustainable Management of Natural Tropical Forests use the ITTO C&I, as revised in 2005, as an important reference document and draw on them in the development of both principles and specific guidelines.

Table 1 ITTO criteria for monitoring and reporting on progress towards SFM

Criterion and description	Observations related to the present guidelines
1. Enabling conditions for SFM Addresses the legal, policy and institutional arrangements necessary to achieve and maintain SFM, including participatory decision-making, governance and law enforcement, and monitoring and assessment of progress.	Applies mainly at the national, provincial and local government levels. There is often a gap between economic and trade policies and environmental policies. In many tropical countries, providing an overarching legal framework for SFM and a comprehensive institutional framework for knowledge-sharing, incentive systems and compliance arrangements remain major challenges for SFM.
2. Extent and condition of forests Addresses forest cover and stocking, including trees outside forests, to support the social, economic and environmental dimensions of SFM. Encompasses objectives to reduce deforestation and to restore and rehabilitate degraded forest landscapes.	Applies at both the national and FMU levels. There is no consensus on the optimal extent of forests at a local, national or global level. As circumstances change, so too do the demands for goods and services from forests. The emergence of an agenda for payments for reduced emissions of greenhouse gases from deforestation and forest degradation (REDD+) has added urgency to the need to improve assessments of forest biomass, carbon stocks, biological diversity, etc.
3. Forest ecosystem health Addresses the need to manage forests to minimize the risks and impacts of unwanted disturbances such as wildfires, airborne pollution, storms, invasive alien species, pests and diseases (such disturbances have impacts on the social and economic as well as environmental dimensions of forests and associated communities).	Applies mainly at the FMU level. The effects of pollution, climate change, fire and other disturbances are often insufficiently known or managed. Generally, natural forests are resilient; forests with low genetic or species diversity, such as plantations, are less resilient and more at risk to disturbance by pests and diseases.
4. Forest production Addresses the capacity of forests to provide a wide range of timber and non-timber forest products and services, and the need for information on resource use and trade.	There is an ambition to maintain a high-volume and valuable supply of forest products and ecosystem services from natural tropical forests while, at the same time, ensuring that production is sustainable and dos not compromise the management options of future generations. Quantitative indicators are important for monitoring.
5. Biodiversity Linked directly to forest resilience, health and productivity. Addresses concerns about the conservation and management of biodiversity at the ecosystem (and landscape), species, and genetic levels.	The *ITTO/IUCN Guidelines on the Conservation of Biological Diversity in Tropical Timber Production Forests* are helping to close the gap between policy and implementation in tropical forests. Nevertheless, a range of issues, such as the lack of data on the extent of forest protected areas, the lack of knowledge of key ecological processes in tropical forests, and issues related to endangered species, genetic resources and forest-based genetically modified organisms, still need to be addressed.
6. Soil and water protection *A*ddresses the role of forests in moderating soil, hydrological, atmospheric and aquatic systems. Includes the production and conservation of soil, the cycling of carbon and oxygen, the maintenance of clean water and aquatic systems, and reductions in the risk or impacts of floods, avalanches, erosion and droughts (the protective	The protective functions of forests have strong cross-sectoral aspects because they provide immense benefits to agriculture and to both rural and urban livelihoods. Forests are an essential element in emerging green economies and debates over water, and can help ameliorate land degradation and desertification. A comprehensive holistic approach based on SFM has not yet

functions of forests also contribute to ecosystem conservation efforts).	been developed, however, at any scale.
7. Economic, social and cultural aspects Addresses the economic contributions of forests (e.g. employment, revenue and foreign exchange generated by the production, harvesting, processing and marketing of forest products and services, and investments in the forest sector). Also addresses the social functions of forests and aspects such as land tenure, indigenous and community management systems, and traditional knowledge.	SFM needs to bridge forest-based production (in particular of timber), environmental protection and local development concerns. Tropical natural forests are important in subsistence livelihoods and poverty alleviation; they are associated with customary rights that, in many countries, are not recognized under the law. SFM can play a vital role in promoting local participation, rights and the use of traditional knowledge and use.

Multi-purpose management

Natural forests are the source of a diverse array of products, ecosystem services and social and economic opportunities, and they have many stakeholders. Managing a forest for a single product or service may affect its capacity to provide others—for example, a high level of timber production may affect a forest's value as a habitat for wildlife. Decisions on tradeoffs in the provision of various goods and ecosystem services are best made using processes that involve the full range of stakeholders. Forest managers applying SFM must continually balance various management objectives that inevitably will change over time as social and community needs and values change; this is the challenge of multi-purpose forest management. Although embedded in the laws of many countries, it has proven to be a complex endeavour that faces a range of economic, social and institutional barriers. Nevertheless, success stories around the tropics, particularly in community-based initiatives, show that it can be made to work—to the benefit of communities and the forest itself.

Adaptive forest management

Adaptive management is the process by which research and learning is continuously incorporated in management planning and practice. Specifically, it is the integration of design, management and monitoring to systematically test assumptions in order to adapt and learn.

While much knowledge has been accumulated on the composition, structure and dynamics of tropical forest ecosystems and their social and economic roles, there are still many uncertainties; moreover, they are subject to very rapid social and physical change. Forest management, therefore, must be based on a continuous monitoring and learning process that enables the adaptation of practices as conditions change. In general, these guidelines advocate an adaptive management that implies the:

- Analysis of the costs and benefits of SFM practices and to whom (e.g. government, communities, private sector, forest managers and civil society) they accrue.
- Monitoring and evaluation of the environmental, social and economic impacts of management.
- Provision of mechanisms for the continued involvement of stakeholders in decision-making on forest management at the appropriate scale.
- Documentation and quantification of the tradeoffs between and synergies among multiple objectives (e.g. related to timber, NTFPs, carbon, water and biodiversity).
- Monitoring and evaluation of incentives and disincentives for SFM and the potential for failures of governance.

Issues for the sustainable management of natural tropical forests

SFM and extra-sectoral forces

Over the past two decades, tropical forestry has been shaped by powerful forces at the global, regional, national and subnational levels. These forces are mainly extra-sectoral in nature.

- In many tropical countries, the demands of growing populations for food, fuel and land have led to increased deforestation (i.e. the conversion of forests to a non-forest land use), forest degradation and fragmentation and the appropriation of customary lands.
- Globalized markets and national and international trade and investment are contributing to pressure on forested land by providing incentives for and investment in the expansion of agriculture, livestock, biofuel production, mining and other extraction activities.
- Poor governance and its associated illegal operations and corruption have been implicated in deforestation and forest degradation in a number of tropical countries. Of particular concern is a lack of clarity on land tenure and a sense of grievance among many indigenous and local people about their lack of rights to land. Although progress has been made, poor governance continues to hinder efforts to implement SFM.
- A lack of financial remuneration for the many ecosystem services provided by natural tropical forests is one of the reasons for their low financial competitiveness against other land uses such as agriculture and cattle-ranching.

While forest managers are often powerless to combat such forces, they nonetheless should be aware of them in their efforts to put these guidelines into effect.

A recent survey of SFM in its 33 producing member countries (ITTO 2011) found that only about 30 million hectares, or less than 8% of the tropical production PFE, is under SFM. Douglas and Simula (2010) attributed the slow uptake of SFM to two central issues, as follows:

- The economic and social policies influencing forests and forest-dependent people are initiated a long way from the forest sector itself and can only effectively be manipulated by mechanisms that operate well outside the sector (without having a close relationship or concerns to forests).
- Forest sustainability requires the commitment of stakeholders closely involved in forest management—government agencies, forest owners, private-sector operators, local communities and others—not all of whom have been convinced of the benefits to them of SFM.

ITTO (2011) recognized several constraints to SFM that frequently recur in tropical countries. Probably the most important, and the most generally applicable, is that the sustainable management of natural tropical forests is less profitable as a land use than other ways of using the land, especially some forms of agriculture and ranching but also urban development and mining. As a result, SFM tends to be a low priority for governments and the private sector often lacks incentives to pursue it. In general, prices for tropical timber, still the major commodity extracted from natural tropical forests, remain relatively low. It is possible that they will increase in the future to better reflect the true costs of production, including the opportunity cost of retaining natural forest, but to date there is no sign of this.

Nevertheless, natural tropical forests are recognized increasingly as an important resource at the local, national and global levels, especially for the ecosystem services they supply. In some countries, payments are being made for such ecosystem services, and REDD+ offers a potentially significant revenue-earning opportunity for forest owners. In the long run, the extent of payments for the ecosystem services supplied by tropical forests—made at either the national level or the global level—is likely to play a large part in determining the fate of

remaining tropical forests. In order for such payments to achieve their potential to affect forest management, constraints related to governance also need to be overcome. Those governments, companies and communities that have been striving to improve forest management, even when they have not yet been wholly successful, merit the long-term support of markets, development assistance agencies, NGOs and the general public.

Another constraint to SFM is confusion over ownership. SFM is unlikely to succeed without the security provided by credible, negotiated arrangements on tenure. In many countries, resolving disputes over land tenure is no easy task but it must be tackled—preferably through a transparent and equitable process—if resource management is to become sustainable.

Civil society on SFM

Some NGOs have criticized SFM as an excuse for a 'business as usual' approach to forest management, placing timber values first and offering little consideration to the protective, social or ecological values from forests. For example, in their critique of the World Bank's Forest Investment Programme, Greenpeace and Rainforest Foundation (2009) stated that SFM has, in practice, often been misused to legitimize destructive activities. On the other hand, other NGOs have helped to advance SFM through forest certification (Box 4).

BOX 4: Forest certification

Forest certification has been promoted by many NGOs since the mid 1990s. A voluntary, market-based instrument, forest certification has helped to increase awareness of the need for defining standards for good forest management. It has helped to initiate an important capacity-building and awareness-raising process, and has provided an incentive for many tropical-timber-producing companies, especially those exporting their products to Europe and North America, to improve the standards of their forest management. Although certification has been most successful in temperate and boreal forests, it has also had important effects on SFM in natural tropical forests.

Issues on the implementation of SFM in natural tropical forests

SFM in closed natural tropical forests

In closed natural tropical forests[4] subject to their first timber harvest, the way in which operations are implemented (including the opening-up of areas with access roads) is of major importance in determining the success of SFM. Influencing the way this first cut is carried out, therefore, is an important task of proponents of SFM.

Closed natural forests generally stock more carbon and are biologically more diverse than modified forest ecosystems on the same sites. The entry of forest operations to previously intact primary forests could therefore lead to increased carbon emissions and biodiversity loss (CBD 2009), mainly because the provision of access roads is associated with deforestation and the loss of forest fauna through overhunting (Nasi et al. 2008). For example, the likelihood of deforestation in logged forests in the Brazilian Amazon was found to be up to four times greater than for non-logged forests because logging was often a precursor of land-clearing for

[4] The term 'closed natural forest' is subject to debate. Here, it is taken to mean forests of native species in which ecological processes are not significantly disturbed (FAO 2005); the term 'primary forest' is also often used in this context. ITTO (2002) defined primary forest as: 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. The 'elastic capacity' of a forest ecosystem relates to "dynamic forest processes within a range of changing vertical forest structure, species composition and biodiversity, and productivity normally associated with the natural forest type expected at that site" (ibid.). ITTO proposes a set of definitions in a continuum of forest use, including, as main categories, primary forests, modified natural forests and planted forests.

agriculture (Asner et al. 2006). In Southeast Asia, roads built by loggers to access high densities of valuable *Dipterocarpus* trees in lowland forests led to deforestation in sparsely populated protected areas (Curran et al. 2004). Nasi et al. (2008) concluded that improved access to forests considerably increases the risk of unsustainable hunting of bushmeat.

Deforestation and overhunting are incompatible with SFM. Therefore, broad, well-enforced land-use planning and policies are needed to guard against them in the PFE. In many countries, however, land-use planning is often ad hoc, and even when good planning and policies exist they may not be well enforced. Natural forests, therefore, continue to be converted or degraded at a high rate, often illegally. Controlling road access is the most effective determinant of deforestation, as improving access to a forest area often creates strong pressures to deforest it (The World Bank 2007). This should be taken into account at all stages of SFM at the landscape and national levels when natural forests are involved.

Forest degradation and restoration

Forest degradation is often considered to be a precursor to deforestation and conceptualized as part of the same process; therefore it has tended to be coupled with deforestation in considerations by the UNFCCC on the role of forests in climate change mitigation.

But forest degradation is not always followed by deforestation. In most cases the drivers behind them are not the same, and nor are the actors. Most deforestation is caused by the large-scale commercial conversion of forest for agriculture or ranching, the expansion of urban areas, and infrastructure development, some of which is 'governed' (sanctioned by government authorities) and some of which is ungoverned (Blaser and Thompson 2010). On the other hand, most degradation is the result of unsustainable extraction of forest products and values by local people as part of their livelihood strategies (ibid.). The area affected as such is estimated to be between 850 million hectares (ITTO 2002) and 1.1 billion hectares (WRI 2009). An additional cause of forest degradation is commercial logging, but this affects a relatively small area (about 130 million hectares, ITTO 2006).

Since the actors and processes are different, it follows that strategies to deal with deforestation may differ from those aiming to reduce forest degradation. Moreover, while a reduction in deforestation will reduce greenhouse-gas emissions, curbing degradation will both reduce emissions and (usually) increase carbon capture. This is because reducing degradation pressures and instigating SFM—including forest restoration programs—will usually lead to forest growth. Box 5 explores some of the aspects of the relationship between SFM and REDD+.

SFM and biodiversity

There is a close relationship between ecosystem resilience and forest biodiversity (Thompson et al. 2009). Resilience is an emergent property of ecosystems that is conferred at multiple scales by genes, species, functional groups of species, and the processes within an ecosystem. From an ecological perspective, SFM attempts to manage and maintain ecosystem resilience. To accomplish this, biodiversity must be maintained because of its functional roles in maintaining ecosystem processes (as well as for other reasons, such as for its intrinsic, spiritual, aesthetic, scientific and economic values and for moral reasons). Thompson et al. (2009) suggested that the relationship between biodiversity, productivity and the resilience and stability of forests is a key element of adaptive management, particularly in light of climate change. Therefore, maintaining biodiversity in space and time is a critical aspect of SFM.

Biodiversity conservation should be considered at the landscape scale (among others). According to ITTO/IUCN (2009), many tropical forest species require a variety of habitats that they use at different times of the year or for different periods of their life cycles; these habitat should be provided for in forest zoning and harvesting patterns. Methods are available to help

achieve a balance between different components of a landscape mosaic that will provide optimal conditions for a broad range of species and populations.

BOX 5: SFM and REDD+

- Forests sequester and store more carbon than most other terrestrial ecosystems and could play an important role in mitigating climate change. When forests are cleared or degraded, however, their stored carbon is released into the atmosphere as carbon dioxide and other greenhouse gases. Tropical deforestation is estimated to have released 1–2 billion tonnes of carbon per year for the past 20 years. There are no estimates of counteracting tropical-forest-based sequestration. The largest source of greenhouse-gas emissions in most tropical countries is deforestation and forest degradation. In Africa, for example, deforestation accounts for nearly 70% of total greenhouse-gas emissions of all sectors.
- REDD+ focuses on the capacity of forests in developing countries to capture and store carbon. Carbon may accumulate rapidly in young planted forests or in recently harvested forest stands but is lost when forests are converted to other land uses and also on harvesting. Mature natural tropical forests usually have very large carbon stocks in their biomass but tend to sequester little new carbon. Theoretically, a sustainably managed production forest will be carbon-neutral—that is, it will produce no net carbon emissions over the long term.
- The aim of REDD+ is to provide financial incentives to tropical countries to compensate them for forest-based climate change mitigation efforts by reducing greenhouse-gas emissions from forests and by increasing carbon sequestration. By carrying out REDD+ activities, countries could simultaneously increase the resilience of ecosystems and social systems to face climate change, conserve biodiversity, protect other ecosystem goods and services, increase income for forest owners and managers, and help address issues of forest governance. Forest management activities included in REDD+ schemes are likely to be subject to high levels of scrutiny and accountability and the operationalization of REDD+ will require accurate monitoring and reporting.

How to use these guidelines

The basis of these guidelines is a set of eight framework principles and ten management principles. These core principles are applicable to SFM in natural tropical forests worldwide, with an emphasis on production forests in the PFE. They can also serve as a framework for the preparation of specific national or subnational guidelines. For each principle, practical *guidelines* are proposed, together with possible *recommended actions* addressed to particular target groups.

An important aim in revising the guidelines was to keep them simple and practical, avoiding unnecessary prescriptions and always bearing in mind their usefulness to forest managers. Another aim was to support recommendations with science to the greatest extent possible. Thus, the documents makes full use of the wealth of scientific literature that explicitly or implicitly provides evidence for recommended actions (i.e. practical approaches or measures for context-specific SFM implementation). Nevertheless, anecdotal evidence and field experience from experts and practitioners have also been taken into consideration.

The document comprises three parts. Part 1 introduces the guidelines and provides background information on important concepts, including definitional aspects of SFM, multi-purpose management, landscape-based approaches, and adaptive management. Part 2 gives an overview of the framework and management principles and their associated guidelines. For each guideline, the main relevant stakeholder group is identified. Part 3 sets out recommended actions for each guideline at the national and FMU scales.

An addendum provides a set of two principles and eight guidelines specifically on the role of SFM in climate change adaptation and mitigation. A glossary of terms used in this document is presented in annex.

PART 2 OVERVIEW OF PRINCIPLES AND GUIDELINES

FRAMEWORK PRINCIPLES FOR THE SUSTAINABLE MANAGEMENT OF NATURAL TROPICAL FORESTS

The following eight principles are applicable at the national and sub-national levels or related to landscape-level issues. They are of a strategic nature, implicitly identifying the enabling conditions for SFM.

Principle 1: Forest governance

Adequate national policies, laws and regulations are implemented and enforced with the support of appropriate institutions and by a strong and continued commitment to SFM by all stakeholders.

Number	Guideline	Description	Indicative stakeholder group[5]					
			Government	Forest manager	Private sector	Civil society	Research/education	Other
1.1	Political commitment and supportive policies for SFM	There should be a strong and continued political commitment and an enabling policy environment to formulate, reform and implement policies within and outside the forest sector for the effective implementation of SFM.	x					
1.2	Coherent and coordinated policy and laws	An agreed, up-to-date forest policy should be supported by appropriate legislation, which should, in turn, be in harmony with laws concerning related sectors, and, where applicable, customary laws and rights.	x					
1.3	Effective regulations and administrative procedures	SFM should be encouraged by a lean bureaucracy, by fiscal and economic incentives, and by the elimination of excessive administrative requirements that often drive forest users into illegality.	x					
1.4	Forest law compliance and enforcement	Law compliance in the forest sector requires effective enforcement, control systems and institutions, as well as the effective dissemination of relevant information to actors and their capacity building. Policies on law enforcement should address the underlying causes of illegality and the need for remedial actions, assess the economic feasibility and	x	x	x	x	x	x

[5] Governments (generally forest departments under a specialized ministry; forest managers (public, private or community-based); private sector (e.g. downstream industries, investors); civil society (including NGOs); research and education organizations; and other stakeholders (including national-level extra-sectoral institutions and international organizations).

		social acceptability of reforms, and ensure stakeholder participation.						
1.5	Appropriate and capable institutions	There should be appropriate institutions with adequate personnel and other resources at all levels to promote SFM in a transparent manner.	x			x	x	x
1.6	Decentralized forest management	Appropriate political support and adequate planning, financial resources, capacity building and follow-up should be in place to create the enabling conditions for decentralized forest management.	x			x		x
1.7	Monitoring of SFM and the cross-sectoral forces that influence SFM	At the national level, there should be monitoring of progress towards SFM as well as of the external forces that affect forest management—including economic issues and market fluctuations, societal pressures, national development policies, and climate change. Forest monitoring systems should measure the impacts and progress of cross-sectoral forces.	x	x	x	x	x	x

Principle 2: Land-use planning and permanent forest estate **Managing tropical forests sustainably requires that land allocation to different uses and spatial planning within and outside forests ensure that the social, environmental and economic values of forests are maintained or enhanced. This, in turn, requires collaboration between sectoral institutions at the national or subnational level and negotiation among all stakeholders.**			**Indicative stakeholder group**					
			Government	**Forest manager**	**Private sector**	**Civil Society**	**Research/education**	**Other**
Number	**Guideline**	**Description**						
2.1	National and subnational land-use planning	A land-use policy aimed at the conservation and sustainable use of natural resources, including the establishment of a permanent forest estate, should be developed in collaboration with all stakeholders.	x	x	x	x	x	x
2.2	Permanent forest estate	Based on the land-use policy, suitable land, whether public or private, should be kept under permanent forest cover and so categorized in order to secure the multiple functions of forests and their optimal contributions to national development and ecological sustainability.	x	x		x	x	x

Principle 3: Security of tenure, access and use rights **Secure forest tenure and clearly defined access and use rights, including customary and traditional rights, are necessary conditions for SFM.**			**Indicative stakeholder group**					
			Government	**Forest manager**	**Private sector**	**Civil Society**	**Research/education**	**Other**
3.1	Security of forest tenure	Security of tenure is a necessary condition for SFM, based on legislation and recognized customary and traditional rights.	x					x
3.2	Clear and equitable rights to forest access and use	Rights to access and use forests and their goods and services must be clearly defined, documented and recognized (e.g. by demarcation, titling or customary practice).	x			x	x	x
3.3	Clear and respected traditional use rights	Recognized tenure, access and use rights of communities and indigenous peoples over publicly owned forests should be respected.	x			x	x	x

Principle 4: Multi-purpose forest management **The role of forests as providers of multiple goods and services should be safeguarded by the application of sound planning and management practices that maintain ecosystem functions and the potential of the forest to yield the full range of benefits to society.**			**Indicative stakeholder group**					
			Government	**Forest manager**	**Private sector**	**Civil Society**	**Research/education**	**Other**
4.1	Forest resource assessment	National and/or subnational forest resource assessments and inventories, such as on timber and NTFPs, forest carbon, other ecosystem services and social aspects, should regularly be carried out.	x				x	x
4.2	Enabling environment for multi-purpose forest management	Policies and institutions should be reviewed to ensure they are effective in their support for multi-purpose forest management.	x	x	x	x		
4.3	Public participation in forest management	All stakeholders should have access to information on forest management and the opportunity to participate in decision-making processes.	x	x	x	x	x	x
4.4	Integrating emerging issues	Emerging issues such as climate change adaptation and mitigation should be identified and integrated into SFM, capturing synergies and addressing tradeoffs with existing objectives of forest management.	x	x	x	x	x	x

Principle 5: Forest resilience **Resilience is a key tenet of SFM in natural tropical forests. Measures to conserve and enhance forest resilience should be incorporated in strategic and operational planning and implemented at the applicable scales.**			**Indicative stakeholder group**					
			Government	**Forest manager**	**Private sector**	**Civil society**	**Research/education**	**Other**
5.1	Forest health and resilience	Forests are vulnerable to abiotic and biotic effects, such as climate change, extreme events, fire, pests and diseases. Policies and programs to support preventative and remedial actions should be in place.	x				x	x
5.2	Conservation and use of biodiversity	Biodiversity should be used and conserved in ways that maintain forest resilience and to enable adaptation to future change. High-conservation-value forests should be identified and managed accordingly.	x			x	x	x
5.3	Maintaining functional forest ecosystems	Forests should be managed in ways that maintain their regenerative capacity and ecosystem resilience.	x	x			x	
5.4	Soil and water conservation	The conservation of soil and water is essential for maintaining the productivity and health of forests and their related aquatic ecosystems, supporting downstream water quality and flow, and reducing flooding and sedimentation.	x	x			x	
5.5	Restoring degraded forest ecosystems	To the greatest extent possible, degraded forest ecosystems should be restored to their original species composition, structure, biodiversity, productivity and ecosystem functions.	x	x			x	

Principle 6: Social values of forests and inclusive decision-making **Policies on forest management should recognize and aim to meet the social needs from forests. Decisions about SFM should be participatory and inclusive and the costs and benefits of forest management should be shared equitably among stakeholders.**			**Indicative stakeholder group**					
			Government	**Forest manager**	**Private sector**	**Civil society**	**Research/education**	**Other**
6.1	Livelihood benefits from SFM	The livelihood needs of people, including indigenous peoples and other vulnerable forest-dependent peoples and communities, need to be addressed by national and subnational forest policies and programs related to SFM.	x	x		x		
6.2	Gender in SFM	Gender aspects should be integrated into national and subnational forest policies and	x	x				

		programs related to SFM.						
6.3	Stakeholder participation and involvement	The participation of stakeholders, especially affected local communities, is an essential element of SFM. SFM policies and practice should be transparent and accountable, and effective conflict-resolution mechanisms should be in place.	x	x		x		
6.4	Observance of and respect for cultural and spiritual values	Cultural and spiritual values should be recognized and respected. Archaeological, cultural and spiritual sites should be identified and protected at the landscape level.	x	x		x		x

Principle 7: Economic viability **Capturing the full value of forests and ensuring the equitable distribution of costs and benefits are essential for SFM.**			**Indicative stakeholder group**					
			Government	**Forest manager**	**Private sector**	**Civil society**	**Research/education**	**Other**
7.1	Financial viability	In order to manage the PFE sustainably, instruments should be developed to support acceptable financial returns for forest use and adequate financial compensation should be provided for otherwise unpaid ecosystem services and social benefits.	x					x
7.2	Equitable distribution of costs and benefits	The distribution among the principal stakeholders of the costs and benefits of forest management should be monitored to promote SFM.	x	x				
7.3	Economic instruments	Economic instruments, such as fees, taxes, incentives and bonds, should encourage SFM and discourage unsustainable and destructive use. They should also support the establishment of an efficient downstream industry and markets for forest products and the creation of payment mechanisms for ecosystem services, such as those associated with water, carbon and biodiversity.	x					
7.4	Access to well-functioning markets	Efficient markets should be promoted as a way of encouraging SFM and preferential access should be provided for products from sustainably managed natural tropical forests.	x	x				x

Principle 8: Regional and international commitments **Legally and non-legally binding intergovernmental agreements at the regional and global levels to which countries have committed have implications for SFM.**			**Indicative stakeholder group**					
			Government	**Forest manager**	**Private sector**	**Civil society**	**Research/education**	**Other**
8.1	International commitments and the legal and regulatory framework	The national legal and regulatory frameworks for SFM should be adjusted, as appropriate, to incorporate the provisions of international commitments.	x			x	x	
8.2	International reporting requirements on SFM	Information systems should be developed or improved to provide data to meet international reporting requirements, including those of the International Tropical Timber Agreement, the United Nations Forum on Forests and the Convention on Biological Diversity.	x			x	x	
8.3	Institutional networking and collaboration	Networking and collaboration among national and international forest institutions, NGOs, the private sector and individual experts, using modern information and communication technologies, should be improved to provide more access to and the better dissemination of existing knowledge and experiences on SFM.	x	x	x	x	x	

MANAGEMENT PRINCIPLES IN NATURAL TROPICAL FORESTS

Principles 9–18 are designed to guide SFM at the FMU level.

Principle 9: Well-defined and established forest management units **SFM should be applied to clearly defined forest areas that are managed to achieve explicit objectives and according to long-term management plans.**			**Indicative stakeholder group**					
			Government	**Forest manager**	**Private sector**	**Civil society**	**Research/education**	**Other**
9.1	Define and secure the FMU	As part of the PFE, FMUs should be clearly defined and have secure tenure or use rights and boundaries that are demarcated and respected.	x	x	x	x		

Principle 10: Management planning **Good planning, at the FMU and operational levels, reduces economic and environmental costs and is therefore essential for SFM.**			**Indicative stakeholder group**					
			Government	**Forest manager**	**Private sector**	**Civil society**	**Research/education**	**Other**
10.1	Forest resource assessment	There should be a clear and reliable definition of all the resources in an FMU, irrespective of ownership or control.	x	x		x		
10.2	Forest management objectives	Management objectives should be established for an FMU, taking into account the tradeoffs needed to achieve the desired mix of forest goods and services and ensuring the long-term maintenance of the environmental, social and economic values of the forest.	x	x				
10.3	Zoning of the FMU	Wherever there is more than one management objective for an FMU, the process of forest management planning should include zoning by forest function.	x	x			x	
10.4	Forest management plan	An FMU should have an approved management plan with clearly stated management objectives and measures for achieving them; the plan should be periodically revised in the light of accumulated experience, new information and changing circumstances.	x	x				

10.5	Managing for non-timber forest resources	Forests may be managed primarily for the sustainable production of non-timber forest products.	x	x			x	
10.6	Managing for ecosystem services	Forest management should take into account the potential for generating income from the ecosystem services provided by an FMU, such as those related to carbon, water and biodiversity.	x	x			x	
10.7	Adaptive management	An FMU should be managed using an adaptive learning approach that effectively supports decision-making in the planning, implementation, evaluation and modification of forest activities.	x	x		x	x	

Principle 11: Yield regulation and control **A reliable method for regulating and controlling yield is needed to ensure the sustainable production of timber and other forest products and services from each FMU.**			Indicative stakeholder group					
			Government	Forest manager	Private sector	Civil society	Research/education	Other
11.1	Continuous forest resource assessment	Forest resource assessments should be carried out periodically to ensure the sustainable production of forest goods and services. They provide essential information not only on the quantities that may be harvested but also on the type and quality of forest produce that may be extracted.	x	x			x	
11.2	Sustainable levels of product harvesting	To ensure the sustainable production of wood and other forest products and services from an FMU, a reliable method for determining the annual allowable cut and controlling the harvest intensity should be adopted.	x	x			x	
11.3	Yield control	Forest managers should conduct regular checks to ensure that the annual allowable cut and other harvesting prescriptions are followed. .	x					

Principle 12: Harvesting operations **Reduced impact harvesting is a key element of SFM.**			Indicative stakeholder group					
			Government	Forest manager	Private sector	Civil society	Research/education	Other
12.1	Harvest planning for optimal efficiency and to minimize impacts	Harvesting should be planned to enable good technical control, minimize harvesting costs and reduce environmental impacts.		x				
12.2	Efficient and safe harvesting operations	Harvesting practices and standards should be employed to ensure safe and efficient operations, minimize damage and waste and reduce environmental impacts, including from road construction and logging tracks.		x				x
12.3	Post-harvest measures	Post-harvest measures should be undertaken as required, such as the deactivation of harvested areas, erosion mitigation, and the rehabilitation of high-impact areas.		x			x	
12.4	Harvesting assessment	The quality of harvesting operations should be assessed and the need for corrective actions or measures determined.	x	x			x	

Principle 13: Silviculture **Silvicultural interventions should be implemented in accordance with the management objectives defined in the management plan of an FMU.**			Indicative stakeholder group					
			Government	Forest manager	Private sector	Civil society	Research/education	Other
13.1	Silvicultural assessment and planning	The need for and nature of silvicultural interventions in an FMU should be assessed.		x			x	
13.2	Silvicultural interventions	Silvicultural interventions should be implemented in accordance with specific prescriptions set out in the FMU's management plan.	x	x			x	

Principle 14: Forest protection **The forest needs to be protected from destructive and illegal activities.**			Indicative stakeholder group					
			Government	Forest manager	Private sector	Civil society	Research/education	Other
14.1	Illegal activities	The FMU should be protected from illegal activities, especially those that are incompatible with SFM.	x	x		x		x
14.2	Fire prevention and suppression	A fire management plan for the FMU and adjacent lands should be formulated and implemented.		x		x	x	
14.3	Management of pests and diseases	The management of pests and diseases should be an integral part of an FMU's forest management plan.		x			x	
14.4	Management of wastes and chemicals	All waste derived from, and chemical used in, forest management activities should be stored and disposed of properly.	x	x				

Principle 15: Biodiversity conservation at the FMU level **Management measures in production forests can make an important contribution to the conservation of biodiversity.**			Indicative stakeholder group					
			Government	Forest manager	Private sector	Civil society	Research/education	Other
15.1	Measures to conserve biodiversity	Biodiversity should be given a prominent place at all stages of the preparation and implementation of the management plan of an FMU.	x	x			x	
15.2	Monitoring biodiversity	Biodiversity monitoring should be in place to ensure that forest management does not impact negatively on biodiversity features identified as having special value.		x			x	

Principle 16: Community involvement in SFM **Community involvement is essential for SFM to succeed.**			**Indicative stakeholder group**					
			Government	**Forest manager**	**Private sector**	**Civil society**	**Research/education**	**Other**
16.1	Consultation with local communities	Free, prior and informed consent in forest management decisions should be obtained in an appropriate, consultative manner.		x		x		
16.2	Rights and responsibilities of local communities	Local communities should be fully informed of their responsibilities in forest management, which in turn should be commensurate with their rights to use and benefit from the forest.	x	x		x		
16.3	Equitable benefit-sharing	Benefits should be shared equitably among stakeholders according to their rights, roles and responsibilities.		x		x		
16.4	Community-based forest management	Local communities should have opportunities to actively and sustainably manage forests to increase income and improve living conditions.	x	x		x		

Principle 17: Working conditions and capacity development at the FMU level **The provision of safe and adequate working conditions and capacity building are essential elements for SFM.**			**Indicative stakeholder group**					
			Government	**Forest manager**	**Private sector**	**Civil society**	**Research/education**	**Other**
17.1	Rights and responsibilities of forest workers and local stakeholders	The rights and responsibilities of forest workers and local stakeholders in an FMU should be clearly defined, acknowledged and respected.		x				x
17.2	Occupational safety and health	Measures should be taken to ensure the safety and health of workers.		x				x
17.3	Capacity building	Capacity development at all levels of workforce, including attention to working conditions, is essential for SFM and should be integrated in forest management plans.	x	x			x	X

Principle 18: Monitoring, evaluation, research and communication **Monitoring, evaluation, research and communication are essential elements of SFM, providing a sound and transparent basis for guidance and feedback to improve the planning and implementation of operational activities.**			**Indicative stakeholder group**					
			Government	**Forest manager**	**Private sector**	**Civil society**	**Research/education**	**Other**
18.1	Monitoring progress in the implementation of forest management	A program should be put in place to monitor the implementation of an FMU's forest management plan and the impacts of interventions and to use the findings to improve forest management planning and practices.	x	x		x		
18.2	Reporting	The information generated by a monitoring program should be reported regularly to the responsible people or organizational structures within the company, forest agency or other entity.		x				
18.3	Research	Ongoing research into the effects of forest management at the landscape, national and international levels should be complemented by research at the FMU level.		x			x	
18.4	Communication, transparency and public awareness	The public should be kept informed about the management of an FMU through clear and open communication and the provision of regular information, thereby helping to ensure market access and public acceptance of forest management.	x	x				

ADDENDUM

CLIMATE CHANGE MITIGATION AND ADAPTATION AT THE FMU LEVEL

Principle 1: Forest carbon management

Climate change mitigation actions in natural tropical forests must not compromise the ecological principles of SFM. It can be complementary to other objectives of forest management but may also involve tradeoffs. Synergies between forest-based climate change mitigation and climate change adaptation should be sought.

Managing forests for one or several of the five REDD+ options—reducing emissions from deforestation, reducing emissions from forest degradation, conservation of forest carbon stocks, sustainable management of forests and enhancement of forest carbon stocks—can contribute to global climate change mitigation goals and can potentially yield economic benefits for a country's forest sector in general and for FMUs in particular. This requires that a country has the appropriate institutional and incentive structures for REDD+ and that rules and regulations for REDD+ governance and management are operationalized.

Guideline 1: Assessment of carbon management options for climate change mitigation in FMUs

Existing REDD+ country strategies and regulations, including on carbon rights, incentives and the responsibilities of forest managers, should be analyzed, an action plan for forest carbon management developed, and safeguards established to avoid negative social and environmental impacts.

Recommended actions

- Analyze national REDD+ strategies, financial and other incentives, and national laws regarding rights to own and trade forest carbon.
- Consult with local interested parties on the appropriate REDD+ options for a given FMU.
- Identify primary stakeholders, including indigenous people and local communities, and clarify rights to carbon in the FMU.
- Identify options for improved carbon management and evaluate the risks, costs and benefits of carbon management options and their implications for other forest management objectives.
- Assess and identify means for addressing leakage, permanence and safeguard requirements.
- Integrate carbon management into the forest management plan.

Guideline 2: Defining the reference emission level and reference level for carbon management

The reference emission level (REL) is the benchmark established for assessing progress in reducing emissions from deforestation and forest degradation. The reference level (RL) is used for assessing the mitigation effects achieved through the conservation of forest carbon stocks, sustainable management of forests and enhancement of forest carbon stocks.

Recommended actions

- Calculate the REL and/or RL for the FMU using existing approved methodologies under UNFCCC REDD+ instrument or the voluntary carbon market framework.
- Harmonize the identified REL/RL with the national/sub-national REL/RL.

Guideline 3: Monitoring and reporting on forest carbon and safeguards

The implementation of an effective forest carbon measurement, reporting and verification system is essential because the REDD+ incentive structure is based on the amount of carbon sequestered and the volume of greenhouse-gas emissions reduced. It requires that safeguard measures are in place to avoid negative impacts on biodiversity, indigenous peoples and local communities.

Recommended actions

- Update forest inventory procedures to meet REDD+ requirements related to forest carbon measurement, reporting and verification.
- Carry out forest carbon assessments using the guidelines of the Intergovernmental Panel on Climate Change, as specified by the UNFCCC.
- Develop and implement monitoring of social and environmental safeguards for REDD+, consistent with national guidelines on REDD+ safeguards.
- Undertake leakage monitoring and assessment, as per national guidance on REDD+ or voluntary carbon markets.
- Develop a reporting system to meet the national requirements for reporting on REDD+, including on REDD+ actions taken, forest carbon monitoring, and social and environmental safeguards.

Guideline 4: Research into and development of best-practice forest carbon management

Research is needed to develop effective forest carbon management options at the FMU level and will entail collaboration between research institutions and forest managers.

Recommended actions

- Collaborate, where possible, with research institutions and access and use relevant research findings to identify and implement best-practice forest management for climate change mitigation under varying conditions consistent with ecological principles and social responsibilities.
- Review and promote suitable forest management options and the sharing of lessons learned with a view to strengthening forest-based climate change mitigation activities.
- Take up REDD+ demonstration activities and spread awareness about their climate change mitigation and income-enhancing potential.

Principle 2: Climate change adaptation related to tropical forests

Climate change is likely to affect tropical forests as well as people who depend on those forests. Predicted changes in climate will place pressure on the capacity of forests to maintain biodiversity, productivity and ecosystem services. Managers of tropical forests should take measures to reduce the vulnerability of forests to climate change and facilitate their adaptation to changing conditions.

Guideline 1: Impact assessment on forests

An assessment of the impacts of climate change and climate variability on the physical characteristics of the forest and its productivity, ecological dynamics and ecosystem functions will help forest managers to respond quickly to changing conditions.

Forests may be affected biophysically by climate change in several ways: plant physiology and metabolism; pathology; insect and animal herbivory; the incidence and severity of fire, floods and drought; ecosystem functioning; and spatial extent. Climate-related change could have significant impacts on the availability and quality of forest goods and ecosystem services, including the capacity of forests to sequester and store carbon.

Recommended actions

- Obtain information on recent trends and projected changes in climatic variables (e.g. temperature and precipitation) and impact assessments relevant to a given area.
- Monitor trends in the frequency and severity of climate change-related impacts (e.g. the incidence of pest and disease outbreaks, fire, floods and drought).
- Assess the current and likely future impacts of climate change on forest characteristics, productivity and ecosystem services.

Guideline 2: Assessment of social and economic impacts of climate change

Climate change may have significant impacts on forest-related social and economic factors. Forest managers should be aware of such impacts and should seek to limit them when they are negative and maximize them when they are positive.

Climate change could lead to, for example, the movement and resettlement of human populations, increased pressure on forests for agricultural use (e.g. if the productivity of agricultural lands decreases), and changes in markets for forest products driven by increased demand for renewable energy. Climate change may also affect the livelihoods of rural people, who could benefit from forest-based employment, including in small-scale forest enterprises. The management of forests for the delivery of forest ecosystem services, such as the protection of soil and water resources, could become more important under climate change.

Recommended actions

- Referring to climate change impact assessments and other relevant sources of social and economic data, identify emerging and likely future socioeconomic impacts of climate change on forests.
- Monitor changes in markets for forest products due to changes in demand for forest-based energy and for product substitution.

Guideline 3: Costs of adaptation

Estimates of the costs and benefits of climate change adaptation are needed to support decisions on forest management and related investments.

Implementing climate change adaptation measures should enhance forest resilience and provide co-benefits including biodiversity conservation and the protection of forest soils and hydrological cycles. Nevertheless, the implementation of such adaptation measures may be costly. Forest managers should assess the costs of adaptation compared with the potential financial losses caused by climate change. Demonstrating the benefits of adaptation actions will help to leverage financial support for adaptation.

Recommended actions

- Promote and support research into the analysis of forest adaptation costs and benefits in different forest types and under various management options, and share the results of such research.
- Monitor key variables (indicators) of adaptation effectiveness.

Guideline 4: Management for adaptation

Well-planned and implemented adaptation actions will maximize benefits and minimize costs.

Forest managers should modify forest management plans and practices to include adaptation measures, taking into account the biophysical, social and economic impacts of climate change, the costs and benefits of action, and the long-term costs of inaction.

Recommended actions

- At the level of forest stands within an FMU, identify the short-term and long-term risks, costs and benefits of adaptation measures.
- Modify forest management plans and practices to include relevant adaptation measures.

***

GLOSSARY

Adaptive management. Also known as adaptive resource management (ARM), is a structured, iterative process of optimal decision making in the face of uncertainty, with an aim to reducing uncertainty over time via system monitoring.

Biomass stock. Organic material both above-ground and below-ground, and both living and dead, e.g., trees, crops, grasses, tree litter, roots etc. Biomass includes the pool definition for above - and below - ground biomass

Civil society. Groups affecting voluntarily in their capacity as citizens to advance common goals and agendas.

Deforestation. The conversion of a forest into another land-use.

Ecosystem Services. The multitude of resources and processes that are supplied by natural ecosystems.

Externality. A consequence of an action affecting others for which the actor is neither rewarded nor penalized through the market.

Food security. Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life *(World Summit on Food Security, Rome, November 2009)*

Forest. Land spanning more than 0.5 hectares with trees higher than five meters and a canopy cover of more than 10%, or trees able to reach those thresholds in situ. It does not include land that is predominantly under agricultural or urban use.

Forest degradation. Reduction of the capacity of a forest to provide goods and services. 'Capacity' includes the maintenance of the elasticity of ecosystem structures and functions.

Forest management unit. A clearly defined forest area, managed to a set of explicit objectives according to a long-term management plan.

Forestry. Forestry is the art and science of managing forests and trees, embracing a broad range of concerns which include providing timber, fuelwood and non-wood forest products, biodiversity management, wildlife habitat management, watershed management and water quality management, recreation, landscape protection and erosion control, employment, and sinks for atmospheric carbon dioxide.

(Forest) Governance. A policy and political approach related to defining the elements needed to conserve and sustainably managing forests.

Growing stock. Volume over bark of all living trees more than X (generally 10) cm in diameter at breast height (DBH). Includes the stem from ground level or stump height up to a top diameter of Y cm (generally end of the bole), and may also include branches up to a minimum diameter of W cm

Landscape. A cluster of interacting ecosystem types, pristine or modified by man.

Non-wood forest products (NWFP). Non-wood forest products consist of goods of biological origin other than wood, derived from forests, other wooded land and trees outside forests

Private sector. Encompasses for-profit entities that are not owned or operated by the government.

REDD+. Policy approaches and positive incentives on issues relating to reducing emissions from deforestation and forest degradation in developing countries; and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries

(Forest) Stakeholders. Any individuals or groups who are directly or indirectly affected by, or interested in, a given resource and have a stake in it.

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

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