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REVISED ITTO PRINCIPLES AND GUIDELINES FOR THE SUSTAINABLE MANAGEMENT OF NATURAL TROPICAL FORESTS

Revised through three Regional Validation Workshops in Kuala Lumpur (Malaysia), Libreville (Gabon) and Punta Sal (Peru)

September 2012

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Acronyms

AAC	AnnualAllowableCut
ARM	Adaptive Resource Management
C&I	Criteria and Indicators
CBD	TheConvention on Biological Diversity
CBFiM	Community Based Fire Management
CEPA	Communication, Education and Public Awareness
CFM	Community Forest Management
CIFOR	Center for International Forestry Research
CPF	Collaborative Partnership on Forests
DBH	Diameter at Breast Height
FAO	Food and Agriculture Organization
FMPs	Forest Management Plan
FMU	Forest Management Unit
FPIC	Free, Prior, and Informed Consent
GIS	Geographic Information Systems
IAC	International Agricultural Centre
ITTO	International Tropical Timber Organization
IUCN	International Union for Conservation of Nature
MDH	Minimum Diameters for Harvesting
MRI	Multi-resource Inventory
NGOS	Non-governmental organizations
NLBI	Non-Legally Binding Instrument
NTFPs	Non-timber forest products
NWFP	Non-wood forest products
PCTs	Potential (or Future) Crop Trees
PFE	Permanent Forest Estate
PSPs	Permanent Sample Plots
REDD+	Reduced Emissions from Deforestation and Forest Degradation
REL	Reference Emission Level
RIL	Reduced Impact Logging
RL	Reference level
SFM	Sustainable Forest Management
UNCCD	The Convention to Combat Desertification
UNFCCC	The Framework Convention on Climate Change

INTRODUCTION

Purpose of the SFM Principles and Guidelines

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. 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. They recommend implementation actions for each guideline based on best practices and existing tools. The specific objectives of the I*TTO Principles and Guidelines for the Sustainable Management of Natural Tropical Forests* (P&G) are to:

- Identifythe framework conditionsfor 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 issuesthat 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.

Scope and use of the Guidelines

These Guidelines are designed as a basis for policy decisions and as a technical reference that can be used or adapted to the needs and capacities of users. They present the rationale for action and identify roles and responsibilities of stakeholders, actions needed for SFM. They are intended for governments, public and private organizations and actors, professional practitioners and associations, scientific, educational and research institution, civil society organizations and all other groups and bodies with responsibilities and activities relevant to sustainable forest management.

Target audience

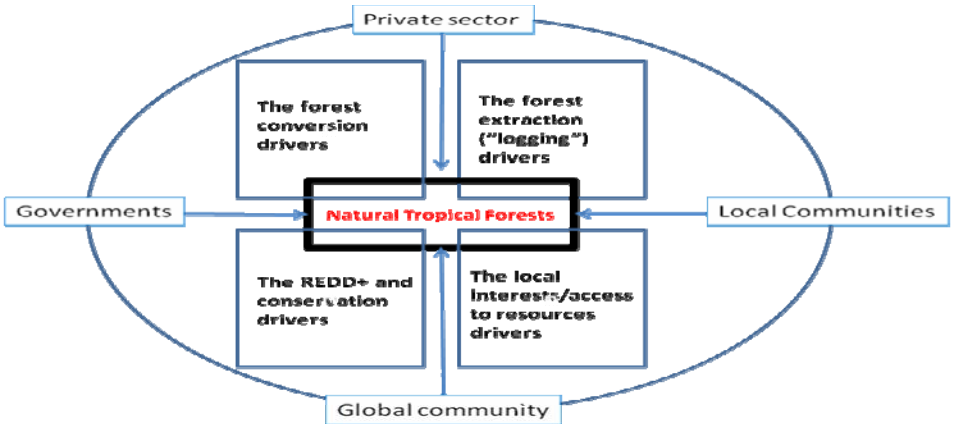
Many actors have interests in forests (Figure 1). While some of these interests are compatible, some are not. At one extreme, there are stakeholders who aim to preserve forests (even though interpretations of the term 'preserve' may vary), while, at another, there are stakeholders who would like to clear 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. Because of this, these P&Gs have a wide audience which includes the following groups involved in the management and protection of tropical natural forests:

- Forest operators, 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.

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

- 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



Structure and organization of this document

The rest of the document is organized as follows:

- Part I introduces the P&Gs user to the context in which they are developed. Part of this context is the important extent at which ITTO has developed approaches and tools for the sustainable management of tropical forests.

- Part II provides an overview of the Principles, showing how connectivity with ITTO's C&I is established.

- Part III describes the Principles and respective Guidelines and Recommended Actions.

- A glossary of terms used in this document is presented in annex.

PART 1: THE CONTEXT FOR SUSTAINABLE MANAGEMENT

1.1 The International Context of Forests

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 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.

Box 1 summarizes some of the general trends that have affected the management of natural tropical forests since 1990.

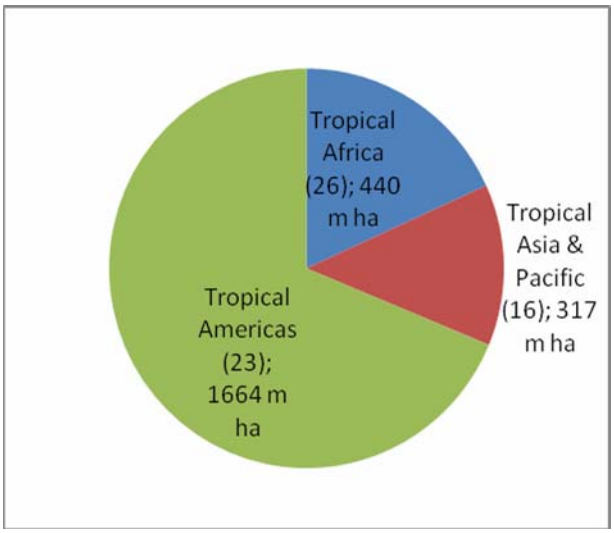
[2] Policy approaches and positive incentives on issues related to reducing emissions from deforestation and forest degradation in developing countries; and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries. *From the Bali Action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

1.2 The ITTO Context

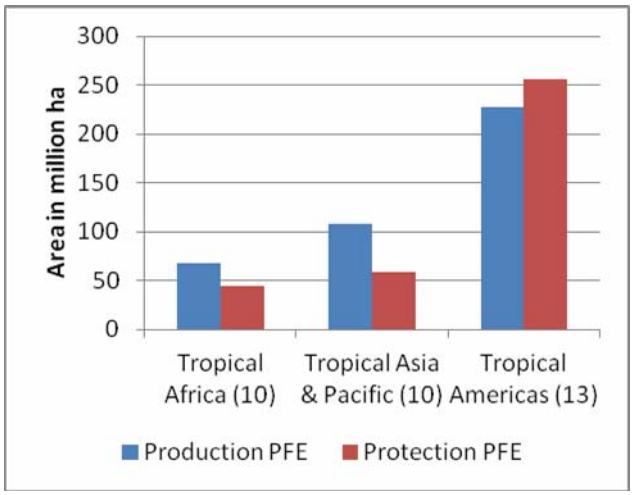
1.2.1 The extent of tropical forests in ITTO's membership

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).

1.2.2 ITTO's Management Approaches

Influenced by the above international 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 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 operators, policymakers and other stakeholders to manage, conserve and sustainably use some of the planet's most valuable resources—natural tropical forests.

Sustainability. 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
- conservingbiologicaldiversity
- sustaining the resilience and renewal capacity of forests, including carbon storage
- supporting the food security and livelihood needs of forest-dependent communities
- ensuring 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 criteria and indicators for SFM that can be used to guide forest management and assess its sustainability. 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. The seven criteria which have been harmonized with other C&I schemes constitute the basis for the assessment of SFM. These are:

- Enabling conditions for SFM
- Extent and condition of forests
- Forest ecosystem health
- Forest production
- Biodiversity
- Soil and water protection
- Economic, social and cultural aspects

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 operators 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 endeavor 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 operators and civil society) they accrue.
- Monitoring and evaluation of the environmental, social and economic impacts of management.

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

- 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.

1.2.3 Issues for the sustainable management of 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 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 2008). 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 2 explores some of the aspects of the relationship between SFM and REDD+.

[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.

Box 2: 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 tons 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 regeneration of forest stands but reduce 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.

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.

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 are 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 operators 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 3).

Box 3: 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.

PART 2: OVERVIEW OF THE PRINCIPLES

2.1 Definition of key concepts

Sustainable forest management.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 which is recalled under 1.2.2 above. 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 4). 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.

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.

Box 4: 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.

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 ecosystem services. It will therefore produce an array of products and services that may—and may not—include timber. SFM therefore relates to the *multipleuse* 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 shouldbeaddressedat 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, trade-offs will almost always have to be made in the mix of products, ecosystem services and values offered by forests. Ideally, such trade-offs 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 ecosystem 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).

Permanent Forest Estate (PFE). 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.

2.2 Overview of the Principles

The *Principles and Guidelines for the 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. They complement the following other ITTO guidelines on various aspects of tropical forest management[5]:

- ITTO (1990). ITTO Guidelines for the Sustainable Management of Natural Tropical Forests. ITTO Policy Development Series No 1.

[5]All the documents listed can be downloaded at www.itto.int.

- 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.

Table 2 gives an overview of the ITTO SFM Principles and shows connectivity between them and ITTO Criteria and Indicators. Principles are statements of goals or values that represent what are accepted or professed requirements that guide forest policies, processes and practices for achieving SFM. They provide a critical foundation that can be applied to reach SFM. The set of principles described in this document should be considered by its users as the essential characteristics of SFM, which means that SFM would not be effectively met if any one principle was to be ignored. The underlying expectation is that once the principles are understood, the actors involved in SFM will be able to implement good practices, keeping in view the specificities of their own contexts and with the assistance of more specific tools as needed.

Table 2: Overview of the ITTO SFM Principles and connectivity with ITTO Criteria and indicators

Group	**Present SFM Principles**		**Connectivity with ITTO C&I**
	Description	**Observations**	
Enabling conditions for SFM (legal, policy and institutional framework	– Principle 1: Forest Policy, Governance, Laws and Institutional Arrangements; – Principle 2: Security of tenure, access and use rights	Apply mainly at the national, provincial and local government levels to address gaps between economic and trade policies and environmental policies.	Criterion 1: “Enabling conditions for sustainable forest management”; Criterion 7: “Economic, social and cultural aspects” (7.12 Extent to which tenure and user rights of communities and indigenous peoples over publicly owned forests are recognized and practiced)
Extent and condition of forests	– Principle 3: Land-use planning and permanent forest estate	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	Criterion 2: “Extent and condition of forests”

		improve assessments of forest biomass, carbon stocks, biological diversity, etc.	
Forest ecosystem health	– Principle 4: Forest resilience; – Principle 5: Identification, prevention and management of threats to forest and ecosystem health	Applies mainly at the FMU level. The effects of pollution, climate change, fire and other disturbances are often insufficiently known or managed.	Criterion 3: "Forest ecosystem health"
Climate change mitigation and adaptation at the FMU level	– Principle 6: Forest carbon management – Principle 7: Climate change adaptation related to tropical forests	The role of forests in simultaneously reducing carbon emissions, sequestering carbon, and enhancing adaptation to climate change is new a new challenge for SFM	Not defined
Forest Multiple functions	– Principle 8: Multi-purpose forest management ; – Principle 9: Biodiversity conservation at FMU level	There is an ambition to maintain a 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.	Criterion 4: "Forest production"; Criterion 5: "Biological diversity"; Criterion 6: "Soil and water protection"
Economic, social and cultural aspects	– Principle 10: Social values of forests and inclusive decision-making; – Principle 11: Community involvement in SFM – Principle 12: Productive and safe work working conditions in forestry at the FMU level – Principle 13: Economic viability	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.	Criterion 7: "Economic, social and cultural aspects"
Sustainable forest management planning and	– Principle 14: Forest management	Planning is an integral component of forest management. It is about	Criterion 1, under "Planning Framework"

implementation	planning at national/regional level; – Principle 15: Forest management planning at FMU level; – Principle 16: Adaptive management	determining and expressing the objectives which government, rural communities or companies have, and for deciding the targets and steps that should be taken in order to achieve those objectives, and applying the best practices to do so.	

The Guidelines are evidence-based advisory statements which are intended to assist decision-makers, forest operators and other stakeholders to make informed decisions about appropriate forest management decision or intervention. They focus on outcomes. They suggest specific good practices and contribute information on how to comply with SFM Principles. They are aspirational in intent and are framed at a certain level of generality so as to be of relevance under most tropical forest management conditions and circumstances. While they may not be applicable to every forest management situation, they may facilitate the continued systematic development of the SFM and assure a high level of application of good practices.

The Recommended Actions focus on processes. They are measures which are suggested for implementing respective guidelines. Some of the actions proposed may be relevant in some cases but not in others, while there may be circumstances that demand actions that have not been addressed here at all. Such details need to be worked out by those actively participating in the implementation of SFM and these details are bound to vary depending on the context.

There are 16 principles; the core principles relating to management are applicable to SFM in natural tropical forests worldwide, with an emphasis on production forests in the PFE. These P&G 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 operators working under a variety of management and tenure arrangements.

The P&G 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.

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 operators. Another aim was to support recommendations with science to the greatest extent possible. Thus, the document 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.

To conclude this Part, it should be emphasized that the criteria and indicators for SFM are the reference for the soundness of forest management. However they do not provide by themselves good practices to policy and decision makers,forest owners, or forest managers for given forest areas and management contexts and dimensions. The Principles and Guidelines for the Sustainable Management of Natural Tropical Forests outline such practices for each criterion. For this reason, the structure of the Guidelines is such that this operational link is established. Therefore as the C&I are the reference for the Principles and Guidelines, they need to continue to serve as a management reference but be updated namely to harmonize respective indicators with SFM principles and to take into account climate change in a more comprehensive manner.

PART 3: PRINCIPLES, GUIDELINES AND RECOMMENDED ACTIONS FOR SUSTAINABLE FOREST MANAGEMENT

This Part presents the Principles and respective Guidelines in a way that allows to easily establish connectivity with ITTO's C&I for the sustainable management of tropical forests. To achieve this, Principles are grouped under the heading of the Criterion to which they correspond as described under "Table 2: Overview of the ITTO SFM Principles and connectivity with ITTO Criteria and indicators". This way of presentation indicates that the Principles and Guidelines which are described below conform well to ITTO's Criteria for SFM.

3.1 ENABLING CONDITIONS FOR SFM (LEGAL, POLICY AND INSTITUTIONAL FRAMEWORK)

Principle 1: Forest Policy, Governance, Laws and Institutional Arrangements

Firm political commitment, supportive national policies, strong institutions, laws and regulations and good governance structure are essential to SFM.

Rationale

Strong political commitment.A national commitment to preserving its forest resources is essential to achieve SFM. Such a commitment is based namely on a provision for sustainable forest management in the country's laws. Forest laws should place important forest resources of the country under control for the use by the owners for the welfare of the people. In addition to such laws, another important sign of political commitment is ensuring that adequate resources are made available to conserve and manage the forests in order to meet the economic needs of society without sacrificing the needs of future generations. With a sustained effort of committing resources to SFM, it is possible to accelerate the implementation of a comprehensive and sustainable forest management program.

Forest policy.A national forest policy should be a negotiated agreement between governments and stakeholders on the orientations and principles of actions they adopt, in harmony with other national long-term socio-economic and environmental policies, to guide decisions on the promotion of SFM. It guides present and future decisions relating to forests, determines appropriate actions and provides directions over a period of time. Forest policy goals should be clearly linked to national development strategies that determine wider societal developments. For example, new challenges relating to food security, energy security and climate security open up possibilities for a wide array of new forms of forest management. Forest policies no longer address only the traditional aspects of forestry, but take into account the broader needs of and benefits to society as well as the problems arising from increased pressure on a finite resource base (FAO 2010a). Considerations in deciding on a forest policy include inter alia the present proportion of land under forest cover, the needs and aspirations in regard to forests of present and future generations of the population, the place of forestry in national economic planning, and the needs of protection and conservation of biological diversity.

Good governance. Governance is the process of governing, the way in which society is managed and how the competing priorities and interests of different groups are reconciled. It includes the formal institutions of government but also informal arrangements. Governance is concerned with the processes by which citizens participate in decision-making, how government is accountable to its citizens and how society obliges its members to observe its rules and laws (FAO 2009). Policies and laws provide incentives and disincentives which affect the behavior and choices of forest operators,

users and other stakeholders. On their own, however, good laws and regulations are insufficient. Political will to provide the means for the enforcement and implementation of laws and regulations is necessary, as is strong leadership to coordinate across sectors. Political will and good governance are, in turn, fuelled by adequate stakeholder participation and awareness in all sectors of the importance of sustainable management and use of natural tropical forests. Today, an effective forest policy is widely understood as a negotiated agreement among government and other stakeholders on a shared vision on forests and their use (FAO 2010a)

Legislation. A forest policy sets out a broad vision or goal and a long-term direction about forests and their use but does not specify in detail the instruments or practices to implement it. One key instrument for implementing a forest policy is the forest legislation. While government policy needs to be consistent with the Constitution and other overarching legislation of a country, all laws, including those pertaining to forests, need to be based on policies. Thus, a policy needs to be developed before any aspect of it can be made legally binding. The primary purpose of forest legislation is the distribution and enforcement of rights and responsibilities that support the sustainable management of forests. A forest legislation that is generally accepted and implementable can only be drafted in a meaningful way after the policy decisions have been made.

Institutional arrangements. As part of an effective governance arrangement, there must be adequate institutions and personnel at all levels to undertake sustainable forest management. These include effective government agencies that guide and supervise forest management, forest operators including those of the private sector, research institutions and appropriately trained personnel to ensure that management is in accordance with scientific and technical knowledge. Nonetheless, forest institutions also need to be able to appropriately deal with non-technical issues as balancing conflicting interests in SFM is often rather a political and societal than a technical matter. The diversity of public and private stakeholders involved in policy implementation calls for the need to be explicit about the division of responsibilities among different government institutions and stakeholder bodies.

Decentralization is based on the ideals of greater accountability in local governments for sustainable forest management, increased voice for local communities and more appropriate use of forest resources. Decentralization is implemented through the delegation of authority and responsibilities for the development of the forest sector at local levels to municipalities, communities and other local players. It requires considerable efforts by government officials to coordinate and collaborate not only across sectors but also across different levels of government as more levels of government share responsibility for implementation of SFM. Thus, public agencies at all levels need to have goals, structures and capacities to discharge their mandate in respect to SFM.

Law enforcement. Legislation is setting out rights and obligations and institutionalizing the rules through primary legislation (as prescribed in Guideline 1.2) and secondary legislation, defined by e.g. regulations, decrees, ordinances and by-laws. Many implementation aspects of SFM policies, e.g. encouraging certain type of behavior, prohibiting certain conduct, providing for sanctions or offering foundations for actions are defined at such secondary legislative level. Often, that level is much influenced by bureaucracy and has the potential to comprise some undesired consequences, e.g. excessive administrative requirements or incentives and disincentive measures that do not correspond to the needs of adaptive management. Addressing effective regulations and defining clear, transparent and implementable administrative procedures are keys for sustainable forest management. The lack of forest law compliance and good governance has far-reaching environmental, social and economic consequences in-side and outside forests. Although the extent of illegal forest activities is notoriously difficult to quantify, their economic, social and environmental cost is likely to be high. Five factors give rise to a lack of forest law compliance: (i) failings in the policy and legal frameworks, (ii) insufficient enforcement, (iii) a lack of information, (iv) corruption, and (v) market distortions. Problems relating to inconsistent forest policy and legal frameworks arise when laws are incoherent, unrealistic and unenforceable and fail to address forest land tenure and use rights. Excessive regulations can mean that the transaction costs of legal operations are prohibitively high and push forest users to illegal practices. Insufficient enforcement capacity is often due to institutional weaknesses coupled with a lack of transparency and accountability in the implementation of the policy and legal frameworks. Insufficient monitoring of the forest resource management and of the supply chain makes it difficult for forest law enforcement agencies to know when illegality occurs. Corruption in the private sector, government institutions and among local decision-makers is linked to a lack of transparency in policy implementation, the marginalization of rural people, and a lack of public

scrutiny. Market distortions for wood products can occur in domestic and export markets where there are ready outlets for low-priced illegally harvested products.

In order to have an effective decentralization process, it is critically important to establish a dynamic balance between authority, accountability mechanisms, responsibilities and revenue sharing across different levels of government. Experiences from diverse countries indicate that the relationship and balance among these elements determine, to a large extent, the effectiveness and efficiency of decentralized systems of forest governance (Colfer and Capistrano 2005). Equally important are effective linkages with other sectors that affect or are affected by the forest sector. In general terms, successful decentralization is linked to secure tenure and access to forest resources, financial means and authority at lower levels, commercials rights and market access, and sensitivity to cultural traditions and local knowledge.

Integrating emerging issues. Sustainable forest management provides a flexible, robust, credible and well-tested framework for addressing emerging issues concerning forests. Some issues, that are classified as emerging in these days have been internalized in forest management since many years: the regulatory function of forests on freshwater is well known; also the renewed regard on the role of forests to deliver bioenergy is well known (fuelwood) even that today new demands and technologies are at stake. The role of forests to simultaneously reducing carbon emissions, sequestering carbon, and enhancing adaptation to climate change is however a new challenge for SFM. At the same time, forests can help supply environmentally friendly forest products, protect biodiversity, secure freshwater supplies and other essential ecosystem services, providing an effective framework for forest-based climate change mitigation and adaptation.

Guidance for Principle 1

Guidelines		**Recommended Actions**		**Indicative stakeholder group**
G1.1	Reaffirm political commitment and strengthen and implement effective policies and strategies to promote SFM.	A1.1.1	Develop, jointly with all interested stakeholders, a formal forest policy statement with a shared vision and goals on forests and lays out the strategies for their achievement within a broader national policy context.	Government, forest operators, private sector, civil society, research and education institutions
		A1.1.2	Revise periodically the forest management policy. When revising an existing forest policy or developing a new one, allow the use of flexible methods.	Government, forest operators, private sector, civil society, research and education institutions
		A1.1.3	In revising SFM legislation, observe principles for drafting better forestry laws: (i) avoid legislative overreaching; (ii) enhance provisions for transparency and accountability; (iii) enhance role of stakeholders; (iv) ensure that the drafting of laws is participative and transparent; and (v) ensure that the law includes direct enforcement mechanisms.	Government, forest operators, private sector, civil society, research and education institutions
		A1.1.4	Maintaining a permanent platform for dialog among stakeholders to allow continuous adaptation and fine-tuning of forest policy and its implementation.	Government, forest operators, private sector, civil society, research and education institutions
G1.2	Establish coherence, effective linkages and coordination of policies and	A1.2.1	Implement the updated forest policy through regulations.	Government, forest operators, private sector, civil society, research and education institutions

	laws between different levels of governance.			
G1.3	Developing effective regulations and administrative procedures.	A1.3.1	Ensure consistency of the regulatory framework to make certain that rules and regulations do not contradict others within the forest legal framework or other sectors.	Government, forest operators, private sector, civil society, research and education institutions
		A1.3.2	Streamline bureaucracy, reduce administrative burdens.	Government, forest operators, private sector, civil society, research and education institutions
		A1.3.3	Develop fiscal and economic incentives in order to encourage the actors to work in legality.	Government, forest operators, private sector, civil society, research and education institutions
		A1.3.4	Foster and practice a transparent governance culture in administrative processes and in forest management planning and implementation.	Government, forest operators, private sector, civil society, research and education institutions
		A1.3.5	Build institutional capacity for forest law enforcement and build alliances with the private sector and civil society.	Government, forest operators, private sector, civil society, research and education institutions
		A1.3.6	Adopt strategies for control of illegal activities, focusing on preventive actions.	Government, forest operators, private sector, civil society, research and education institutions
		A1.3.7	Enable key stakeholders to improve their own livelihoods and the condition of forests by removing any constraints that inhibit them from doing so.	Government, forest operators, private sector, civil society, research and education institutions
G1.4	Recognize that it is essential to have appropriate and capable institutions with effective linkages between them.	A1.4.1	Establish institutions with adequate personnel and other resources at all levels to promote SFM in a transparent manner.	Government, forest operators, private sector, civil society, research and education institutions
		A1.4.2	Establish an administrative structure responsible for sustainable management of forest resources.	Government, forest operators, private sector, civil society, research and education institutions.
		A1.4.3	Strengthen forest education at university and technical levels, and forestry research in technical areas as well as in non-technical issues, knowledge and skills in order to support SFM programs.	Government, forest operators, private sector, civil society, research and education institutions.
		A1.4.4	Develop clear terms of reference for implementing agencies for forests and forestry.	Government, forest operators, private sector, civil society, research and education institutions.
		A1.4.5	Seek innovative funding mechanisms such as national forestry funds to finance SFM programs.	Government, forest operators, private sector, civil society, research and education institutions.
G1.5	Transfer authority and/or responsibility from the central government to	A1.5.1	Provide appropriate political support in planning, financial resources, capacity building and follow up in order to ensure that the enabling conditions for decentralized forest management are in	Government, forest operators, private sector, civil society, research and education institutions.

	sub-national governments and empower private sector and civil society institutions for their efficient collaboration.		place.	
		A1.5.2	Increase local governments' awareness, coordination and ownership for sustainable forest management in support of decentralization processes.	Government, forest operators, private sector, civil society, research and education institutions.
		A1.5.3	Facilitate delegation of administrative power from national governmental institutions to local public institutions and civil society groups.	Government, forest operators, private sector, civil society, research and education institutions.
		A1.5.4	Strengthen further the capacities of local constituencies to develop and implement norms that are more adequate and adapted to the local SFM realities and conditions.	Government, forest operators, private sector, civil society, research and education institutions.
		A1.5.5	When implementing decentralization of forest management and strengthening the capacity of civil society, take into account a balanced stakeholder participation and gender equity.	Government, forest operators, private sector, civil society, research and education institutions.
G1.6	Monitor and analyze the impact that policies and laws of other sector may have on SFM**.**	A1.6.1	Adopt and implement at national level a system to monitor progress towards SFM as well as of the external forces that affect forest management.	Government, forest operators, private sector, civil society, research and education institutions.
		A1.6.2	Assess in particular drivers of deforestation and forest degradation at national and landscape level.	Government, forest operators, private sector, civil society, research and education institutions.
G1.7	Foster accountability and establish mechanisms for stakeholders participation and involvement with regard to SFM	A1.7.1	Adopt regulations that define the mechanisms for public participation in the decision-making process for managing natural forests and that require forestry institutions to be accountable to peoples' needs and aspirations.	Government, forest operators, private sector, civil society, research and education institutions.
		A1.7.2	Develop pathways for more transparent information and communication that are locally accepted and adaptable for community and other stakeholders.	Government, forest operators, private sector, civil society, research and education institutions.
G1.8	Consider taking action to identify and integrate relevant emerging issues into SFM.	A1.8.1	Monitor and assess new and emerging issues in SFM ensuring greater coordination at all levels and informing decision-making level.	Government, forest operators, private sector, civil society, research and education institutions.
		A1.8.2	Embed new and emerging issues into the overall forest management approach including particular societal needs in the resource assessment, planning and implementation strategies for SFM at national and/or sub-national level.	Government, forest operators, private sector, civil society, research and education institutions.
G1.9	Recognize and evaluate the implication on SFM of the legally and non-legally binding intergovernmental agreements at the regional and global levels	A1.9.1	Consider adjusting the national legal and regulatory frameworks for SFM as appropriate, to incorporate the provisions of international commitments.	Government, forest operators, private sector, civil society, research and education institutions.
		A1.9.2	Develop or improve information systems to provide data to meet international reporting requirements, including those of ITTA, UNFF, and CBD.	Government, forest operators, private sector, civil society, research and education institutions.

		A1.9.3	Improve networking and collaboration among national and international forest institutions, NGOs, the private sector and individual experts, using modern information and communication technologies to provide more access to and better dissemination of existing knowledge and experiences on SFM.	Government, forest operators, private sector, civil society, research and education institutions.

Principle 2: Security of tenure, access and use rights

Ensuring security of forest tenure and clearly defined access and use rights, including customary and traditional rights, with particular attention to rights of marginalized groups, is a necessary condition for SFM.

Rationale

Forest tenure is a broad concept that includes ownership, tenancy and other arrangements for the use of forests. It is a combination of legally or customarily defined forest ownership and of rights and arrangements to manage and use forest resources. Forest tenure determines who can use what resources, for how long and under what conditions. While forest tenure is closely linked to land tenure it concerns not only the land, but also the natural resource on the land (Romano and Muller 2009). Secure forest tenure is a fundamental element in achieving improved livelihoods and sustainable forest management. It is a strong incentive for investing in forest resources and their management. Conflicting issues in tenure and legislation need to be resolved. Incompatibility between traditional tenure rights (land, trees and other resources) and formal land allocation have often led to contradictory (and free access) situations, resulting in the mismanagement of forest resources. These conflicting issues need to be harmonized and streamlined, whereby customary laws are incorporated into formal land allocation laws. In this respect, multi-stakeholder participation as well as appropriate rules and regulations to enforce legislation at the local level are key issues necessary. The status of women, landless, tenants and immigrants, in particular, needs to be reviewed as they play an important role in the management of this resource. Forest tenure should be implemented as part of a holistic and integrated reform agenda. The forest tenure is a learning process and requires an adaptive, deliberative, reflective and multi-stakeholder approach.

Tenure security. Forest tenure should be embedded within the overall development agenda of the country or region. Security of tenure implies that rights are recognized and guaranteed in the long term and cannot be taken away arbitrarily. Tenure security is not necessarily linked to ownership and to titling, but some kind of formal recognition is necessary. When undertaking a forest tenure reform a careful review of current policies and laws is necessary to ensure that they are supportive to the reform and do not present inconsistencies or contradictions to the objectives of the reform. A land-use planning process should take as a starting point the identification of forest user rights and traditional ownership and control of land. Any new tenure system involving local stakeholders should provide adequate incentives for the new owners/managers to invest human and financial resources in SFM. Incentives can be economic, but should encompass also an increased sense of ownership, equity and empowerment in decision making. Long term arrangements are preferable over short or medium term arrangements because they provide a stronger sense of security.

Forest concessions are a form of forest tenure. They involve a contract between the forest owner and another party giving rights to harvest specified resources from a given forest area (forest utilization contracts) and/or a contract to manage given resources within the specified forest area (forest management services contracts).

Formal recognition may also "legitimize" customary tenure systems, which otherwise are often in danger of being ignored or undermined, especially when different interest groups compete for the same resources. It may thus contribute to reducing conflict potential in forest areas.

Tenure and gender equity. There are often very different concerns between men and women in respect to the use and conservation of forest resources. These differences also affect the way how forests are managed. The variety of activities and knowledge systems of one group are complementary to those of the other, meaning one group usually depends on the other to be able to develop strategies to efficiently use and manage the forest, in order to produce the livelihood outcomes they long for. This therefore indicates how important men and women are to the management process and that they should therefore be considered equal partners in this management process. In order to improve on SFM, it is necessary to include both, the local/indigenous men and women in the management process, because sustainability requires an understanding of the construction of gender roles as a function of resource use and management. Gender is also central when considering management, extension and law enforcement. This can influence the decision-making capacity of professional women in forestry. Forestry tends to be a male-dominated field that privileges the experiences and knowledge of men. While the male-experience is important, it is crucial that women in forestry and forest resource management are fully valued and acknowledged for the diversity and distinctive perspective they currently bring to the field. This shift must occur in both policy and practice, within organizations and field level activities.

Guidance for Principle 2

Guidelines		**Recommended Actions**		**Indicative stakeholder group**
G2.1	Put in place effective formal systems for ensuring security of forest tenure.	A2.1.1	Reform legislation to recognize that security of forest tenure is a necessary condition for SFM and to recognize customary and traditional rights.	Government, forestoperators
		A2.1.2	Provide secure and long-term access or ownership rights to forest resources, ensuring that forest tenure is supported by related forest policy, legislation and institutional arrangements.	
		A2.1.3	When conducting a tenure reform, verify current land ownership and update cadastral and data management systems in order to keep track of who owns and manages forests.	
		A2.1.4	Define the rights for access and use and appropriate duration for use, including specific rights on products and services.	
		A2.1.5	Harmonize and streamline conflicting issues, inter alia through incorporating customary laws into formal land allocation laws.	
		A2.1.6	Strive to remove obstacles toward women's tenure security and gender equity aspects in national and subnational forest policies and programs related to SFM.	
		A2.1.7	Conceive and implement forest policies in concert with improvements	Government

			in tenure rights and other issues of resource access.	
G2.2	Recognize the importance to SFM of clear and equitable rights to forest access and use.	A2.2.1	Strive to define clearly and document the rights to access and use forests and their goods and services (e.g. by demarcation, titling or customary practice).	Government, civil society, research/education, others.
		A2.2.2	Identified, recognize and incorporate traditional tenure systems into regulatory frameworks.	
		A2.2.4	Strive to make administrative procedures in the forestry sector for tenure, access and use simple, easy to understand and affordable for local stakeholders.	
		A2.2.5	Strengthen knowledge about forest tenure with accurate, detailed, and publicly available information on the ownership and control of forest resources.	
		A2.2.6	Consider setting specific goals to address gender equity as far as rights of access and use are concerned.	
G2.3	Ensuring that traditional use rights are clear and respected.	A2.3.1	Put in place measures to ensure that recognized tenure, access and use rights of communities and indigenous peoples over publicly owned forests are respected.	Government, civil society, research/education, others.
		A2.3.2	Put in place measures to ensure that smallholder and local and indigenous communities know their rights and responsibilities and have the capacities to obtain the benefits provided by access to and use of forest resources.	Government, civil society, research/education, others.
G2.4	Ensure that concession/logging rights are clear and transparent	A2.4.1	Consider extending tenure of concession/logging license to a duration of at least two rotation periods.	Government, forestoperators
		A2.4.2	Develop and implement conflict management systems to prevent the invasion of forest concession.	Government, forestoperators
G2.5	Enabling environment for multi-purpose forest management	A2.5.1	Review policies and institutions to ensure they are effective in their support for multi-purpose forest management.	Government, forest operators, private sector, civil society, research and education institutions.
		A2.5.2	Review laws to ensure that access different traditional users have access rights in forest areas	Government, forest operators, private sector, civil society, research and education institutions.
		A2.5.3	Develop a comprehensive knowledge of forest resources in order to boost the values of goods and services from the forest and improve usufruct conditions.	Government, forest operators, private sector, civil society, research and education institutions.

3.2Extent and condition of forests

Principle 3: 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 ensures that the social, environmental and economic values of forests are maintained or enhanced.

Rationale

Sustainable forestry requires good planning that strategically begins with an integrated land-use plan. This plan serves as the backdrop for the allocation and wise use of the resources in a particular area of forest, and for the conservation of the area's ecological integrity[6]. Comprehensive land-use planning and land management is important for creating functional landscapes where agriculture, sustainably managed forests, national parks, protected areas, conservation areas and other land uses are integrated in a sustainable manner. To achieve this, integrated, cross-sectoral, landscape-scale planning and development approaches, which simultaneously focus on different economic activities and social and environmental values over broad areas, are needed (IUFRO/WFSE 2010). To sustain biological diversity and ecosystem services, efforts must be made to conserve trees and a large spectrum of forest types across the landscape through a combination of protected areas and the application of sustainable management practices. The reduction of landscape fragmentation is also necessary for conservation of biodiversity and related ecosystem services. More attention must be directed to restoration of landscape integrity through biological corridors and landscape connectivity, which facilitate species migration and the long-term viability of populations (IUFRO/WFSE 2010).

Permanent Forest Estate. Classifying a Permanent Forest Estate (PFE) is a central requirement for SFM. ITTO defined the PFE as "land, whether public or private, secured by law and kept under permanent forest cover. This includes land for the production of timber and other forest products, for the protection of soil and water, and for the conservation of biological diversity, as well as land intended to fulfill a combination of these functions. A key policy feature of SFM is a commitment by government, endorsed by all stakeholders, to define, and defend a Permanent Forest Estate (PFE) based on secure, long-term land tenure for communities, concession holders and other forest users. The different categories of land to be kept under PFE are: land to be protected (e.g. forests on fragile land), forests set aside for plant and animal and ecosystem conservation, land for production of timber and other forest products, and land intended to fulfill combinations of these objectives. Forest set aside for promoting productive and other functions need a balanced management combining productive, environmental and social aspects. The establishment and maintenance of a PFE must have political commitment at the highest levels. In most countries, such a commitment means protecting public forest lands from conversion to non-forest uses (Johnson and Cabarle 1993).

Continuous forest inventory (CFI).CFI meansthe measurement of forest growth and development through making repeated measurements of different forest components in permanently defined areas of forest or *permanent sample plots* (PSPs) to provide the most reliable data for estimation of (FAO 1998):

i. changes in the characteristics of forest stands over time;
ii. variations in forest composition and productivity with site and silvicultural treatment;
iii. the relationships between tree variables, stand variables and increments which may be used for yield forecasting; and
iv. long-term changes in the site and its continuous productive capacity.

[6]Canadian Council of Forest Ministers: Integrated forest land-use planning, Fact sheet. http://www.sfmcanada.org/english/pdf/LandPlan_FS_Eng.pdf

Land use planning. At landscape level should balance the developmental needs of a country as a whole, or for specific states or provinces within a country, with those of natural resources conservation, including SFM. A fundamental component of national land use planning is identification of a Permanent Forest Estate (PFE), comprising forests of all ownership types. Traditionally the objective of producing wood was overwhelmingly important. The awareness that forest management decisions and developments in other sectors are closely interconnected recently led to approaches to SFM that require a broader perspective that more closely integrates the management of forests with economic, ecological and social realities. Planning thus tends to gravitate to the landscape level, an area large enough that will be able to be resilient and to keep its ecological integrity. Landscape management is an essential approach for the sustainable management of natural resources, one that requires coordinated inter-institutional action and the effective participation and involvement of diverse stakeholders. The failure to use this approach and the lack of land-use planning has contributed in many countries to processes of landscape degradation and fragmentation.

Guidance for Principle 3

Guidelines		**Recommended Actions**		**Indicative stakeholder group**
G3.1	Implement a national and subnational land-use planning	A3.1.1	Develop a land-use policy aimed at the conservation and sustainable use of natural resources in collaboration with all stakeholders.	Government, Forest operators, private sector, civil society, research/education, others.
		A3.1.2	Assure that a national forest policy is an integral part of a national land use policy taking into account the multiple-use nature of forests.	Government, Forest operators, private sector, civil society, research/education, others.
		A3.1.3	Provide technical assistance on land-use planning for smallholders in order to encourage them to invest in forestry.	Government, forest operators, private sector, civil society, research and education institutions.
G3.2	Establish a national Permanent Forest Estate by a law which ensures transparency in relation to its demarcation, utilization, and management.	A3.2.1	Dedicate as Permanent Forest Estate sufficient and suitable land, whether public or private, to be kept under permanent forest cover.	Government, forest operators, private sector, civil society, research and education institutions.
		A3.2.2	Use geographic information systems (GIS) and other up-to-date techniques for forest mapping and zoning, and for modeling alternative technical options as an aid in decision-making.	Government, forest operators, private sector, civil society, research and education institutions.
		A3.2.3	Based on initial plans of zoning the PFE at landscape level, consult with surrounding populations, taking into account their present and future needs for agricultural land and their customary use of the forest.	Government, forest operators, private sector, civil society, research and education institutions.
		A3.2.4	Keep any land for which the final use is uncertain as part of PFE until the need for clearing arises.	Government, forest operators, private sector, civil society, research and education institutions.
G3.3	Carry out forest resource assessments	A3.3.1	Assemble all relevant databases and update maps	Government, forest operators, private sector, civil society,

	periodically to provide reliable data on the sustainable production of forest goods and services.			research and education institutions.
		A3.3.2	Consider the status of locally important species in the forest inventory, with special attention to the distribution of and threats to species that are protected by law, threatened species, and species significant to local communities.	Government, forest operators, private sector, civil society, research and education institutions.
		A3.3.3	Include among measures favoring compatibility of managing timber and non-timber forest species may include: i) multi-resource forest inventories; ii) tree marking of timber species and tree non-timber forest species to minimize damage during selective felling; and iii) hunting control in forest concessions to secure availability of animals for the needs of local populations.	Government, forest operators, private sector, civil society, research and education institutions.
		A3.3.4	Integrate carbon management in forest management planning if it is one of the main objectives.	Government, forest operators, private sector, civil society, research and education institutions.

3.3 FOREST ECOSYSTEM HEALTH AND VITALITY

Principle 4: Forest resilience

Resilience is a key tenet of SFM in natural tropical forests and it is essential to maintain or enhance it in order to reduce any risk that may affect their sustainability.

Rationale

The conservation of ecosystem diversity can best be accomplished by the establishment and management of a system of protected areas containing representative samples of all forest types linked as far as possible by biological corridors or 'stepping stones'. Well managed natural production forests can fulfill many of the objectives of protected areas and effectively fulfill the role of stepping stones. Management measures in production forests can make an important contribution to the conservation of biodiversity by contributing to forest quality and making conservation in neighboring protected areas more effective. Effectiveness and efficiency of conserving functional forest ecosystems can be best ensured by effective land-use policies that are developed with and through the involvement of local communities and other relevant stakeholders.

Forest management should be adaptive according to the specific circumstances where it is applied. It should be based on monitoring and evaluating the outcomes of actions, learning lessons, and applying them. Management needs to be site and circumstance specific, which is *per se* superior to generic defined prescriptions at a national level. One main objective of forest management at all levels is to maintain the functions of the ecosystems in the long term. Addressing forest resilience, including biodiversity contributes to the functions of the ecosystems increasing its stability and durability for the production of timber, non-timber forest products and ecosystem services Biodiversity plays an important role in ecosystem functioning and is essential to ecosystem resilience. A good understanding of forest successions and the dynamics of climax (primary) forests is essential to

maintain or increase resilience of forests to adverse effects. Of particular interest are the habitat requirements of the different species of interest for production and conservation. Efforts to implement SFM need to consider numerous ecological interactions such as the pollination, seed dispersal and symbiotic relationships on which the productive forest depends. To sustain biological diversity and ecosystem services, efforts must be made to conserve trees and a large spectrum of forest types across the landscape through a combination of protected areas and the application of sustainable management practices. The reduction of landscape fragmentation is also necessary for conservation of biodiversity and related ecosystem services (IUFRO/WFSE 2010). All significant management interventions in natural forests have impacts on forest resilience, and in particular on biodiversity; thus, due consideration to strategies and specific measures in forest management planning and implementation in respect to forest resilience are primordial.

Restoring degraded forest ecosystems. Reducing degradation of natural tropical forests implies reversing the trend in many tropical countries of gradual loss of forest productivity and carbon stocks through systematic and planned ecological restoration activities. This becomes particularly important in the development of REDD+. REDD+ makes a clear distinction between deforestation and degradation ("the second D"). Degradation tends in practice to focus on improved management options, such as ecological restoration that does not simply reduce degradation, but result in enhancement of productivity (and forest carbon stock). The aim of restoring forest ecosystems is to regain the dynamic forest processes, species composition, structure, biodiversity and productivity that are normally associated with the natural forest type expected in the given site.

In many other places, and in other types of forest, degradation is not caused by commercial logging but by extraction of various forest products, often for subsistence or local marketing (timber, firewood, charcoal, fodder) or by patchy clearance and re-growth associated with shifting agriculture, by forest dwellers and indigenous communities. In such areas degradation very rarely leads to deforestation – but to a gradual loss of carbon stocks (degradation). To deal effectively with many types of degradation, it is important to see them not as the beginning of a deforestation processes but as a form of poor forest management, which needs to be improved.

Guidance for Principle 4

Guidelines		**Recommended Actions**		**Indicative stakeholder group**
G4.1	Support and put in place preventive and remedial actions to reduce the vulnerability of forests to biotic and abiotic factors	A4.1.1	Develop policies, programs and remedial actions to prevent the vulnerability of forests to abiotic and biotic effects.	Private and public institutions
		A4.1.2	Strengthen the capacity of forest administrations to enable them to perform their normative and supportive duties.	Government, developmentpartners
		A4.1.3	Provide technical support to private and community forest owners to ensure that their activities contribute to increase the resilience of forests to negative abiotic and biotic effects.	Government, civil society, development partners, research/education, others.
		A4.1.4	Provide resources to: (1) improve the availability of basic documentation (2) improve access to up-to-date information, (3) establish technological information systems, and (4) supply adequate equipment and the means for its use and maintenance.	Government, developmentpartners, others
		A4.1.5	Assess the impacts and risks of climate change on the forests	Government, civil society, research,

			(including inter alia yield prediction, harvesting, livelihood impacts).	others.
		A4.1.6	Monitor forest responses to climate change as far as ecosystem processes such as hydrology, nutrient cycles, and carbon balance are concerned.	Government, civil society, research/education, others.
G4.2	Conserve and use biodiversity in ways that maintain forest resilience and enable adaptation to future change	A4.2.1	Assure that the use of biodiversity provides incentives for conservation, allows maintaining forest resilience and enables adaptation to future change.	Government, forest operators, civil society, research, others.
		A4.2.2	Identify high-conservation-value forests and manage them accordingly	Government, forest operators, civil society, research, others.
		A4.2.3	Apply ecological knowledge and R&D findings to ensure that forest management enhances or maintains biodiversity and ensures forest functions.	Government, civil society, forest operators, research/education, others.
		A4.2.4	Pay a particular attention to species that are strongly interactive or play a key role in the ecology of other species or have important influences on the overall ecology of a forest.	Government, civil society, forest operators, research/education
G4.3	Manage forests in ways that maintain their regenerative capacities and ecosystem resilience.	A4.3.1	Manage natural forest ecosystems based on a landscape approach that takes into account protected areas and stepping stones with well-defined roles for production.	Government, civil society, forest operators, research/education, others.
		A4.3.2	Integrate measures to increase resilience and conserve biodiversity in harvesting and silvicultural practices in natural production forests	Government, civil society, forest operators, research/education
G4.4	Restore degraded forest ecosystems to their approximate original species composition, structure, biodiversity, productivity and ecosystem function.	A4.4.1	Restore, rehabilitate and manage degraded forests taking guidance from ITTO guidelines for the restoration, management and rehabilitation of degraded and secondary tropical forests.	Government, Forest operators, research/education.
		A4.4.2	Assess and classify, at landscape level (national, subnational levels) the various forms of forest uses that degrade existing natural forests.	Government, civil society, forest operators, research/education, others.
		A5.4.3	Incorporate measures to conserve and enhance forest resilience in strategic and operational planning and implement them at the applicable scales.	Government, forest operators, civil society, research/education

Principle 5: Identification, prevention and management of threats to forest and ecosystem health

It is essential to protect forests from threats by preventing the start of any destructive agents, including insect or disease outbreak, fire, uncontrolled grazing, erosion, flooding, stress factors, invasive species, illegal activities.

Rationale

Sustainable forest management cannot be achieved in the absence of a firm commitment and action to effectively protect a forest management unit. Protection measures against unauthorized access or illegal activities, from conversion to other land uses, from fire and other potential threats are amongst the most critical to be implemented, irrespective of the objectives. Also, in particular in intensively managed logging concession, waste management is an important protection function. Effective planning, implementation and enforcement of protection measures and related security arrangements should actively seek collaboration and cooperation with local forest communities.

Guidance for Principle 5

Guidelines		Recommended Actions		Indicative stakeholder group
G5.1	Protect the FMU from illegal activities.	A5.1.1	Assure that FMU is protected from illegal activities, especially those that are incompatiable with SFM.	Government, Forest Managers, Civil Society others.
		A5.1.2	Demarcate and signal the FMU boundaries where there are risks of invasion.	Forest operators
		A5.1.2	Put up signs on access roads and other critical places explaining under what conditions access is permitted.	Forest operators
		A5.1.3	Develop collaboration with local authorities, alert them in case of transgressions to the FMU and facilitate access by enforcement personnel.	Forest operators
		A5.1.4	Develop and enforce local rules with regards to subsistence hunting and actively inform workers about its observance.	Forest operators
G5.2	Assure that fire management plans for the FMUs are formulated and implemented.	A5.2.1	Integrate fire management considerations into forest management planning.	Forest operators, civil society, research/education.
		A5.2.2	Prepare FMU fire management plan taking guidance from to ITTO guidelines on forest fires and integrate it into forest management planning.	Forest operators, civil society
G5.3	Integrate the management of pests and diseases into the FMU's forest	A5.3.1	Integrate management of pests and diseases in the FMU forest management plan.	Forest operators, private sector, civil society, research/education

	management plan.	A5.3.2	Monitor incidence of pest and diseases and prepare contingency plans for controlling serious outbreaks.	Government, Forest operators, private sector, research/education, others.
		A5.3.3	Ensure that silvicultural activities and the associated equipment and tools do not move pests or intensify their impacts.	Forest operators, research
G5.4	Ensure that all waste derived from, and chemicals used in, forest management activities are stored and disposed of properly.	A5.4.1	Incorporate waste management in the forest management plan.	Government, Forest operators, research
		A5.4.2	Formulate and enforce procedures and practices that minimize the quantity of waste and, whenever appropriate, recycle the residues.	Forest operators, civil society, research
		A5.4.3	Provide adequate training for staff on procedures and practices defined in the waste management strategy.	Forest operators, civil society, education
		A5.4.5	Organize awareness campaigns, e.g., using written communication and conferences.	Government, Forest operators, civil society, medias
		A5.4.6	Identify and use appropriate collectors to store dangerous inorganic waste.	Forest operators, civil society

3.4 CLIMATE CHANGE MITIGATION AND ADAPTATION AT THE FMU LEVEL

Principle 6: Forest carbon management

Ensure that management at FMU level is implementing national policies and international commitments for low-carbon and climate-resilient development strategies.

Rationale

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. Climate change can significantly affect forests through negative effects on their health, physiology, structure, and species composition. Through skillful forest management and rehabilitation of degraded forests, it is possible to maintain and enhance the climate change mitigation capacity of tropical forests. For this forest ecosystems need to be assessed and monitored to quantify their contributions towards climate change mitigation and the impact of climate change. With adequate information, SFM can help mitigate climate change in tropical forests and to minimize the effects and impacts of that change on the forest ecosystem and on society. Hence managing forests for one of the options to reduce emissions from deforestation, or from forest degradation, to conserve and enhance forest carbon stocks, can contribute to global climate change mitigation goals and can potentially yield economic benefitsfor 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 these options and that rules and regulations to implement are available and governance systems to use incentives for they adoption are operationalized. Existing country strategies, regulations and

incentives such as REDD+, carbon rights, and the responsibilities of forest operators, need to be analyzed, and an action plan for forest carbon management developed, and safeguards established to avoid negative social and environmental impacts. It is important to be aware that benefiting from SFM incentives such as REDD+ requires the implementation of an effective forest carbon measurement, reporting and verification system in order to provide the amount of carbon sequestered and the volume of greenhouse-gas emissions reduced. It further requires that safeguard measures are in place to avoid negative impacts on biodiversity, indigenous peoples and local communities. Research is therefore needed to develop effective forest carbon management options at the FMU level and will entail collaboration between research institutions and forest operators.

Guidance for Principle 6

Guidelines		**Recommended Actions**		**Indicative stakeholder group**
G6.1	Consider under existing management plans, alternatives of carbon trade as an additionality to SFM.	A6.1.1	Assess and identify means for addressing leakage, permanence and requirements for the safeguard of sequestered carbon.	Government, forest operators, private sector, civil society, research
		A6.1.2	Integrate carbon management into the sustainable forest management plan.	Government, forest operators, private sector, civil society, research
G6.2	Define the reference emission level (REL) and reference level (RL) for carbon management	A6.2.1	Calculate the REL and/or RL for the FMU using existing approved methodologies or the voluntary carbon market framework.	Government, civil society, research/education
		A6.2.2	Harmonize the identified REL/RL with the national/sub-national REL/RL.	Government, civil society, research/education
G6.3	Monitor and report on forest carbon and safeguards	A6.3.1	Monitor and assess the carbon stocks on a regular basis as per national guidance or voluntary carbon markets.	Government, civil society, development partners, private sector, research
		A6.3.2	Carry out forest carbon assessments using the guidelines of the Intergovernmental Panel on Climate Change, as specified by the UNFCCC.	Government, civil society, research
		A6.3.3	Develop and implement monitoring of social and environmental safeguards consistent with national guidelines.	Government, development partners, forest operators, private sector, civil society, research
		A6.3.4	Integrate carbon measurement in forest inventory procedures.	Government, forest operators, private sector, civil society, research
		A6.3.5	Develop a reporting system to meet the national requirements for reporting on forest carbon monitoring, and social and environmental safeguards.	Government, Forest operators, civil society, research
G6.4	Research into and develop best-practice forest carbon management	A6.4.1	Collaborate with research institutions to identify and implement best-practice forest management for climate change mitigation.	Government, forest operators, private sector, civil society, research/education
		A6.4.2	Review and promote suitable forest	Government, forest

			management options and the sharing of lessons learned with a view to strengthening forest-based climate change mitigation activities.	operators, private sector, civil society, research

Principle 7: Climate change adaptation related to tropical forests

Promote the use of adaptation techniques at FMU level to reduce the vulnerability of forests to climate change and to use them to reduce the vulnerability of society to the effects of climate change.

Rationale

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 operators to respond quickly to changing conditions. Forests may be affected biophysically by climate change in several ways: plant physiology and metabolism; pathology; insect and herbivore animals; 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. Climate change may have significant impacts on forest-related social and economic factors. Forest operators 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. 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 operators 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. Well-planned and implemented adaptation actions will maximize benefits and minimize costs. Forest operators 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.

Guidance for Principle 7

Guidelines		Recommended Actions		Indicative stakeholder group
G7.1	Conduct assessments of the impacts of climate change and climate variability on the physical characteristics	A7.1.1	Obtain information on recent trends and projected changes in climatic variables and impact assessments relevant to a given area.	Government, private sector, civil society, research/education
		A7.1.2	Monitor trends in the frequency and severity of climate change-related impacts.	Government, private sector, civil society, research
		A7.1.3	Assess the current and likely future	Government, civil society,

	of the forests and their productivity, ecological dynamics and ecosystem functions		impacts of climate change on forest characteristics, productivity and ecosystem services.	research/education
G7.2	Assess social and economic impacts of climate change	A7.2.1	Identify emerging and likely future socioeconomic impacts of climate change on forests.	Government, civil society, research/education
		A7.2.2	Monitor changes in markets for forest products due to changes in demand for forest-based energy and for product substitution.	Government, development partners, forest operators, private sector, civil society, research/education
G7.3	Assess the costs of adaptation	A7.3.1	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.	Government, social society, research
		A7.3.2	Monitor key variables (indicators) of adaptation effectiveness.	Government, forest operators, private sector, civil society, research/education
G7.4	Manage for adaptation to climate change	A7.4.1	Identify the short-term and long-term risks, costs and benefits of adaptation measures at the level of forest stands within an FMU.	Government, forest operators, private sector, civil society, research
		A7.4.2	Modify forest management plans and practices to include relevant adaptation measures.	Government, forest operators, private sector

3.5 MAINTAINING THE MULTIPLE FUNCTIONS OF FORESTS

Principle 8: 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.

Rationale

Forests can be managed for multiple, most times complementary objectives: production of goods, protection of soil and water and other environmental services, conservation of biodiversity, provision of socio-cultural services, livelihoods support and poverty alleviation (FAO 2010). Multiple-purpose forest management (also called multiple-use management) has been envisioned as a promising and balanced alternative to single timber-dominated strategies of forest use. It can be found in existing livelihoods of forest dependent peoples, the operations of some forest industries and is even supported by some regional forest legislation. However, in practice, multiple-purpose management is not a dominant strategy and is often a marginal activity in forest sectors. Incipient efforts are emerging ranging from community forestry projects to national programs to develop comprehensive REDD+

strategies, but much more could be done to diversify and enhance multiple-purpose management (Guariguata*et al.* 2008). Under the right conditions, multiple-purpose forest management could diversify forest use, broaden forest productivity and provide incentives to maintain forests. It could also allow a greater number of stakeholders to participate in forest benefit streams. In addition, multi-purpose management could provide a venue for reducing social conflict and exclusion related to remaining forest resources. It could also provide useful alternatives for reducing forest degradation. The multi-purpose approach applies to the management of primary as well as secondary and degraded forests. In secondary forests, in particular, the multiple-use (edible fruits, firewood, wood for rural construction and handcrafts, medicinal compounds, etc.) of many species growing in those stands is one of the most important features to take into account for management purposes. Conflicts over use can be minimized by legally protecting those tree species whose economic and social value as NTFP equals or exceeds its timber value. For example, such a protection currently exists for Brazil nut (*Bertholletiaexcelsa*, Lecythidaceae) trees in Brazil, Peru and Bolivia due to their importance in contributing to supporting extractive communities throughout the Amazon Basin (Ortiz 2002, Peres et al. 2003). However, in other cases the degree of conflict between concurrent uses may be culturally and geographically specific which complicates the necessary steps for legal protection at wider spatial scales. First, the conservation of soil and water in forests has a bearing on maintaining the productivity, health and condition of the forests themselves. Secondly, it plays a crucial role outside the forest in maintaining downstream water quality and flow and in reducing flooding and sedimentation. Quantitative indicators of the effects of forest management on soil and water include such measures as soil productivity within the forest and data on water quality and average and peak water flows for streams emerging from the forest. Optimal multi-purpose forest management can be better attained with the use of watershed or river basin framework.

Guidance for Principle 8

Guidelines		**Recommended Actions**		**Indicative stakeholder group**
G8.1	Conductforestresourceassessments	A8.1.1	Carry out regularly national and/or subnational multi-resource assessments and inventories.	Government, research, civil society, forest operators, private sector.
		A8.1.2	Integrate into the national multi-resource inventory the specific assessment methods that are proposed at international or national level for carbon assessment. Decide if the assessment is done for all five carbon pool or focused on the main pool(s).	Government, forest operators, private sector.
G8.2	Soil and water conservation are essential for maintaining the productivity and health of forests and their hydrological regulation function.	A8.2.1	Maintain permanent soil cover and promote minimal mechanical disturbance to soil through RIL:	Government, Forest operators, private sector.
		A8.2.2	Adopt appropriate forest harvesting practices so that accelerated soil erosion does not take place and the productive potential of the soil is not diminished.	Government, Forest operators, private sector.

		A8.2.3	Take measures to protect areas prone to accelerated erosion: soils into which water infiltrates with difficulty; areas which contribute to the surface flow into streams; the margins of stream beds.	Government, Forest operators, private sector.
		A8.2.4	Provide guidance for determining areas of the PFE to be maintained and managed primarily for the protection of soil and water.	Government
		A8.2.5	Develop specific guidelines for the conservation of soil and water at FMU or wider water catchment levels.	Government
		A8.2.6	Ensure that adequate procedures to protect soil productivity and water retention capacity within production forests have been developed at national level and are applicable at FMUs level.	Government, forest operators, private sector
		A8.2.7	Classify catchments based on source protection, restoration, conservation, flood buffers, slope, and sediment loads.	Government, Forest operators, private sector
		A8.2.8	Establish zoning requirements for critical watershed areas, including restrictions on forestry operations on the basis of elevation, degree of slope, proximity to surface and groundwater resources.	Government, Forest operators, private sector
		A8.2.9	Establish buffer zones along watercourses, around aquifers recharge areas and water intakes.	Government, Forest operators, private sector.

Principle 9: Biodiversity conservation at FMU level

It is essential to take into account national policies, strategies, laws and regulations on biodiversity conservation when planning forest management at FMU level.

Rationale

Effective forest management, in which economic, social and environmental objectives are balanced in accordance with societal needs and priorities, is essential for setting and achieving biodiversity conservation and sustainable use goals. An important argument for why forest operators should conserve biodiversity is that it will help ensure the healthy functioning of their forests. In the long run, forests will produce more valuable products and will be more resistant to external changes, including climate change, if they retain as much of their natural biodiversity as possible. The ITTO/IUCN Guidelines for the conservation and sustainable use of biodiversity in tropical timber production forests (ITTO/IUCN 2009) have been specially designed to assist policymakers and forest operators by bringing together in one place the specific actions that are needed to improve biodiversity conservation in tropical production forests, and should serve as a prime reference, in particular Principle 9: Biodiversity considerations at the forest management unit level (Guidelines 24 to 37).

Monitoring of biodiversity should be in place to ensure that forest management does not impact negatively on biodiversity features identified as having special value. Such a monitoring is needed to ensure that the practices and specific measures defined in the FMP do indeed translate into minimum levels of performance on the ground, and to evaluate the extent to which these management standards are adequate and how they can be further refined to ensure continued progress towards the long-term management goals. Low-cost monitoring programs for biodiversity in tropical production forests that serve the needs of forest operators should be developed and conducted in ways that facilitate learning and adaptive management and that make information on achievements and failures widely available (ITTO/IUCN 2009).

Guidance for Principle 9

Guidelines		Recommended Actions		Indicative stakeholder group
G9.1	Give prominent place to biodiversity at all stages of the preparation and implementation of the management plan of an FMU.	A9.1.1	Focus conservation efforts on those species or habitats that are of greatest conservation value. In this regard, pay particular attention to the management of species or habitats that are internationally recognized as rare, threatened or endangered.	Government, Forest operators, civil society, private sector, research/education
		A9.1.2	Measures and safeguards to protect biodiversity should be included in all FMPs. Biodiversity should be given a prominent place at all stages of the preparation and implementation of the FMP.	Government, Forest operators, civil society, private sector, research/education
		A9.1.3	Set aside a portion of the FMU for complete protection. Optimally, these reserves should be large, shaped so as to minimize edge effects, cover representative areas of all the ecosystem types present, and include features of special concern for biodiversity maintenance such as water courses, rock outcrops, and salt licks	Government, Forest operators, civil society, private sector, research/education
		A9.1.4	Include in forest management plans information on the presence and conservation status of plants, animals and habitats of special conservation concern.	Forest operators, civil society, private sector, research/education

		A9.1.5	Improve silvicultural operations to achieve significant gains in conserving biodiversity.	Government, Forest operators, civil society, private sector, research/education
		A9.1.6	Take into consideration the local occurrence of species or habitats of special conservation concern in the preparation of harvesting plans, including stock maps at the compartment level.	Government, Forest operators, civil society, private sector, research/education
		A9.1.7	Forest management should ensure that changes do not impact negatively on biodiversity features identified as having special conservation value.	Government, Forest operators, civil society, private sector, research/education
		A9.1.8	Assess the need for special measures to encourage the retention of viable populations of seed trees and maintain the genetic diversity of commercially important species, and ensure that the silvicultural requirements of target tree species are known and applied.	Government, Forest operators, civil society, private sector, research/education
		A9.1.9	Retain hollow trees in harvest operations, although generally of low commercial value, as they provide important habitats for a wide range of animal species	Government, Forest operators, civil society, private sector, research/education
		A9.1.10	Disruption of canopy cover might be important in allowing the regeneration of light-demanding species but this should be balanced by the need to retain canopy connectivity for canopy-dwelling animals and to reduce fire risk and the exposure of open ground to rain and sun.	Government, Forest operators, civil society, private sector, research/education
		A9.1.11	Avoid the use of arboricides or other means of suppressing certain tree species (particularly keystone species).	Government, Forest operators, civil society, private sector, research/education
		A9.1.12	Ensure that forest operators are trained and motivated to seek locally appropriate approaches to biodiversity conservation and sustainable use.	Government, Forest operators, civil society, private sector, research/education
		A9.1.13	Encourage collaboration between conservation NGOs and timber companies to adapt management practices to suit local conditions.	Government, Forest operators, civil society, private sector
G9.2	Provide guidance and take measures to avoid unsustainable levels of NTFPs and hunting.	A9.2.1	Take measures to control the harvesting and transport of bushmeat and NTFPs.	Government, Forest operators, civil society, private sector
		A9.2.2	Minimize forest fragmentation to maintain greater species diversity and reduce the risk of loss of NTFP	Government, Forest operators, private sector

			species.	
		A9.2.3	The method and scale of timber harvesting should accommodate any existing NTFP harvesting and trade patterns of local communities if well developed and where disruption that might be caused by logging would become a source of conflict.	Government, Forest operators, civil society, private sector
		A9.2.4	An optimal planning of the road network limits the direct negative impacts on wildlife while a better control of access limits commercial hunting and fishing activities.	Forest operators, private sector
		A9.2.5	Take measures that benefit wildlife species such as leaving dead snags and large fruiting trees, having wide riparian corridors for animal access to water, providing migration pathways for the larger wide-ranging predators.	Forest operators, private sector
		A9.2.6	Forest operators should consider, in forest management plans, potential human-wildlife conflicts that could arise from logging activities and take appropriate measures to prevent their occurrence.	Forest operators, private sector
G9.3	Monitor biodiversity in the FMU to ensure that forest management does not impact it negatively.	A9.3.1	Ensure that FMPs provide for biodiversity monitoring and that management will be responsive to the results of that monitoring.	Forest operators, research/education.
		A9.3.2	Consider simple, widely recognized and widely applicable measures for protection, control and impact reduction that can be taken with respect to each human impact.	Forest operators, private sector
		A9.3.3	Involve local people in setting up a system for biodiversity monitoring. This will facilitate the process of implementing any management recommendations, providing a cost-effective and sustainable means of data collection and a potentially rich source of local knowledge to help interpret results.	Forest operators, private sector
		A9.3.4	Forge partnerships for long-term biodiversity monitoring between forest operators and universities and specialized institutions.	Forest operators, civil society, private sector, research/education

3.6 SOCIAL, ECONOMIC AND CULTURAL DIMENSIONS

Principle 10: 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, inclusive and competitive.

Rationale

Natural tropical production forests need to be managed for more than just timber production, but also for objectives such as supporting local livelihoods, biodiversity conservation, and ecological services, including carbon capture and storage. A key aspect to capture the full value of forests and ensuring the equitable distribution of costs and benefitsinvolves the concept and application of adaptive management. Important for all processes is the availability of financial resources, mechanisms that guarantee that costs and benefits are distributed in fair way amongst all stakeholders that contribute to SFM and that markets are accessible to all types of products and services that are delivered by the forests. The full value of forests include direct use values from timber, fuelwood, NTFP etc.; indirect use values from services, such as water, biodiversity and carbon, option values relating to the willingness to pay to conserve the option of use the forests even that there even though that no current use of it made out of it[7].

Financial. The full value of forests does not include only the financial return for the stakeholders that are involved directly and presently, but also to those that take benefit indirectly and in a foreseeable future. Clear incentive structures need to be defined in order to respect not only the financial return to the immediate stakeholders, but also the economic return to society. One of the most important requirements for sustainable forest management to succeed is the availability of financial resources, as well as the provision of incentives and appropriate economic instruments that promote and support sustainable forest management.

Active and informed participation of communities and stakeholders.SFM is dependent upon social needs from forest being met.An appropriate understanding of SFM encompasses a wide range of social, economic and environmental processes and interrelationships, including gender aspects that affect decision making. Decision-making processes should embrace the different phases of the forest management cycle (from strategic and operational planning to implementation to monitoring and evaluation) taking into account the dynamic context in which it operates. Adaptive and collaborative approaches for managing forests have received considerable attention over the past years. Participatory approaches that link forest stakeholders, empower local communities and their subgroups, and strengthen adaptive capacities of communities as well as of local governments are of particular importance. The active and informed participation of communities and stakeholders affected by forest management decisions is critical to the credibility and sustainability of management processes. Public awareness raising and communication activities play a critical role in informing and educating the public, thereby allowing them to more effectively participate in SFM decision-making (CBD 2010). An informed, free, and independent development of opinions among indigenous peoples in particular is one of the essential elements for successfully managing natural tropical forests. Thus multistakeholder processes are an important approach for supporting people's direct participation in decisions, building collaboration and managing conflicts among competing interest groups (Wollenberg et al. 2005).

Knowledge and rights of local communities. In planning management frameworks for the sustainable management of natural tropical forests, include provisions to respect the knowledge and rights of local communities and indigenous peoples by also taking into account relevant international obligations, national circumstances and laws, and noting that the United Nations General Assembly has adopted the United Nations Declaration on the Rights of Indigenous Peoples. Also, provisions should be made that forest operators should work with forest communities in assessing, planning and

[7] Pierce, D.W. (1991). The Economic Value of Forest Ecosystems. Economic Health 7(4): 284-295

monitoring the management of natural tropical forests, according to locally defined concerns, needs and goals, in order to better address rural communities' needs. Effective mechanisms should be formulated that will enable the achievement of effective and enduring two-way communication between forest operators and forest communities.

Guidance for Principle 10

Guidelines		Recommended Actions		Indicative stakeholder group
G10.1	Address the livelihood needs of people, including indigenous peoples and other vulnerable forest-dependent peoples and communities, by national and sub-national forest policies and programs related to SFM	A10.1.1	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.	Government, Forest operators, research/education
		A10.1.2	Provide guidance and tools for use of participatory approaches and tools to facilitate the involvement of local communities in sustainable forest management.	Government, Forest operators, civil society, research/education
		A10.1.3	Ensure that there is a clear recognition and respect for the rights of indigenous peoples who live in or have a traditional dependence on tropical forests.	Government, Forest operators, civil society
G10.2	Take into account the possibility for generating income from the ecosystem services provided by the FMU, such as those related to carbon, water and biodiversity.	A10.2.1	Forest management should take into account the possibility for generating income from the ecosystem services provided by an FMU, such as those related to carbon, water and biodiversity.	Government, forest operator, research/education
G10.3	The participation of stakeholders, especially affected local communities, is an essential element of SFM. Ensure that SFM policies and practice are transparent, accountable, and effective and put in place conflict-resolution mechanisms	A10.3.1	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.	Forest operators, research/education.
		A10.3.2	Establish participation processes and design multi-stakeholder dialogues to formulate the normative framework for the management of natural tropical forests.	Government, civil society, forest operators, private sector
		A10.3.3	Provide guidance and tools and take steps to enable	Government, civil society

			local and indigenous people to participate equitably in managing natural tropical forests.	
		A10.3.4	Promote gender equity at the level of forest education, research and in the implementation of SFM.	Government, forest operator, forest operators, research and education institutions
		A10.3.5	Provide guidance and tools to resolve conflicting issues in tenure and legislation at a broader level.	Government, civil society
		A10.3.6	Develop forest management plans that link traditional forest-related knowledge and practices; recognize and value the knowledge and skills of experienced local people about forest resources (ecology, assessment, management and utilization).	Forest operators, forestoperators
G10.4	Recognize cultural and spiritual values and respect archaeological, cultural and spiritual sites identified and protected at the landscape level.	A10.4.1	Provide in the standards for forest management planning guidance and tools for consultation with local people on archaeological, cultural and spiritual sites in a natural production forest area.	Forest operators, private sector
		A10.4.2	Provide due respect to local decisions on the protection and conservation of cultural and spiritual sites.	Government, civil society

Principle 11: Community involvement in SFM

Local community involvement is essential for SFM to succeed

Rationale

Community forest management (CFM) – embracing various degrees of community involvement, including arrangements such as participatory forest management, joint forest management, co-management and community-based forest management – can significantly contribute to improve the livelihoods of rural people, reduce forest emissions and increase forest carbon stocks, while maintaining other environmental and social services. CFM can also be an important vehicle providing employment and income, strengthening community rights on land and resource use, as well as organizational capacities for achieving sustainable development. Community forest management is defined here according to the UNFF (2011) as “the management of forest lands and forest resources by or with local people, whether for commercial or non-commercial purposes”. Local people encompass a diversity of actors including native groups, other traditional communities (like river dwellers), settlers and migrants. The associated concept of smallholder forest management is also

considered, though in this case land and resource use rights are not collective and most management activities are not necessarily shared among.

The practice of free, prior, and informed consent (FPIC). This consists of giving local people a formal role —and some form of veto power—in the consultations and ultimate decisions about local development projects. It is intended to secure the rights of indigenous peoples and local communities: their rights to self-determination, to control access to their land and natural resources, and to share in the benefits when these are utilized by others (WRI 2005). FPIC is a tool for greater equity and a natural pathway to a co-management role for local communities in large development projects.

Rights and responsibilities of local communities. It is important that the rights and responsibilities of those concerned about and making use of the forest be adequately considered in forest management. This approach requires taking into account the rights attained by practice as well as rights attributed by formal laws with regards to use and benefit from the forest. The active participation from and support to local stakeholders provides useful knowledge about local forest use and management strategies. It contributes to efforts to control access to and regulate the use of forest resources and a means for conflict resolution and empowerment.

Equitable sharing. Equitable benefit sharing and decision making processes are fundamental factors in the sustained development of community forestry. The income generated from selling timber and non-timber forest products can be used for common community interests and as a direct form of compensation or income for communities (Huy 2007). Experiences to date highlight that equity is not an automatic outcome of community-based forest management, so that promoting more equitable sharing of benefits is a shared concern (Mahanty 2008). In particular, if communities are able to secure the benefits that community-managed forests generate, and whether these actually reach the poorest at the community level.

Guidance for Principle 11

Guidelines		**Recommended Actions**		**Indicative stakeholder group**
G11.1	Consultwith local communities.	A11.1.1	Free, prior and informed consent in forest management decisions should be obtained in an appropriate, consultative manner.	Forest operators, private sector, civil society
		A11.1.2	Include in the consultation process participatory methodologies to ensure participation and voice of forest dependent groups within affected communities, to build community consensus, to enhance transparency, and to ensure local ownership of the process.	Forest operators, private sector, civil society
G11.2	Inform local communities of their responsibilities in forest management, which in turn should be commensurate with their rights to use and benefit from the forest.	A11.2.1	Promote participation of communities in all aspects of implementing SFM.	Government, forest operator, civil society
		A11.2.2	Whenever possible, involve neighbor communities in management decisions that may affect or benefit them.	Forest operators, private sector, civil society
		A11.2.3	Promote collaboration amongst people and institutions who are involved in the various aspects of forest management, including wood production, integrating professional skills and training	Government, Forest operators, private sector, civil society, research/education, others.

			with traditional knowledge and resources of local populations in order to more effectively support the needs of rural communities and to minimize or avoid conflicts in forest management.	
G11.3	Strive to ensure that benefits are equitably shared among stakeholders according to their rights, roles and responsibilities.	A11.3.1	Assist the community to manage the benefits from their forests	Forest operator, civil society
		A11.3.2	In assessing the costs and benefits of community forestry, take into account who bears the costs and who receives the benefits.	Government, Forest operators, private sector, civil society
		A11.3.3	Identify, valuate and analyze costs and benefits to help community decision makers to define options for distributing costs and benefits on an equitable, efficient and sustainable basis.	Government, Forest operators, private sector, civil society
		A11.3.4	As a basis for benefit sharing, there is a need for local governance bodies to operate transparently and have accountability, with appropriate legal and procedural supports.	Government, Forest operators
		A11.3.5	As women, poor and disadvantaged users of community forestry need special assistance, focus particularly on these groups while introducing cost and benefit distribution systems.	Government, Forest operators, private sector, civil society
G11.4	Provide opportunities to local communities to actively and sustainably manage forests to increase income and improve living conditions.	A11.4.1	In planning CFM take particular attention to the community needs, the potential of the forest resources, the organizational and technical capacities and the availability of workforce in the community	Government, forest operator, civil society
		A11.4.2	Develop and/or strengthen the community's organizational capacity and capability for CFM	Government, Forest operators, private sector, civil society
		A11.4.3	Provide guidance to simplify the requirements for forest management plans and adapt them to the capacity and scale of management objectives of local forest owners and managers.	Government, civil society, research/education, others.
		A11.4.4	Clearly define roles and responsibilities of community members in the forest management process, including processing and marketing of any products and/or services derived from the FMU.	Government, Forest operators, private sector, civil society
		A11.4.5	Encourage diversified and	Government, Forest

			value-added forest production integrating forest products in CFM plans.	operators, private sector, civil society
		A11.4.6	Improve profitability and competitiveness of forest management through the development of forest product value chains to help community managers gain market access for lesser known species, non-wood products, and to use wood and forest waste more efficiently.	Government, Forest operators, private sector, civil society
		A11.4.7	Support communities so that they can qualify and measure the products and/or services in the forest management area, as well as to monitor and assess the impacts of the management interventions.	Forest operators, private sector, civil society
		A11.4.8	Build participatory monitoring activities on existing management institutions (village leaders, forest user group councils), and in turn be institutionalized at the local level.	Forest operators, private sector, civil society
		A11.4.9	Strengthen communities' capacity to bargain with outside actors including on timber price information, connections to different timber buyers, written contracts.	Government, Forest operators, private sector, civil society
		A11.4.10	Provide means to overcome common challenges related to access to capital and technology, as well commercial opportunities and favorable integration of small and medium forest enterprises into supply and value chains to generate income.	Forest operators, private sector, civil society
		A11.4.11	Engage external technical and/or financial support in the process of implementing CFM.	Government, Forest operators, private sector, civil society

Principle 12: Productive and safe working conditions in forestry at the FMU level

The provision of safe and adequate working conditions and capacity building are essential elements for SFM.

Rationale

Human beings are the most precious asset in any forest management operation and as such every effort should be made to ensure safe working conditions and adequate capacity building. Forestry in

general and logging in particular continue to be among the most risky occupations. Accidents are normally caused by poor organization and supervision, inadequate tools and equipment, poor planning, and lack of skills and competence among workers, supervisors and managers (ILO 2011). In this regard, policies should be developed/refined to: i) eliminate risks, ii) control risks at the source, iii) minimize risks by focusing on safety of work methods and organizations, and iv) provide personal protective gear, equip all machinery with safety devices and make sure these are used. Adequate and continuous training of forest workers has made great strides in some countries over the last decades; it is inadequate in certain other countries.

Capacity development. Capacity development at all levels of workforce, including attention to working conditions, is essential for SFM and should be integrated in forest management plans. Forest operators should therefore consider the critical importance of staff training at all level in order to: i) minimize damage to the forest and the environment by implementing RIL in an effective and efficient manner; ii) make staff fully aware of the social and environmental impacts of harvesting; iii) increase work productivity, quality and safety; and iv) reduce harvesting losses as well as direct costs and production costs (FAO 2004).

Guidance for Principle 12

Guidelines		**Recommended Actions**		**Indicative stakeholder group**
G12.1	Define and respect rights and responsibilities of forest workers and local forest operators with regard to SFM.	A12.1.1	Consider establishing a framework for rights and responsibilities of forest workers and forest operators to ensure a positive attitude to safety and health of forest operation.	Government
G12.2	Require forest operators to give top priority to health and safety for the personnel involved in forest management operations.	A12.2.1	Provide safe and healthy working conditions for all personnel according to international occupational health and safety standards.	Government, forest operators, private sector
		A12.2.2	Establish a training program for qualification and awareness-raising of staff on forest management activities, specifying risks and preventive measures for each operation.	Forest operators, private sector
		A12.2.3	Workers should only be assigned to jobs that correspond with their age, physical capacity, state of health and vocational qualifications.	Forest operators, private sector
		A12.2.4	Introduce financial incentives to encourage workers to observe safety regulations.	forestoperators, private sector
		A12.2.5	Make sure that all equipment, tools and materials needed to work under conditions of safety are provided and kept in good state of repair.	forestoperators, private sector
		A12.2.6	Foster stability of workforce as a way to reduce the occurrence of hazardous situations and thus risks	forestoperators, private sector

			of accident.	
		A12.2.7	All work accidents or professional diseases should be communicated in written and adequately registered in an information system and database. This would allow, among others, to indicate the main areas of attention for training and recycling.	forestoperators, private sector
		A12.2.8	Give first-aid training to forest workers as they are generally dispersed in crews operating over wide areas.	forestoperators, private sector
		A12.2.9	Make available clearly marked and serviceable first-aid kits in all worksites.	forestoperators, private sector
		A12.2.10	Make arrangements for the rapid evacuation of workers in emergency situations.	forestoperators, private sector
		A12.2.11	Provide communication equipment to crews working in remote areas and ensure that they have permanent connection to base.	forestoperators, private sector
		A12.2.12	Arrange regular medical check-ups for all personnel, especially those exposed to occupational disorders.	forestoperators, private sector
		A12.2.13	Carefully plan logging camps and supply them with clean water.	forestoperators, private sector
G12.3	Introduce best practices and standards in harvesting to ensure safe and efficient operations, minimize damage and waste and reduce environmental impacts.	A12.3.1	Provide adequate supervision of personnel, and, when appropriate, performance-based incentives for efficient, safe and careful implementation of harvest operations.	Forest operators
		A12.3.2	Adopt recommended practices for cutting operations, namely directional felling to reduce damage to both vegetation and soils, and streams and increase the utilizable volume of the tree stem by reducing breakage.	forestoperators, private sector
		A12.3.3	Adopt recommended guidelines and best practices for extraction with ground-skidding equipment and other extraction systems	forestoperators, private sector
		A12.3.4	Ensure that adequate planning of landings and their layout respects sound practices and can help reduce the risks and ensure that operations proceed efficiently and safety.	forestoperators, private sector
G12.4	Provide guidelines for optimal efficiency in timber harvesting to reduce log wastes.	A12.4.1	The measurement used for log production must be fair to the buyer and to the seller of wood.	forestoperators, private sector
		A12.4.2	Adopt standards allowing minimizing forest harvesting waste and ensuring that no marketable component of the felled tree is left in the forest.	Government, Forest operators, private sector
		A12.4.3	Establish a system of incentives and penalties to encourage practices to reduce waste.	Government, Forest operators, private sector
		A12.4.4	Whenever feasible, extract forest	Government, Forest

			residues as an additional income source, especially for forest dependent communities.	operators, private sector
		A12.4.5	Consider establishing a framework for consultation and cooperation between forest operators and forest workers on enforcement of regulations and standards relating to working conditions in forests.	Government, forest operators, civil society.
		A12.4.6	In situations of equal qualification and experience, give priority to workers from nearby communities or localities.	Forest operators, private sector
G12.5	Develop capacity at all levels of workforce, including attention to working conditions.	A12.5.1	Ensure forest workers receive adequate training and supervision to ensure proper implementation of the forest management plan.	Forest operator, civil society
		A12.5.2	Practical on-site training modules should be designed and applied as a matter of priority for inventory, felling and skidding crews.	Forest operator, private sector, research/education
		A12.5.3	Increase and maintain the professional skills, work performance and work quality of workers, and develop and maintain an awareness of social and environmental issues.	Forest operator, private sector
		A12.5.4	Recognize and value the knowledge and skills of experienced local people about forest resources (ecology, assessment, management and utilization).	Forest operator, private sector

Principle 13: Economic viability

Capturing the full value of forests and ensuring the equitable distribution of costs and benefits are essential for SFM.

Rationale

Natural tropical production forests need to be managed for more than just timber production, but also for objectives such as supporting local livelihoods, biodiversity conservation, and environmental services, including carbon capture and storage. A key aspect to capture the full value of forests and ensuring the equitable distribution of costs and benefitsinvolves the concept and application of adaptive management. Important for all processes is the availability of financial resources, mechanisms that guarantee that costs and benefits are distributed in fair way amongst all stakeholders that contribute to SFM and that markets are accessible to all types of products and services that are delivered by the forests. The full value of forests include direct use values from timber, fuelwood, NTFP etc.; indirect use values from services, such as water, biodiversity and carbon, option values relating to the willingness to pay to conserve the option of use the forests even that there even though that no current use of it made out of it[8]. The full value of forests does not include only the financial return for the stakeholders that are involved directly and presently, but also

[8]Pierce, D.W. (1991). The Economic Value of Forest Ecosystems. Economic Health 7(4): 284-295

to those that take benefit indirectly and in a foreseeable future. Clear incentive structures need to be defined in order to respect not only the financial return to the immediate stakeholders, but also the economic return to society.

Reliable data and information are important for monitoring and decision-making. Monitoring systems should be designed to be flexible and able to respond to a dynamic context, which can change the scope and objective of monitoring. The monitoring system design must consider the end user and sustainability of the system. Engagement of end users in the design and implementation of the system increases their confidence in the system and ensures its utility (World Bank 2008).

Participatory monitoring[9] can create spaces and opportunities for more inclusive, better-informed decision making in forest management, facilitating community-based decision making and management action. For participatory forest monitoring programs to be sustainable, they must be simple to conduct, inexpensive and locally relevant. Furthermore, participatory monitoring activities should build on existing management institutions (village leaders, forest user group councils), and in turn be institutionalized at the local level (Evans and Guariguata 2008).

Economic instruments. Policies and laws provide incentives and disincentives which affect the behavior and choices of forest operators, users and other stakeholders, including investors. Forest fees and taxes should be considered as incentives to encourage more rational and less wasteful forest utilization and the establishment of an efficient processing industry and to discourage high-grading and logging of natural tropical forests which are marginal for timber production. They should be and remain directly related to the real cost of forest management. Forest fees and taxes may need to be revised at relatively short notice, due to circumstances outside the control of forest operators and the forest agency (e.g. fluctuations in international timber market and currency). The national forest agency should be granted the authority to carry out such revisions.

Guidance for Principle 13

Guidelines		**Recommended Actions**		**Indicative stakeholder group**
G13.1	Develop instruments to support acceptable financial returns for forest use and provide adequate financial compensation for otherwise unpaid ecosystem services and social benefits.	A13.1.1	Develop instruments and incentives including equitable pricing for forest products to support acceptable financial returns for forest use and adequate financial compensation should be provided for otherwise unpaid ecosystem	Government, others.
		A13.1.2	Help forest operators and stakeholders understand the value of the adaptive management process and implement adaptive management approaches to improve financial viability of managing natural tropical forests.	Government, others.
		A13.1.3	A share of the financial benefits accruing from timber harvesting in particular should be considered and used as funds for maintaining the productive capacity of the forest resource	Government, others.
		A13.1.4	For economic viability, take the required reinvestment into account for maintenance of the system and the additional costs due to protection of the forest ecosystem.	Government, others.
		A13.1.5	Intensify national and international	Government, others.

[9]After Evans and Guariguata 2008.

			marketing efforts in order to realize highest possible value of forest products and improve utilization of the resources from sustainably managed forests.	
		A13.1.6	International market transparency should be encouraged and supported by international and regional organisations.	Government, others.
G13.2	Monitor the distribution among the principal stakeholders of the costs and benefits of forest management in order to promote SFM.	A13.2.1	Monitor the distribution of the costs and benefits of forest management among the principal stakeholders to promote SFM.	Government, forest operator, private sector.
		A13.2.2	List any mechanisms for the distribution of incentives among all parties involved in forest management	Government.
		A13.2.3	Explore the opportunity of interested parties to be employed under comparable conditions to those in other sectors	Government.
		A13.2.4	Consider developing effective mechanisms for the resolution of conflicts between interested parties	Government, forest operator, private sector.
		A13.2.5	Consider and develop the ability of forest land or right-holders to receive a fair return for the use of their forest land	forest operator, private sector, civil society
G13.3	Encourage economic instruments to support the establishment of an efficient downstream industry and markets for forest products and the creation of payment mechanisms for ecosystem services.	A13.3.1	Encourage SFM through economic instruments, such as fees, taxes, incentives and bonds, and support the establishment of an efficient downstream industry.	Government.
		A13.3.2	Ensure that there are effective measures in place to encourage forest owners and managers to operate legally and sustainably manage the forest resources.	Government.
		A13.3.3	Encourage smallholders and communities to invest in SFM by providing long-term tenure and user rights, assisting in effective land-use planning and facilitating access to appropriate credit and support.	Government.
		A13.3.4	Secure and clearly defined property rights and land tenure are necessary to secure effective financing for SFM	Government.
		A13.3.5	Create incentives for those that operate responsibly.	Government.
G13.4	Promote efficient markets as a way of encouraging SFM and provide preferential access for	A13.4.1	Promote efficient markets as a way of encouraging SFM and give preferential access to products from sustainably managed natural tropical forests.	Government, forestoperator, others.
		A13.4.2	Support, through adequate policies and, if needed, economic instruments, open access to markets of sustainably produced	Government

	products from sustainably managed natural tropical forests.		products and services from natural tropical forests.	
		A13.4.3	Recognize the potential contribution of independent voluntary certification to SFM.	Government, forestoperator, others.

4.7 IMPLEMENTING SUSTAINABLE FOREST MANAGEMENT PRACTICES

Principle 14: Forest management planning at national/regional level

It is essential to adopt at national level a forest management plan defining objectives and strategies for sustainable use of forest resources and ensuring the maintenance and/or improvement of multiple use and functions of forests.

Rationale

Land use planning at landscape level should balance the developmental needs of a country as a whole, or for specific states or provinces within a country, with those of natural resources conservation, including SFM. A fundamental component of national land use planning is identification of a Permanent Forest Estate (PFE), comprising forests of all ownership types. Traditionally the objective of producing wood was overwhelmingly important. The awareness that forest management decisions and developments in other sectors are closely interconnected recently led to approaches to SFM that require a broader perspective that more closely integrates the management of forests with economic, ecological and social realities. Planning thus tends to gravitate to the landscape level, an area large enough that will be able to be resilient and to keep its ecological integrity. Landscape management is an essential approach for the sustainable management of natural resources, one that requires coordinated inter-institutional action and the effective participation and involvement of diverse stakeholders. The failure to use this approach and the lack of land-use planning has contributed in many countries to processes of landscape degradation and fragmentation.

Research. The complexity of tropical forest ecosystems and the ever increasing demands or expectations on SFM pose serious challenges for forest operators in terms of sound information needed for decision-making on the managerial, economic, environmental and social aspects. In that regard, research plays a key role by continuously informing managers on how to improve planning and actions in the forest to maintain a flow of goods and services (Blaser and Thompson 2010). Research on SFM can be divided into two categories: 1) Research with a practical orientation which aids a field activity and which is intended to provide an answer to a concrete question or a concrete problem; and (2) research with a strategic orientation which aims to benefit the forestry sector as a whole (Bodegom 2000).

Communication, transparency and public awareness. One of the core principles of SFM is that it reflects a diverse range of societal values in reference to forest conservation and use. For this reason, the active and informed participation of communities and stakeholders affected by forest management decisions is critical to the credibility and sustainability of management processes. Public awareness raising and communication activities play a critical role in informing and educating the public, thereby allowing them to more effectively participate in SFM decision-making (CBD 2009). Successful awareness-raising activities must conform to the principles of professional communication, such as honesty and reliability, openness and transparency, fairness and continuity, but also the capacity of listening to the public and taking its concerns seriously. Professional communication and public relations offer a whole array of instruments and methods that can equally be used in awareness raising. The choice of the appropriate instruments depends very much on the context, objectives and characteristics of the awareness-raising process (FAO/ECE/ILO 2003).

Guidance for Principle 14

Guidelines		Recommended Actions		Indicative stakeholder group
G14.1	Develop and implement a national forest management plan.	A14.1.1	Divide the PFE into FMUs of appropriate sizes based on ecological, socio-economic and forestry considerations	Government, civil society, forest operator, private sector, research/education, others.
		A14.1.2	Carrying out land management planning and cadaster geographical areas covered by forests and other land uses.	Government, civil society, forest operator, private sector, research/education, others.
		A14.1.3	Develop a strategic national forest planning and/or regional programmes, focusing on sustainable forest management.	Government, civil society, forest operator, private sector, research/education, others.
		A14.1.4	Clarify the ownership and other tenure rights (e.g. customary or traditional) over the designated forest management area.	Government, forest operator, private sector
		A14.1.5	Clearly and permanently define external boundaries of FMUs and compartments within FMUs.	Government, forest operator, private sector.
G14.2	Support research into the effects of forest management.	A14.2.1	The forest management plan should foresee applied research in support to management operations.	Forest operator, private sector, research/education, others.
		A14.2.2	Seek collaboration or partnerships with research institutions and/or other service providers to conduct relevant applied experiments, in order to find solutions for the technical or operational problems in the field.	Forest operator, research/education, others.
		A14.2.3	Test technological innovations derived from basic and applied forestry research in the FMU.	Forest operator, private sector, research/education
		A14.2.4	A good forest management requires efforts of research and development appropriate to the local circumstances to solve problems respond questions and increase our understanding on how the forest functions, how it reacts to management activities, and how these can be more efficient.	Forest operator, private sector, research/education
		A14.2.5	Promote applied and participatory research to extend and communicate knowledge and experiences on all aspects of implementing SFM.	Government, civil society, forest operator, private sector, research/education, others.

G14.3	Keep the public informed about the state of SFM through clear and open communication and the provision of regular information.	A14.3.1	Build trust and understanding of different stakeholders through communication, education and public awareness (CEPA).	Government, civil society, forest operator, private sector, research/education, others.
		A14.3.2	Prepare and regularly update an informative summary of the forest management plan and the progress with implementation, and disseminate it in regular meetings or consultations with stakeholders as well as through official channels.	Government, civil society, forest operator, private sector, research/education.
G14.4	Monitor progress in the implementation of sustainable forest management.	A14.4.1	Use the ITTO Criteria and Indicators for Sustainable Forest Management to assess ecological impacts due to the introduction of SFM.	Government, civil society, forest operator, private sector, research/education, others.
		A14.4.2	Internalize at the proper decision-making levels the results of monitoring and new scientific findings or technical data, so that these are adequately taken into account to improve forest management.	Government, civil society, forest operator, private sector, research/education, others.
		A.14.4.3	Engage end users in the design and implementation of the monitoring system to increase their confidence in its utility.	Government, civil society, forest operator, private sector
		A.14.4.4	Include among the indicators those of resource condition chosen by local people in order to increase their commitment to both the monitoring, and to consequent management adjustments.	Forest operator, private sector
		A.14.4.5	Consider collaborative relationships or arrangements with research institutions for participating in forest monitoring and related activities.	Forest operator, private sector
		A14.4.6	Assess economic impacts due to the introduction of SFM.	Forest operator, private sector
		A14.4.7	Assess socio-economic and cultural impacts.	Forest operator, private sector
		A14.4.8	Assess policy impacts due to introduction of SFM.	Forest operator, private sector

Principle 15: Forest management planning at FMU level

It is essential to have for the FMU 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.

Rationale

Multi-functional zoning (MFZ) and multi-resource inventory (MRI). Multi-functional zoning is the first step of forest management planning. It identifies the areas the areas where timber and NTFP can be sustainably produced and areas for other functions such as water catchment, social use, biodiversity conservation, flood control, cultural sites, rare ecosystems, etc.). After the forest functions are identified, they are grouped and mapped according to their compatibility with timber production: functions that preclude logging and functions that are compatible with low impact logging. This process is described by Haase and chindele (2005) and is called forest zoning. MRI refers to "data collection efforts designed specifically to meet all or parts of the information requirements for two or more functions, e.g. forest products, wildlife carbon etc. The objective is to collect the needed information at least cost and present it in such a way so it is available and useful to the maximum number of decision-makers" (Lund and Wigton 1996). A first consideration in planning for multi-resource forest inventories is to decide which forest resources or production capabilities to look for, i.e. the assessment of the production possibilities. A second consideration is the assessment of relative economic values of, and of the level of demand for the various resource services of the forest (Bowles and Krutilla 1989). The generally little knowledge available about the resource possibilities and the economic value of mostly non marketed commodities pose difficulties that may be overcome by an incremental, and even experimental approach.

Annual allowable cut (AAC). A prerequisite for SFM is that removal of forest products does not exceed levels of re-growth. In commercial forests where the major product is timber, this means calculating and implementing sustained yields for timber harvests. This requires information which shows stocking levels, and replacement rates (for example, inventory data and growth and yield data) and which can be used as a basis for calculating sustainable harvest levels. In areas where NTFP are harvested, similar inventory data and calculations will be needed, to ensure that harvesting levels remain within the capacity of the forest for replacement (Higman et al. 1999). AAC, a commonly used calculation of the rate of harvest, particularly for timber harvests in natural forest, is defined as the volume of timber which may be cut in one year in a given area. Its calculation is based on the volume of timber in the area which can be harvested, whilst leaving enough stems to provide the next crop. It depends on the standing stock, the growth rate and the size of the forest operation. As a practical measure of the sustained yield for a period, the AAC can be used to monitor forest production and set limits for forest use. Although it is usually quoted as an aggregate figure, for all commercial species, in forest management planning it is often broken down by species/species group and stands or harvesting compartments. The calculation of a sustainable ‘harvest’ for many NTFPs remains problematic, as very little information is currently available on how to estimate the maximum annual harvesting level from the yield for particular non-timber forest plant resources. Thorough understanding of their productivity must be interpreted from ecological and harvesting studies, which involve determining the rates and patterns of variation in recruitment, growth, mortality, and reproduction, and how these patterns relate to environmental and management changes (FAO 2001).

Yield regulation. Yield regulation (or yield allocation) is the practice of calculating and controlling the quantities of forest products removed from the forest each year to ensure that the rate of removal does not exceed the rate of replacement (Higman et al. 1999). The "yield" could be the volume of wood of specific trees, or the wood volume of the whole forest, or it might be non-wood products, or it may be a mix of wood and non-wood products (FAO 1998). The knowledge of forest growth provides a confident basis for the measurement of increment which can be used to derive yields of wood or non-wood forest production and construct *yield tables* and *growth models* (FAO 1998). Preliminary planning is paramount to facilitate harvest operations also in order to make operations safer and more efficient. Being an essential component of RIL, harvest planning involves annual harvest estimates based on stand potential in designated harvest areas. It follows the harvest cycle and can cover one or more harvesting blocks or compartments. The planning is normally one to two years before harvesting and generally produces a document on scheduled operations, actions to be taken, means to be employed and a detailed map (1:5 000 or 1:10 000) of the areas to be harvested (FAO 2004).

Forest Management Planning. At FMU level, management plans are of three types: Forest Management Plan, Working Plan, and Annual Operations Plan. The three types are an integral part of the forest management planning process.

Silvicultural system. Silviculture is essentially about decision-making on how to treat or manipulate forest stands in order to achieve stand management objectives (Kleine 1997). Silviculture includes all operations that are done between one harvest and the next, such as planting, thinning, pruning, weeding or poison girdling (see Box 5). Harvesting operations themselves are a major silvicultural treatment (Higman et al. 1999). The choice of a silvicultural system is determined by the ecological characteristics of a forest for which sustainable management is being planned (e.g. forest type, site conditions, current species composition, regeneration status of desirable species etc.) and by the management goal and objectives for a specific forest management unit (FAO 1998). But silviculture also requires moving towards a more comprehensive ecosystem management with adequate consideration of the socio-economic (such as labor and inputs available for management, the end-products and services required, including current and foreseeable demands) and institutional/ regulatory environment.

In forest managed for timber production, silvicultural interventions are generally necessary to overcome the relative depletion of commercial tree species, to compensate for the slow growth rate, and to ensure a future commercial timber value of the forest. Options that can be applied, depending on the condition of the forest stand and the objectives (what major products are expected), include improvement treatments, treatments to stimulate natural regeneration, enrichment planting, and direct planting (Sabogal and Nasi 2005). To guide decisions on silvicultural intervention a simple assessment method called *diagnostic sampling* can be used. This is a rapid and inexpensive field sampling method intended to estimate the potential productivity of a forest stand and decide whether treatment is necessary or not, and if necessary, whether it can be delayed or not, and what type of treatment should be given. Silvicultural decisions on the type of interventions needed may also be based upon the conclusions of studies that have been made to gain a better understanding of forest ecology problems which are considered to be barriers to the effective practice of silviculture (FAO 1998).

Box 5. Silvicultural systems, treatment régimes and operations (source: Kleine, 1997)
The silvicultural decisions can occur at three levels: silvicultural systems, silvicultural treatment regimes, and silvicultural operations. A silvicultural system may be defined as the process by which the crops constituting a forest are tended, removed and replaced by new crops resulting in the production of stands of distinctive form" (Matthews 1994). A silvicultural treatment may be defined as a planned programme of silvicultural operations that can be implemented during the entire or partial rotation of a stand. Within the context of silvicultural stand treatment, each stand is assigned a specific silvicultural objective and separately assessed for its size (e.g., locality, slope, soil type) and stocking conditions (e.g., composition, age, diameter distribution, regeneration). Based on this information, a treatment regime is formulated.Silvicultural operations are procedures that aim to achieve the stand-specific objectives by using specific silvicultural techniques. Such techniques may refer to canopy alterations to induce natural regeneration, harvesting of mature trees, planting, or thinning etc to improve timber quality and stand growth. Decisions at this level are related to operational aspects such as methods, work organization, machinery and equipment, manpower and skills as well as operational costs and investment requirements.

Model Code of Forest Harvesting Practice. Efficiency and sustainability of forest management depend to a large extent on the quality of harvesting operations. Inadequately executed harvesting operations can have far-reaching negative impacts on the environment (such as erosion, pollution, habitat disruption and reduction of biological diversity), may jeopardize the implementation of the silvicultural concept, and increase health risks for field personnel. With regard to harvesting, (FAO 1996) provides recommendations for developing strategic and tactical harvest plans, as well as guiding principles and recommended practices for implementing harvesting operations, including detailed explanations on forest road engineering, cutting, extraction, landing and transport operations, harvesting assessment, and the forest harvesting workforce. Recommendations include practices for harvest inventories, road planning and construction; and planning and layout of secondary road

network, skid trails and landings. A map and a written plan are the basic components for both strategic and tactical harvest planning[10].

Reduced Impact Logging (RIL). Improved logging procedures and techniques are collectively referred as *Reduced Impact Logging* (RIL). The application of RIL pursues two goals: to harvest marketable trees as economically and safely as possible, and to achieve desirable characteristics of the residual forest as they derive from ecological and, to a certain extent, social requirements (TFF 2007). RIL can be defined as timber harvest technologies and practices with the following main objectives (TFF 2007):

- minimize impact on the environment (including wildlife) and related social aspects;
- minimize damage to potential future crop trees (including regeneration);
- providesafeworking conditions, and
- improve timber utilization and recovery of the forest.

RIL comprises the entire spectrum of harvesting operations from pre-harvest inventory, selection of merchantable trees and design of infrastructure to felling, extraction and hauling of logs, and finally post-harvest operations and assessments (see details in FAO 1996 and Applegate et al. 2004).
Deactivation of harvested areas as well as rehabilitation of harvested areas can serve as measures aiming to reduce erosion and sedimentation, to maintain/increase vegetation diversity for wildlife conservation purposes, and to safeguard against unauthorized activities.
A*harvesting assessment* is a systematic check made in the field during or following harvesting to determine the degree to which the operation is or has followed a harvesting plan and has complied with its objectives. It provides information about the quality of operations, including the volumes cut and the condition of a forest following harvesting. Harvesting assessments may be undertaken while the operation is still under way (*in-process assessment*) or after its completion (*post-harvest assessment*) (FAO 1996, 1998).

Monitoring. Monitoring the implementation of activities set out in an approved forest management plan is fundamental to SFM and forms the basis for transparent accountability of operational activities. Monitoring at the FMU should be addressed at two levels: operational and strategic. Operational monitoring should provide information on whether appropriate procedures are being followed and management objectives are being met. Strategic monitoring should provide data about the long-term effects of the forestry operation, so that potential problems can be rapidly identified and resolved (Higman et al. 1999). One possible approach to monitoring involves making comparisons between physical achievements and targets as set in the forest management plan and between financial expenditure and budgets at the end of specified time periods (for example, at three- or six-monthly intervals) – this is the so-called periodic monitoring. Another approach is to monitor specified key indicators continuously (continuous monitoring), which enables information on the progress of plan implementation to be collected more frequently, such as at weekly intervals, thus allowing a close control over forest operations (FAO 1998).

Post-harvest assessment. Post-harvest measures should be undertaken as required, such as the deactivation of harvested areas, erosion mitigation, and the rehabilitation of high-impact areas. Deactivation of harvested areas as well as rehabilitation of harvested areas can serve as measures aiming to reduce erosion and sedimentation, to maintain/increase vegetation diversity for wildlife conservation purposes, and to safeguard against unauthorized activities. The quality of harvesting operations should be assessed and the need for corrective actions or measures determined. A harvesting assessment is a systematic check made in the field during or following harvesting to determine the degree to which the operation is or has followed a harvesting plan and has complied with its objectives. It provides information about the quality of operations, including the volumes cut and the condition of a forest following harvesting. Harvesting assessments may be undertaken while the operation is still under way (in-process assessment) or after its completion (post-harvest assessment) (FAO 1996, 1998). Harvestingassessmentsshould look at items such as:

- Location, condition of roads, landings and skid trails
- Extent (in percentage) of the operating area disturbed by roads, landings, skid trails and cable corridors

[10]For detailed information on the content of these harvesting maps, see FAO (1996) and FAO (1998).

- Condition of buffer strips and water courses
- Stump heights and any usable logs left in the forest
- Trees marked for felling but not felled
- Trees marked for retention but were felled or otherwise destroyed or damaged
- Areas in need of rehabilitation
- Type and condition of equipment, and qualification of operators
- Availability, suitability and actual use of protective equipment.

Guidance for Principle 15

Guidelines		Recommended Actions		Indicative stakeholder group
G15.1	Conduct preliminary FMU management studies.	A15.1.1	Carry out preliminary studies in the FMU on socio-economic, environmental, biodiversity aspects for the elaboration of the management plan.	Forest operator, private sector
		A15.1.2	Create a GIS database to keep the information from the preliminary studies, which can be used to prepare forest zoning maps.	Forest operator, private sector
		A15.1.3	Based on air photographs or satellite imagery, identification and map different vegetation types of plant formations covering the FMU.	Forest operator, private sector
G15.2	Conduct a multi-resourceforest management inventory.	A15.2.1	Conduct a multi-resource forest inventory in order to collect statistical data on timber and NTFPs, natural regeneration, fauna, flora, soil, hydrology, human activities, areas with high biodiversity, scientific or historical value, etc.	Forest operator, private sector
		A15.2.2	Integrated forest resource inventory and forest zoning by forest functions, taking into account traditional rights.	Forest operator, private sector
		A15.2.3	Incorporate wildlife conservation areas in FMU mapping as an integral part of sustainable forest management.	Forest operator, private sector
		A15.2.4	Carry out an analysis of management scenarios in accordance with the national legislation/policies, strategies and plans based on inventory data.	Forest operator, private sector
		A15.2.5	Develop a clear understanding of values and goals and establish clear long term and medium term management objectives taking into account the trade-offs needed.	Forest operator, private sector
G15.3	Define management objectives for	A15.3.1	Forest management objectives and the means of achieving them should be defined in a forest	Forest operator, private sector

	individual resources (timber, NTFPs, biodiversity, environmental services, etc.).		management plan or equivalent document.	
		A15.3.2	Involve as far as possible all stakeholders through a participatory process in the definition of management objectives should,	Forest operator, private sector
		A15.3.3	Start defining preliminary objectives, adjusting them as new information becomes available from the planning process.	Forest operator, private sector
		A15.3.4	In selecting management objectives consider all potential range of goods and services from the FMU	Forest operator, private sector
G15.4	Use a reliable method for regulating and controlling yield to ensure the sustainable production of timber and other forest products and services in the FMU.	A15.4.1	Determine the minimum cutting diameter per species or species group and the cutting cycle.	Forest operator, private sector
		A15.4.2	Carry out sustainable yield analysis, with spatial allocation of yield based on the variation of the forest mosaic and taking into account multiple use constraints, buffer zones, species and minimum cutting diameter limits.	Forest operator, private sector
		A15.4.3	Determine the AAC based on the minimum cutting diameter for each species or species group.	Forest operator, private sector
		A15.4.4	Division of the FMU into blocks or compartments and definition of annual cutting areas and volumes are essential for the practical control of the harvest level.	Forest operator, private sector
		A15.4.5	Close-off the block or compartment after harvesting until the next felling cycle.	Forest operator, private sector
		A15.4.6	Maintain records of production levels of wood and non-wood forest products for each block or compartment harvested.	Forest operator, private sector
G15.5	Carry out pre-harvest inventory.	A15.5.1	Undertake systematic pre-harvest inventory of the timber	Forest operator, private sector
G15.6	Plan harvest to enable good technical control, minimize costs, and reduce environmental impacts.	A15.6.1	Formulate RIL Guidelines	Forest operator, private sector
		A15.6.2	Implement RIL Guidelines	Forest operator, private sector
		A15.6.3	Develop and implement documented procedures to ensure that harvesting operations are carried out to the highest standards.	Forest operator, private sector
		A15.6.4	Make and implement arrangements for effective training of all personnel involved in harvesting operations (managers, supervisors, operators, workers).	Forest operator, private sector

		A15.6.5	Locate and demarcate non-harvest areas that have to be excluded and protected from harvesting in order to reduce negative impact on local populations, resources and the ecosystem.	Forest operator, private sector
		A15.6.6	Use machinery and equipment that are appropriate for RIL.	Forest operator, private sector
		A15.6.7	Properly design and construct forest roads and layout skid trails according to environmentally sound practices	Forest operator, private sector
		A15.6.8	Design and implement forest harvesting operations in ways that accommodate and enhance the multi-resource character of the forest.	Forest operator, private sector
		A15.6.9	In planning and implementing forest harvesting practices, aim to conserve as wide a range of species as possible.	Forest operator, private sector
G15.7	Put the FMU under a management Plan.	G15.7.1	Write, implement and keep up-to-date a forest management plan appropriate to the scale and intensity of the operations.	Forest operator, private sector
G15.8	Select the silvicultural systems to be applied.	A15.8.1	Use diagnostic sampling as a tool for determining stocking and regeneration targets.	Forest operator, private sector
		A15.8.2	Consider the likely impact that the chosen silvicultural system or treatment régime might have on the sustainable production of NTFPs.	Forest operator, private sector
		A15.8.3	Document and justify the silvicultural system in the forest management plan to ensure that all levels of management understand what they are doing and why.	Forest operator, private sector
		A15.8.4	Consider how the implementation of a silvicultural system might have an effect on: growth rates of harvestable species, forest services such as watershed protection, recreation or aesthetic value; biodiversity and wildlife; ecological processes, seed production; regeneration, social acceptability.	Forest operator, private sector
G15.9	Provide specific prescriptions for silvicultural interventions in the FMU's management plan.	A15.9.1	Use simple silvicultural practices that will produce faster results and also tend to reduce costs and labor requirements and facilitate the participatory process.	Forest operator, private sector
		A15.9.2	Combine silviculture with the main harvesting operation.	Forest operator, private sector
		A15.9.3	Apply cautiously silvicultural	Forest operator,

			treatments to address specific objectives.	private sector
		A15.9.4	Apply silvicultural treatments within one or two years of harvesting, before regrowth makes movement difficult.	Forest operator, private sector
		A15.9.5	Use the first silvicultural interventions to target the advanced regeneration of current and potential commercial or useful tree species.	Forest operator, private sector
		A15.9.6	Assure protection of exclusion areas for conservation of biodiversity in intensive silvicultural systems, where biodiversity is reduced	Forest operator, private sector
		A15.9.7	Prefer the use of indigenous species with proven commercial value for enrichment planting in harvested natural forests.	Forest operator, private sector
G15.10	Incorporate wildlife concerns into FMPs.	A15.10.1	Integrate wildlife management in the FMU management plan.	Forest operator, private sector
		A15.10.2	Carry out an initial survey of forest animal resources where no information on those resources exists.	Forest operator, private sector
		A15.10.3	Include wildlife in routine forest inventories of the forest under management. The results can provide important recommendations for managers and help limit the negative impacts of logging activities on wildlife	Forest operator, private sector
G15.11	Take into account in the FMP the potential for generating income from the ecosystem services provided by the FMU.	A15.11.1	Identify and describe the ecosystem service(s) of interest that could be part of the management objectives for the FMU, based on forest zoning, the resource assessments, and consultations with the local population and relevant stakeholders.	Forest operator, private sector
		A15.11.2	Analyze the economic opportunities for providing environmental services at the FMU, and include them in the FMP if suitable.	Forest operator, private sector
		A15.11.3	Whenever appropriate, provide details in the FMP on activities to maintain and/or restore the ES of interest, including specifications for compliance, monitoring and evaluation.	Forest operator, private sector
		A15.11.4	Use tools prepared under the CBD (2008) to provide useful support to defining and valuing forest ES.	Forest operator, private sector
G15.12	Develop FMU	A15.12.1	Write a working plan to address	Forest operator,

	Working Plan revised every 5 years, to implement the FMP.		activities during specific periods of 5 years in greater detail than in the management plan, including the specification of silvicultural system to be applied, the road network and other infrastructures, the extraction methods and equipment, fire control, hunting, monitoring and control measures, description of data management and reporting.	private sector
		A15.12.2	Establish the administrative capacity and provide necessary resources to implement the FMU management plan	Forest operator, private sector
G15.13	Plan harvesting to enable good technical control, minimize harvesting costs and reduce environmental impacts.	A15.13.1	Conduct a pre-harvesting inventory in areas about to be harvested to provide information that facilitates the planning and control of an efficient harvesting operation.	Forest operator, private sector
		A15.13.2	Develop and implement documented procedures to ensure that harvesting operations are carried out to the highest standards.	Forest operator, private sector
		A15.13.3	Make and implement arrangements for effective training of all personnel involved in harvesting operations.	Forest operator, private sector
		A15.13.4	Provide safe and healthy working conditions for all personnel according to international occupational health and safety standards.	Forest operator, private sector
		A15.13.5	Locate and demarcate non-harvest areas that have to be excluded and protected from harvesting in order to reduce negative impact on local populations, resources and the ecosystem.	Forest operator, private sector
		A15.13.6	Use machinery and equipment that are appropriate for RIL.	Forest operator, private sector
		A15.13.7	Properly design and construct forest roads and layout skid trails according to environmentally sound practices	Forest operator, private sector
		A15.13.8	Design and implement forest harvesting operations in ways that accommodate and enhance the multi-resource character of the forest.	Forest operator, private sector
		A15.13.9	In planning and implementing forest harvesting practices, conserve as wide a range of species as possible. In particular, endangered plant and animal species need to be protected.	Forest operator, private sector

G15.14	Include in the Working Plan Guidance for post-harvest assessment and measures.	A15.14.1	Conduct post-harvest inspection and evaluation.	Forest operator, private sector
		A15.14.2	Conduct harvesting assessments not later than two years after the end of the operation so that any corrective action needed can be initiated in a timely fashion.	Forest operator, private sector
		A15.14.3	Carry out harvesting assessments by qualified planning and supervisory staff.	Forest operator, private sector
		A15.14.4	All debris from harvesting operations should be removed from buffer zones and banks.	
		A15.14.5	All obstacles blocking water-flow under bridges e.g. culverts or box drains should be removed.	Forest operator, private sector
		A15.14.6	Develop and implement instructions for deactivating landings, skid trails and roads no longer required for forest management after finishing an annual compartment or felling coupe.	Forest operator, private sector
		A15.14.7	After harvesting, close all roads to traffic until the next rotation.	Forest operator, private sector
		A15.14.8	Reforest landings and roads, where these will not be used in future harvest cycles.	Forest operator, private sector
G15.15	Prepare each year an annual operational plans (AOP) scheduling and specifying all activities and resources required.	A15.15.1	Including in the AOP silvicultural interventions in accordance with the management objectives.	Forest operator, private sector
		A15.15.2	Carry out silvicultural planning and treatment based on post-harvest assessment data.	Forest operator
G15.16	Monitor the implementation of the Management plan	A.15.16.1	Monitor all operations being carried out under the FMU management plan.	Government, forest operator, civil society
		A.15.16.2	Internalize at the proper decision-making levels the FMU the results of monitoring and new scientific findings or technical data, so that these are adequately taken into account to improve forest management.	Forest operator, private sector
G15.17	Use the information from monitoring for regular reporting.	A15.17.1	Prepare and maintain permanent records of forest operations.	Forest operator, private sector
		A15.17.2	Report at least monthly, weekly or even daily in the case of log harvesting where close control of output, location of logging and trees being cut should be followed closely.	Forest operator, private sector

Principle 16: Adaptive management

Recognize the importance of implementing an adaptive management process and framework that provides for change at the appropriate planning level and in a timely manner, and the participation of stakeholders in the process for dealing with changes in policies and practices when needed.

Rationale

A key aspect of SFM involves the concept and application of adaptive management, or learning by doing (Holling 1977). Adaptive management involves the use of science (research results) to support best practices, planning, monitoring results against expected outcomes and then adapting the practices to improve outcomes based on the original expectations (Blaser and Thompson 2010). Management should be responsive and adaptable to changing knowledge and needs (FAO 1998). Even the most carefully planned arrangements should be modified as new information becomes available and good management requires early recognition of the need for modification. Adequate and timely information has thus a significant impact on decision-making. Effective forest management planning and monitoring requires multiple forms of knowledge. In this regard, it is important to consider and link both the scientific as well as the traditional knowledge for practical forest management implementation. Existing local knowledge, experiences and capacities (for instance, to stratify and classify local forest types, on the uses of tree species or in relation to tending practices) can enrich and improve forest management, broadening the benefits obtained (CIFOR 2007).

Guidance for Principle 16

Guidelines		Recommended Actions		Indicative stakeholder group
G16.1	Manage the FMU using an adaptive learning approach that effectively supports decision-making in the planning, implementation, evaluation and modification of forest activities.	A16.1.1	Institutionalize the adaptive management process so that it is used routinely and systematically in the forest management cycle.	Government, forest operator, private sector, civil society, research/education, others
		A16.1.2	Have a mechanism in place for the periodic collection and use of information in the amount, type and quality needed for the forest management decision making process.	Government, forest operator, private sector, civil society, research/education, others
		A16.1.3	Recognize the knowledge and skills of experienced local people and link traditional forest-related knowledge and practices in forest management planning and implementation.	Forest operator, private sector, civil society, research/education, others
		A16.1.4	Support (applied) research to guide and inform adaptive management.	Forest operator, private sector, civil society, research/education, others

GLOSSARY

Adaptive management. It 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.

Allowable cut. Total volume of commercial timber that may be harvested from an FMU during the planning period.

Annual allowable cut. Allowable cut in an FMU expressed on annual basis.

Best practices. Methods, processes, incentives, systems, or policies that have been demonstrated to achieve superior results within an area of work.

Biological Diversity / Biodiversity. The variability among living organisms from all sources, including *inter alia* terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are a part: this includes diversity within species, between species, and of ecosystems. (Convention on Biological Diversity, Article 2)

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.

Criterion.A category of conditions or processes by which sustainable forest management may be assessed.

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

Degraded forest.A forest that delivers a reduced supply of goods and services from a given site and maintains only limited biological diversity. It has lost the structure, function, species composition and/or productivity normally associated with the natural forest type expected at that site.(see also forest degradation).

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

Environmental services. They refer[11] to qualitative functions of natural non-produced assets of land, water and air (including related ecosystem) and their biota. There are three basic types of environmental services: (a) disposal services which reflect the functions of the natural environment as an absorptive sink for residuals; (b) productive services which reflect the economic functions of providing natural resource inputs and space for production and consumption, and (c) consumer or consumption services which provide for physiological as well as recreational and related needs of human beings.

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 function mapping. Process to classify forest areas according to defined functions based on spatial, topographical, floral and faunal information (The functions that need that need to be mapped are only those which require restrictions in forest management activities).

Forest zoning. Classification of an area into productive, restrictive and protective zones based on determined functions.

Forest management unit.A clearly defined forest area, managed to a set of explicit objectives according to a long-term management plan. The FMU might be a large continuous forest concession or community forest or a group of small forestry operations, possibly with different ownership. The important element is the common system of management.

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

[1111]See http://stats.oecd.org/glossary/detail.asp?ID=843

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.

Guidelines. Evidence-based advisory statements which are intended to assist decision-makers, forest operators and other stakeholders to make informed decisions about appropriate forest management decision or intervention.

High conservation value forests. Areas of forest that need to be appropriately managed in order to maintain or enhance the identified high conservation values. A High Conservation Value Forest may be a small part of a larger forest, for example a riparian zone protecting a stream that is the sole supply of drinking water to a community or a small patch of a rare ecosystem (Jennings, S., Nussbaum, R., Judd, N. and Evans, T. 2003).

Invasive species.Any species not native to a particular ecosystem whose introduction causes or is likely to cause economic or environmental harm or harm to human health.

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.

Principles. The overall rules, goals, and responsibilities that guide the planning and decision making process.

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.

Resilience (ecological). The capacity of a community or ecosystem to maintain or regain the desired condition of diversity, integrity, and ecological processes following disturbance.

(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.

Recommended actions. Measures which are suggested for implementing respective guidelines.

Stepping stones. These are small patches of forests that are close enough to one another to allowing for species movement between large patches in fragmented landscapes.

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. Forest tenure is the combination of legally or customarily defined forest ownership rights and arrangements for the management and use of forest resources. Forest tenure determines who can use what resource, for how long and under what conditions.

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

Yield. Clear stem standing volume of timber of commercial species estimated on the basis of trees with a diameter above the minimum cutting diameter.

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