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LATIN AMERICA AND THE CARIBBEAN

BOLIVIA

Forest resources

The landlocked country of Bolivia has a land area of 110 million hectares and an estimated population in 2010 of 10.4 million people (United Nations Population Division 2010). It is ranked 113th out of 182 countries in UNDP's Human Development Index (UNDP 2009). Bolivia has the following broad biogeographical zones: the high-altitude, unforested *altiplano* (highlands in the Andean mountain zone), with peaks exceeding 6000 m; *los yungas* and *los valles,* which include the valleys on the eastern flank of the Andes; and the tropical lowlands of Amazonia (*el oriente*), containing moist tropical forests in the northeastern part and subtropical plains in the southeast (*El Chaco*). About half the country – mainly in the northern and eastern lowlands – is less than 500 m above sea level. Bolivia has the sixth-largest area of tropical rainforests in the world and the 15th-largest forest area. FAO (2010a) estimated the total forest area at 57.2 million hectares, while the Government of Bolivia (2009, citing Olguin 2009) estimated it at 52.4 million hectares.

Forest types. Few countries have as great a diversity of ecosystems as Bolivia; the major biomes are tropical forests, including tropical humid forests and semi-humid forests; mountain forests and high Andean grassland plains; savannas; and wetlands.[a] The tropical forests of Bolivia lie in the departments of Beni, Pando, Santa Cruz, La Paz (the northern part thereof) and (northwestern) Cochabamba. There are twelve tropical forest types, which are rich in timber species such as *Swietenia macrophylla* (mara), *Hura crepitans* (ochoó), *Calophyllum* spp (palo maría) and rubber, as well as NTFPs such as *Bertholletia excelsa* (Brazil nut). The semi-humid forest, the *Chiquitania*, is located mainly in the department of Santa Cruz and is characterized by species such as *Astronium urundeuva* (cuchi) and *Tabebuia* spp (tajibo). Sub-Andean and Andean forests cover the western flank of the Andean chain at altitudes between 400 and 3500 m. These are characterized by Lauraceae and Meliaceae up to 900 m, by walnut–pine forests (*Juglans australis* and *Podocarpus* spp) between 1200 m and 1700 m and, beyond that up to 2700 m, by *Alnus acuminata* (aliso) (ITTO 2006).

Permanent forest estate. Land-use plans covering agriculture, forests and other land uses exist for about 76.5 million hectares of the country (ITTO 2006). Under Decree DS 26075 (February 2001) about 41.2 million hectares of forest have been declared as lands for permanent forest production (i.e. PFE); nevertheless, these forests are under pressure and at least three million hectares have already been converted to agriculture.[a] The area classified as production PFE comprises several tenure regimes: Indigenous lands, individual landholdings, public forests under concessions (including concessions assigned to local social groups – *agrupaciones sociales del lugar* – ASLs; see below), and public forestlands without classification. Of the 41.2 million hectares of the nominal PFE, 28.1 million hectares are classified for sustainable forest production without restrictions, 2.4 million hectares are classified as potentially productive but reserved for recreational or other non-timber use, and the remaining 10.7 million hectares are classified as legally protected areas (Table 1 shows these figures net of the 3 million hectares converted to agriculture).

Forest ecosystem health

Deforestation and forest degradation. FAO (2010b) estimated the annual forest-cover change between 2000 and 2005 at 270 000 hectares, or 0.5% per year, which is considerably higher

Table 1 Permanent forest estate

Reporting Year	Estimated total forest area, range (million ha)	Total closed natural forest ('000 ha)	PFE ('000 hectares)			
			Production		Protection	Total
			Natural	Planted		
2005*	52.2–59.5	47 999	17 000	60	14 700	31 760
2010	**52.4–58.7**	**36 700****	**25 100‡**	**73**	**13 100†**	**38 273**

* *As reported in ITTO (2006).*

** *Calculated using the ratio of forest with greater than 60% forest cover estimated by UNEP-WCMC (2010) (64.1%) and the total natural forest area as estimated by FAO (2010a) (57.2 million hectares).*

‡ *The nominal area is 28.1 million hectares, but at least 3 million hectares have been deforested and converted to agricultural uses. In the PFE, non-forested areas can only be counted as forest if there is a strong intention to reforest.*

† *Based on an estimate by UNEP-WCMC (2010) of IUCN protected-area categories I–IV.*

than the estimated deforestation for the period 1990–2000 of 161 000 hectares per year (ibid.). The Government of Bolivia (2009) estimated that over 300 000 hectares of forest are currently being lost per year as a result of an expanding agriculture/livestock frontier; fire; infrastructure projects (e.g. roads, dams and energy infrastructure); mining; and an expansion of coca production. Illegal logging is one of the main causes of forest degradation in lowland forests. Fuelwood extraction has degraded forest fringes, especially in mountainous areas and dry forests. Accumulated deforestation in Bolivia is about 6 million hectares, of which about 3 million occurred in the last decade, about 80% of it illegally (Government of Bolivia 2008). Approximately 82% of deforestation occurs in the north and east of Santa Cruz as a result of agro-industry development (biofuels, sugarcane and soy), while deforestation around Cobija in Pando and Riberalta in Beni and in northern La Paz tends to be a result of small-scale shifting cultivation (ibid.). Legal, policy and institutional weaknesses stimulate deforestation and promote forest degradation, exacerbated by the politicization of forestry institutions and a lack of innovative approaches that promote forest management over clearing (ibid.). Road development plans in the Amazon could further increase the rate of colonization and lead to significant deforestation and forest degradation (ibid.).

Table 2 shows the estimated area of primary forest, degraded primary forest and secondary forest; no in-depth assessment of forest condition has yet been made, however.

Vulnerability of forests to climate change. The effects of climate change can be observed in an increase of extreme events like droughts and floods, the retreat of glaciers (by more than 60% in some cases) and higher levels of vulnerability in natural ecosystems, water resources, food security, health and infrastructure (Government of Bolivia 2008). Taking into account Bolivia's topography, climate change could potentially cause major alterations in the geographical and altitudinal distribution of forest species and ecosystems. In parallel, poverty related to environmental degradation and an increase in the vulnerability of marginalized communities increase pressure on forest resources, resulting in further deforestation and environmental degradation, particularly in the more populated mountainous areas.

SFM policy framework

Forest tenure. A portion of forests are publicly owned and others are in lands that have been granted under both private individual landholdings and collective rights for Indigenous people and agro-extractive communities. Yet available data on forest tenure reform are confusing. ITTO and

Table 2 Forest condition

	PFE	Non-PFE	Total
	'000 ha		
Area of primary forest	-	-	38 200
Area of degraded primary forest	-	-	10 000
Area of secondary forest	-	-	-
Area of degraded forest land	-	-	3000

Source: Government of Bolivia (2009).

RRI (2009) estimated the extent of government-administered forests at 22.9 million hectares (but did not provide clear criteria for these estimates). Using official sources, Pacheco (2008) estimated the publicly owned PFE at 16 million hectares, comprising forest classified as protected areas (9 million hectares), forests granted as concessions to either timber companies (4.8 million hectares) or ASLs (0.7 million hectares), and forest reserves to be granted as non-timber forest concessions (1.3 million hectares) (Table 3). These numbers are indicative only, since the area of forest concessions declined recently and the process for the allocation of non-timber forest concessions has been delayed. A portion of the PFE has being encroached illegally (P. Pacheco, pers. comm., 2010).

The area of forest that has formally been granted to individual and collective landholders has grown over time, and there is an ongoing process of land titling. It is unclear how much forest is in private hands because official data were unavailable for this report. Using data from the land regularization process, Pacheco (2008) estimated that at least 4 million hectares of forests were in the hands of medium- and large-scale landholders, although this could be much higher if informally encroached public forests are taken into account.

The forestland controlled by smallholders is estimated at about 2.6 million hectares, while the total land under colonization in the lowlands is about 3.8 million hectares (ibid.). The area of forest in the hands of communities, mainly Indigenous groups, has also grown over time due to the formalization of Indigenous community lands (*tierras comunitarias de origen* – TCOs).

About 20 million hectares have been claimed by Indigenous groups, but the titling of these lands is conditional on a process of verification of needs and the rights of other landholders. The titling process has been relatively slow and bureaucratic, although it has accelerated under the current administration. Currently, about 11.4 million hectares of land have formally been granted to Indigenous people (National Institute for Agrarian Reform 2010), not all of which is forested. Taking into account all the Indigenous land claims admitted by the state, Pacheco (2008) estimated that 8.7 million hectares of forests were controlled by Indigenous people. The creation of TCOs has a potentially positive effect in bringing together Indigenous communities with private commercial actors in the forest sector. The National Law 3760 (2007) adopted the United Nations Declaration on the Rights of Indigenous Peoples, with the likely effect of strengthening local forest ownership. Nevertheless, despite efforts to clarify access to and ownership of forest resources, there are still frequent land invasions and illegal logging in Indigenous territories, legal forest concessions and forest protected areas, jeopardizing efforts to achieve SFM.[a] Table 3 summarizes estimates of tenure in the PFE.

Criteria and indicators. In 1995, Bolivia adopted the Tarapoto Proposal of C&I for the sustainability of the Amazon forest, which was sponsored by the

Table 3 Forest area, by tenure

Ownership category	Total area	Of which PFE	Notes
	'000 ha		
State ownership (national, state or provincial government)	-	15 293	Includes forests granted as concessions to timber companies and ASLs, barracas* and protected forests.
Other public entities (e.g. municipalities, villages)	-	681	Correspond to municipal forest reserves granted to ASLs.
Total public	**-**	**15 974**	
Owned by local communities and/or Indigenous groups	-	11 406	Includes forestlands under admitted TCOs, and forestlands occupied by smallholder colonists.
Private owned by firms, individuals, other corporate	-	4000	Includes only titled land in favour of medium- and large-scale landholders, and does not include the amount of PFE that has been informally encroached.

* Barracas *are areas of forest held by a person or family under locally recognized exclusive rights to harvest rubber or Brazil nuts. Between 1930 and the mid 1980s both Brazil nut and rubber extraction coincided and* barraca *owners held labourers under a feudal dependency living permanently on the estate. The area of* barracas *declined from 3.5 million hectares at its peak to less than 1.8 million hectares in 2005 (de Jong et al. 2006).*

Source: ITTO estimate based on Pacheco (2008).

Riverine vegetation, Tambopata Transboundary Conservation Area, Bolivia. © *H. Castro / Conservation International*

Amazon Cooperation Treaty Organization. The Government of Bolivia used the ITTO C&I in its submission to ITTO for this report.[a]

Forest policy and legislation. The Bolivian Constitution (*Constitución Política del Estado – CPE*), adopted in 2009, has created a new legislative framework in Bolivia. The CPE restates the key role that natural forests play in the development of Bolivia (CPE Article 386) and confirms the provisions for SFM and forest conservation made in the Forest Law 1700 (1996; CPE articles 38 and 299). On the basis of the CPE and the result of a recently conducted national assessment of forest policy and law implementation, Bolivia is reviewing the Forest Law with the aim of expanding the scope beyond timber to integrated forest management.[a] Law 3525 of November 2006 regulates the production and use of NTFPs. Regulations were put in place in 2008 to implement the National Forest Development Fund (*Fondo Nacional de Dessarrollo Forestal* – FONABOSQUE), which was designed to promote SFM. Supreme Decree 29643 (2008) established norms and incentives to support forest management for both timber and NTFPs by rural and Indigenous communities through community forestry organizations.[a]

The current forest policy is driven by the broader national development plan for 2006–2011 entitled *Bolivia Digna, Soberana, Productiva y Democratica para Vivir Bien*. This plan recognizes that natural resources play an important role in the country's development. Hydrocarbons, minerals, hydropower and renewable biological resources (i.e. biodiversity and forests) are considered to be the four pillars of economic development. A more specific forest development plan (*Plan para la Revolución Rural, Agraria y Forestal*) was produced in 2007. A national policy for the integrated management of forests (*Politica Nacional para la Gestión Integral de los Bosques*) was announced in 2008, along with a national plan for integrated forest management, the latter of which is being pilot-tested in the northern part of the Bolivian Amazon.[a] In March 2010, the National Forest and Reforestation Program (*Programa Nacional de Forestación y Reforestación*) was installed through Presidential decree (BO-DS-N443) with the aim of contributing to biodiversity protection, forest restoration, SFM, the reduction of deforestation and the creation of new forests. Also in 2010, the National Strategy on Forest and Climate Change was produced with the aim of promoting integrated forest management as a framework for forest-related initiatives to address

climate-change adaptation and mitigation. These recent documents will also help the process of reformulating Forest Law 1700.

Institutions involved in forests. The Department of Environment, Biodiversity, Climate Change and Forest Management and Development, under the Ministry of Environment and Water, has overall responsibility for forest administration at the national level. The General Directorate of Forests (*Dirección General Forestal*) within the Department of Environment, Biodiversity, Climate Change and Forest Management and Development is responsible for the implementation, monitoring and evaluation of forest management and conservation, in close coordination with departments, prefectures (*prefecturas*) and municipalities (*municipíos*). The Forestry Superintendency (*Superintendencia Forestal*), which was the regulating body in 2005 (ITTO 2006), was replaced in 2009 by the Authority for the Social Monitoring and Control of Forests and Lands (*Autoridad de Fiscalización y Control Social de Bosques y Tierras* – ABT), which develops programs for the control, monitoring and supervision of the use of forest and land resources; issues permits for forest exploitation; and guarantees the sustainable management of forests according to the law. However, the transition from the Forestry Superintendency to the ABT caused delays in administrative, financial and control processes.

FONABOSQUE, which is financed through forest taxes, has been functional since 2008; it is designed to provide incentives for SFM and forest conservation but to date it has been relatively unsuccessful.

Sustenar, a decentralized unit created in 2007, is responsible for the implementation of two programs (Sustentar and Conservar), the aim of which is to support sustainable production forestry and forest conservation at the local level.

Among the NGOs that have experience in monitoring access to and the use of forests are the Friends of Nature Foundation (*Fundación Amigos de la Naturaleza*), the Bolivian Institute of Forestry Research (*Instituto Boliviano de Investigación Forestal*), currently linked to the Gabriel Rene Moreno Public University (*Universidad Autonoma Gabriel Rene Moreno*), Conservation International (*Conservación Internacional*) and others.

The Law of Popular Participation (*Ley de Participación Popular, Ley* 1702, 1996) conferred more autonomy on local governments and urban and rural municipalities and gave them responsibility for, among other things, the use and management of forests. Territorial grassroots organizations such as 'peasant communities' and 'neighbours' councils' were recognized and given tasks in the new structure for the use of public resources (ITTO 2006). The 1994 Law of Popular Participation (*Ley* 1551) subdivided the Bolivian territory into 311 municipalities, each given an equitable share of resources. It created prefectures in the country's nine departments with responsibility for the regulation, planning and coordination of activities in the municipalities within them. Prefectures develop and implement forest development plans, including for watershed management, forest plantations, conservation, and extension and research. They are also in charge of implementing Decree BO-DS-N443 (see above), and they prepare programs to support municipalities in forest management.

Municipalities propose to the ministry the delimitation of the PFE as municipal reserves (*reservas municipale*s) and support ASLs in the management of their delimited forests. They also have control of forest management planning and planned deforestation activities, regulate and control forest use, and detect illegal forestry activities.[a] However, even though the regulations are clear between these decentralized levels, widespread poverty limits the prioritization of forest management on the local development agenda; a lack of resources is reflected in the weak capacity of local agencies to apply the regulations. At the municipal level, FMUs are also weak due to a lack of funds and because the institutional framework under construction is generating uncertainty among local actors (G. Ulloa, pers. comm., 2010).

The country is strengthening the ability of its personnel to implement SFM by providing in-service training and maintaining forestry education at a high level, including through specialization courses in forest management at the University of Cochabamba (ITTO 2006).

The FSC established the Bolivian Council for Voluntary Forest Certification (*Consejo Boliviano para la Certificación Forestal Voluntaria*) in 1995 to oversee the establishment of a certification system in Bolivia. The private sector is organized through a producers' association coordinated by the Bolivian Forestry Chamber (*Cámara Forestal de Bolivia*).

The Chamber also includes a technical component known as the *Promabosque* which, among other tasks, promotes SFM in natural and planted forests.

Status of forest management

Forest for production

According to Forest Law 1700 (1996), access to forest resources in the PFE is based on:

- Forest concessions in state lands (*tierras fiscales*) for large-scale companies.
- Forest concessions in state lands for ASLs.
- Harvesting permits in privately owned forest lands, divided into two categories – sustainable forestry with management plans, and conversion permits (*permisos de desmonte*).
- Forest management in TCOs.

Forest concessions are granted for a period of 40 years, subject to a five-yearly audit of the forest management plan (which has not been effective in practice) and operational annual plans for the extraction of timber and NTFPs. Management plans and auditing are also required in TCOs and private forests. The exclusive user rights of Indigenous groups are guaranteed in TCOs.

In privately owned forests, a permit for conversion to other economic land uses can also be obtained. The rules for forest management plans are described in Forest Law 1700 and complementary regulations (Supreme Decree 24453/96). A management plan must be prepared by a professional forester who is independent of the concessionaire. In 2003, a total of 86 commercial forest concessions were operating in an area of 5.47 million hectares, most of them with valid management plans (ITTO 2006). In 2008, 3331 FMUs were in place over a total area of 9.68 million hectares, including 83 commercial forest concessions covering 5.6 million hectares, 243 TCOs covering 930 000 hectares, and 32 ASLs covering 720 000 hectares (see Box 1).[a]

Although a system of auditing has been developed it has proven difficult to monitor concessions.[a] Nevertheless, the certification of a significant area of forest indicates that a high standard of forest management is being achieved in many FMUs (regulations under Forest Law 1700 recognize audits carried out by an international system of voluntary forest certification, properly accredited by credible international bodies). In the past, forest owners have complained about the complicated procedures (in particular for local communities) in fulfilling the demands for inventory and forest management planning and the high transaction costs that are incurred in the planning process.[a] The ABT has therefore attempted to reduce this burden by allowing smaller forest owners (in particular) to comply with a reduced set of planning and management standards.[a]

In coming years the recently approved National Plan for the Integrated Management of Forests is expected to introduce a series of modifications to forest management systems deployed in FMUs. It will broaden the focus of forest management plans to improve control over resources, including timber and NTFPs, increase community-based production forestry, and include the management and conservation of forest services.[a]

Box 1 Forest permits in FMUs, 2008

Rights category	Number of permits	Total area (ha)	Median size of FMU (ha)
Communally owned	876	580 000	662
TCOs	243	930 000	3827
ASLs	32	720 000	22 500
Privately owned	2095	1 820 000	869
Long-term extraction contracts	2	230 000	115 000
Forest enterprises (concessions)*	83	5 400 000	65 060
Total	**3331**	**9 680 000**	

* *These data may no longer be valid since the area of forest concessions was reduced significantly in mid 2010, from 5.4 million hectares (granted in 1996) to about 3.2 million hectares in 2010.* Barracas *are included under long-term extraction contracts and concessions. No recent information on approved plans in individual landholdings, TCOs or community lands was available for this report.*

Source: Government of Bolivia (2009).

Table 4 Commonly harvested species for industrial roundwood

Species	Notes
Hura crepitans (ochoó)*	By far the most harvested species (>1 million m^3 per year).
Dipteryx odorata (almendrillo)	About 87 000 m^3 per year (average 2006–08).
Tabebuia spp (tajibo)*	About 75 000 m^3 per year (average 2006–08).
Amburana cearensis (roble)*	About 53 000 m^3 per year (average 2006–08).
Ceiba spp (ceiba)*	About 45 000 m^3 per year (average 2006–08).

* *Also listed in ITTO (2006).*

Source: Personal communications with Bolivian foresters and administrators – see endnote b.

Silviculture and species selection. Detailed technical norms for silvicultural management (IDF 003-2006) were introduced in 1997 and complemented in 2006. They include adaptive management according to forest type and pre- and post-harvesting inventories; the marking of future crop trees and seed trees; the cutting of climbers; and liberation thinning.[a] Permanent sample plots must be established after harvesting to monitor regeneration. In reality, only those FMUs that follow a certification regime are fulfilling these requirements; the large majority of forest owners ignore silvicultural activities after logging.[a] Harvesting itself must be conducted according to prescriptions and a detailed annual operational plan.

There are more than 2000 tree species in Bolivia, of which at least 220 have been used and marketed (ITTO 2006). In the past, forest operations in Bolivia were based on the selective logging of a few valuable species, in particular *Swietenia macrophylla* (mara) and *Cedrela odorata* (cedro). In recent years, the number of harvested species has increased and this has resulted in higher removals. In 1995 (before the enactment of Forest Law 1700), for example, mara accounted for around 16% of the commercial timber removed (ITTO 2006); currently, however, it officially constitutes less than 1%. The volume of cedro harvested in 2000 was more than 100 000 m^3; today less than 20 000 m^3 of that species is harvested annually.[b] In addition to the species listed in Table 4, important timber species harvested in Bolivia include *Anadenanthera colubrine (*curupaú), *Caesalpinia pluviosa* (momoqui), *Vochysia haenkeana* (cambará), *Aniba guianensis* (canelón), *Terminalia amazonica* (verdolago), *Ficus* spp (bibosi), *Swartzia jorori* (jorori), palo maría, *Sterculia apetala* (sujo), *Cariniana ianarensis* (yesquero blanco) and *Schizolobium amazonicum* (serebó).

Planted forest and trees outside the forest. In 2008 the total area of planted forests in Bolivia was estimated at around 73 000 hectares.[a] Planted forest plots are generally small and include both indigenous and exotic tree species. A large proportion of the planted forest is located in the departments of Cochabamba and Chuquisaca. Most has been established under programs supported by international organizations, the main focus being on local communities with various aims including increasing revenues for small landowners, restoring degraded lands and eradicating coca plantations (ITTO 2006).

The major species planted – mostly in higher-altitude areas – are *Eucalyptus globulus* and *Pinus patula;* these two comprise about 90% of the total plantation area. Although considered relatively ineffective for controlling soil erosion, both species were planted for this purpose because they were considered suitable for cool climates (ITTO 2006); today they are major providers of fuelwood and local timber. Other species planted include *Alnus acuminata*, *Pinus radiata*, *P. pseudostrobus*, *Cupressus lusitanica* and *Acacia* spp. More than 25 species of eucalypt and pine have been tried. Private plantations using teak and high-yielding eucalypts have been established in recent years in lowlands on private land; such plantations are expected to expand, particularly on former pasture land.[b] Plantation timber is not yet used to any great extent in international trade.

Forest certification. In 2005 Bolivia had the largest area of certified natural tropical forest in Latin America. As of September 2010, there were 20 certified management units (including one small timber plantation) covering a total area of 1.72 million hectares (FSC 2010), down from about 2.2 million hectares in 2005 (ITTO 2006). Growth in the international market for certified wood products from Bolivia has been slow and the decrease in certified forest area can be attributed to a lack of market incentives. Many Bolivian companies see little attraction in maintaining forest

management certification in the long term.[b] Legal and institutional uncertainty for investments has also become a disincentive (G. Ulloa, pers. comm., 2010).

Estimate of the area of forest sustainably managed for production. In 2009, there were 3331 forest management plans covering an area of 9.68 million hectares.[a] There are 19 natural-forest FMUs with valid FSC certificates, ranging in size from 15 000 to 220 000 hectares and covering a total area of 1.72 million hectares; this constitutes the estimate of sustainably managed natural forest given in Table 5. In addition, 40 000 hectares of planted forests are considered to be well managed (ITTO 2006), comprising community forests in mountain regions and one certified timber plantation in the lowlands. The 2.4 million hectares of production forests set aside for protection purposes are not counted in the estimates given in Table 5.

Timber production and trade. The estimated industrial roundwood production in Bolivia in 2009 was 910 000 m^3 (ITTO 2010); the Government of Bolivia (2009) estimated the total average annual log production at 1.77 million m^3. On average an estimated 460 000 m^3 of sawnwood were produced annually between 2007 and 2009 (ITTO 2010). Nearly 100% of log production and 85% of sawnwood are used domestically (ibid.), although there are reports of increased exports in recent years, mainly to China. Although the country produces a significant quantity of certified wood, access to environmentally sensitive international markets is limited.

The wood-products industry consists primarily of small and medium-sized enterprises with mostly obsolete technology producing solid wood products.[a] In 2008, 428 sawmills were registered by the ABT and there were an estimated 2100 enterprises in secondary wood-processing.[a] The current insecurity of tenure for industrial enterprises has resulted in insufficient investment in forest industry and there is a risk that the relatively high standard of wood-processing will disappear. A major handicap for Bolivia's wood industry is the high cost of production per unit volume due to factors such as a low rate of extraction per hectare; the high cost of forest management; and the cost of essential inputs such as machinery, fuel and transportation. Wood prices are more than twice as high as in Brazil, Bolivia's principal competitor (USAID 2008).

Non-timber forest products. Brazil nut (also called castaña) is by far the most important NTFP exported by Bolivia, with annual production exceeding 45 000 tonnes. Palm hearts (palmito – *Euterpe predatoria*) are harvested mostly in private forests and are subject to management plans; nationally, annual production amounts to about 350 tonnes. Wild cocoa (*Theobroma cacao*) is collected as a niche export product. Many other NTFPs are used locally, such as the fruits and leaves of the motacú palm (*Attalea phalerata*); medicinal plants (e.g. uña de gato – *Uncaria tomentosa*); wild fruits (e.g. majo – *Oenocarpus bataua* and hoja de patujú – *Phenakospermum guianense*); and materials for roofing. Fuelwood collection is an important activity. Hunting provides protein for local communities, and some native species (e.g. caiman – *Caiman yacare*) are bred in captivity.

Forest carbon. According to inventories of GHG emissions made by the National Climate Change Program (*Programa Nacional de Cambios Climáticos*), the vast majority (83%) of CO_2 emissions stem from changes in land use, in particular the conversion of forests to fields and pastures for agriculture and livestock. Gibbs et al. (2007) estimated the forest biomass carbon stock at 2469–9189 MtC, while FAO (2010a) estimated

Table 5 Management of the production PFE ('000 hectares)

Reporting year	Natural					Planted		
	Total	Available for harvesting	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
2005*	17 000	5470	5470	2210	2210	60	-	0
2010	**25 100**	**9680****	**9680‡**	**1720**	**1720**	**73**	**-**	**0.2**

* *As reported in ITTO (2006).*

** *Only a relatively small portion of this is probably under concession, since it also comprises private (individual and collective) land.*

‡ *According to Government of Bolivia (2009); however, it is unclear if management plans have been formally approved for the entire area.*

it at 4442 MtC. The carbon capture potential of Bolivia's forests has been estimated at 2.4 tonnes of carbon per hectare per year for dry tropical forest ecosystems, and 5–8 tonnes of carbon per hectare per year in humid tropical forests (USAID 2008). Bolivia submitted a readiness idea note to the Forest Carbon Partnership Facility in 2008 but then ceased involvement with the Facility. The government received exploratory missions from UN-REDD in 2009 and submitted its National Joint Program to UN-REDD in 2010. Funds have also been made available by bilateral cooperation agencies for implementing pilot projects related to REDD+. Experience with certified emission reductions through the Noel Kempff Mercado Climate Action Project will assist Bolivia's future participation in REDD+ schemes. Table 6 summarizes Bolivia's REDD+ potential.

Forest for protection

Soil and water. In general, forests in the upper watersheds are a high priority for maintaining functional landscapes. These forests protect soils on steep slopes and improve downstream water quality by reducing siltation; they catch, hold, and slow runoff from precipitation, thereby reducing peak flows and flooding and stabilizing flows during the dry season. The 1992 Environmental Law (*Ley 1333 del Medio Ambiente*) dedicates two chapters to soil and water protection and defines soil and watershed conservation as a specific responsibility of the state. Many small-scale plantations have been established to protect watersheds in the Bolivian Andes, mainly to control soil erosion but also as a local source of fuelwood and products for local markets. Examples of market-like payments, compensation and incentive schemes for conserving hydrological services have been developed in certain municipalities (USAID 2008), mostly in Santa Cruz.

Biological diversity. Bolivia is ranked seventh in the world for the diversity of its birds, tenth for other vertebrates and 15th for primates; it also contains at least 18 000 species of plants, of which approximately 2700 are trees.[a] There is a high degree of endemism and many of Bolivia's ecosystems are undisturbed. Fifteen mammals, 16 birds, one reptile, 26 amphibians and one plant species found in forests are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species (IUCN 2011). Bolivia has eight plant species listed in CITES Appendix I and 319 in Appendix II (UNEP-WCMC 2011). Timber species include mara, *Cedrela* spp and *Podocarpus parlatorei*. *Cedrela* spp are listed in Appendix III.

Protective measures in production forests. Detailed regulations have been established under Forest Law 1700 for commercial forestry operations to assist in protecting watersheds and soil. Forest management plans must make special provision for biological corridors, the regulation of hunting and the conservation of endangered plant and animal species. About 2.4 million hectares of production forests have been set aside for protection purposes.[a]

Extent of protected areas. Bolivia's National System of Protected Areas (*Sistema Nacional de Areas Protegidas* – SNAP) comprises 22 protected areas of national interest and numerous others at the departmental and municipal level covering an area of 10.7 million hectares, which is about 16% of Bolivian territory. All major ecosystem types are represented. SNAP is an ambitious program given the human and financial constraints faced by Bolivia. A foundation for the development of SNAP, FUNDESNAP, was created in 2000.

SNAP comprises five official protected-area categories: national parks; natural monuments; wildlife sanctuaries; wildlife reserves; and natural areas for integrated use. Five protected areas, covering a total area of 4 million hectares situated in lowland areas, are interconnected through permanent production forests (ITTO 2006).

Table 6 Forest carbon potential

Biomass forest carbon (MtC)	% forest with canopy cover >60%	Deforestation/ degradation potential to 2030	Enhancement of carbon sink capacity to 2030	Forest area change monitoring capacity	Forest/ GHG inventory capacity	Importance of forest fire/ biomass burning	Engagement in international REDD+ processes
2469–9189	64	+++	++	+	++	++	++

+++ high; ++ medium; + low; estimate of national forest carbon based on Gibbs et al. (2007); estimate of % total forest with canopy cover >60% based on UNEP-WCMC (2010).

Table 7 Management of the protection PFE ('000 hectares)

Reporting year	Protection PFE	Attributed to IUCN categories I–IV	Allocated for soil and water	With management plans	Sustainably managed
2005*	14 700	7660	6790	-	2380
2010	**13 100**	**10 700**	**-**	**3500****	**2690**

* *As reported in ITTO (2006).*

** *Comprising the Noel Kempff and Madidi national parks and a private reserve covering about 109 000 hectares.*

The Noel Kempff National Park was extended in 2005 through the buy-out of logging rights for 832 000 hectares of forest by a consortium of three organizations and its incorporation into the national park as part of a large-scale carbon offset project. This first known REDD project has certified nearly 1 million tons of CO_2 (Government of Bolivia 2008). However, no financial compensation has been paid due to a lack of institutional and legal agreements and regulations regarding the distribution of carbon credits.

Estimate of the area of forest sustainably managed for protection. The estimated 10.7 million hectares of forested protected areas in the SNAP benefit from decrees or simple management directives and are staffed with forest rangers. Additional efforts to develop management plans and to protect the integrity of the forest have been made in two national parks – the 1.52-million-hectare Noel Kempff National Park, which is one of the largest and most intact national parks in the Amazon Basin, and the Madidi National Park, which is located in the upper Amazon region covering an area of about 1.89 million hectares and was supported for several years by an ITTO-funded project. The Noel Kempff National Park and an area of about 1.17 million hectares comprising the lower-lying areas of the Madidi National Park are counted in Table 7 as sustainably managed protection PFE. Insufficient information is available on the status of management in other protected areas.

Socioeconomic aspects

Economic aspects. Forestry accounted for 0.9% of GDP (approximately US$39 million) and the 'wood and wood products' sector represented 1.1% of GDP (approximately US$45 million) in 2008 (National Institute of Statistics of Bolivia 2010). The forest sector contributes directly to the generation of more than 90 000 jobs, and about 160 000 families benefit from employment in the forest sector (Government of Bolivia 2008). Community forest-user groups are responsible for less than 6% of forest production (Pacheco 2008) because most of the harvest is conducted on private lands and in forest concessions. A significant informal sector is involved in logging and industrial operations.

Livelihood values. Tropical forests are of great value to forest-dwellers, including Indigenous peoples who have subsistence user rights for non-commercial purposes throughout the forest estate without the need for permits; hunting and fishing are the most important activities. Forest areas are also considered as a reserve of available land and are used for subsistence agriculture. Pacheco (2005) estimated that about 1.3 million people rely on forest resources for at least part of their livelihoods, including 180 000–200 000 Indigenous people. An estimated 25 000–30 000 families live in or next to dense forests in the northern Amazon in Bolivia and rely on agro-extractive systems and the seasonal collection of Brazil nuts for income. Some 500 000–600 000 colonists and small-scale farmers settled in Santa Cruz, Chapare and Yungas harvest subsistence goods from forests (e.g. fuelwood, wood for building, fodder and fruits) and obtain indirect benefits from forests, such as through ecosystem services (Pacheco 2005). About 400 000 people living in the temperate valleys of Cochabamba, Tarija and Chuquisaca use forest resources – mainly fueldwood – for subsistence (ibid.).

Social relations. The inclusion and empowerment of Indigenous and other marginalized social groups has been a major political achievement in Bolivia, especially the enactment of Law 1702 on public participation. What is still uncertain, however, is the form that such social inclusion and empowerment will take and the mechanisms through which they will be achieved (USAID 2008). A variety of new laws and regulations guarantee local rights to the use of forest resources, but the system still

needs to be fully implemented. In fact, weak law enforcement and land-tenure problems are creating social unrest and jeopardizing the introduction of SFM. Local tensions between legally defined forest users and other interested parties remain unabated. Illegal logging of high-value timber species is an unresolved problem. Illegal crops, particularly coca, are planted by farmers in fields and small openings and are often a major reason for violence in forested areas.[a]

Summary

The new governance paradigm and development model in Bolivia has brought dramatic changes. While it provides new opportunities for forest management, a number of challenges must be tackled in the longer term. Forest-related policies and laws are generally progressive but there is insufficient capacity to implement them and difficulties in assigning responsibilities and authority to the various levels of government. The capacity of Indigenous organizations needs strengthening to ensure that Indigenous rights are upheld, particularly within the protected-area system. Land tenure and property rights remain uncertain, leading to a lack of investment in forest management and downstream wood-processing. Plans to open up large areas in the Amazon through road development could increase colonization and exacerbate deforestation and forest degradation.

Nonetheless, Bolivia has made remarkable progress towards SFM in the past 15 years. It has launched and implemented a comprehensive and ambitious reform of its forest sector and embarked on a major process of conferring property rights for natural forests to Indigenous communities. Forest certification is a major factor in the introduction of SFM practices – although the area of certified forest has declined in recent years as economic rewards have failed to materialize. New management paradigms have been defined recently to include a broader integrative forest management concept for SFM. While generally this is a positive development, there is a risk that it will lead to a lowering of the standards of forest management.

Key points

- Bolivia has an estimated PFE of 38.3 million hectares (compared with 31.8 million hectares in 2005), comprising 25.1 million hectares of natural production forests (compared with 17.0 million hectares in 2005), 13.1 million hectares of protection forest (compared with 14.7 million hectares in 2005) and 73 000 hectares of planted forest (compared with 60 000 hectares in 2005).
- An estimated 1.72 million hectares of the natural production PFE (all of which is certified) are under SFM. An estimated 2.69 million hectares of protection PFE are under SFM.
- A large area of partly unexploited forest in the Amazon Basin remains protected due to its remoteness. However, there are plans to open up these areas for economic development.
- The management of forest resources has been decentralized and is undertaken at the prefecture level and by municipalities and a variety of local community-based and Indigenous institutions, which lack sufficient resources and capacity.
- About 30% of the PFE is owned by local and Indigenous communities.
- The once well-established wood-processing industry with a strong body of professional knowledge and with significant areas of certified forests is confronted by a number of difficulties, including high costs. In addition, access to markets for certified timber remains problematic and the lack of a significant price premium may make it difficult to maintain high standards.
- The system of protected areas in Bolivia is ambitious, but there is a lack of capacity and funding to fully implement it.
- In many areas, illegal logging and illegal crops are major constraints to the full adoption of SFM and the effective conservation of protected areas.

Endnotes

a Government of Bolivia (2009).

b Information derived from discussions held with representatives of government, civil society and the private sector at an international workshop on governance and REDD, held 30 August–3 September 2010, Oaxaca, Mexico.

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BRAZIL

Forest resources

Brazil has a land area of 846 million hectares and an estimated population in 2010 of 195 million people (United Nations Population Division 2010); the country is ranked 75th out of 182 countries in UNDP's Human Development Index (UNDP 2009). Ninety-three per cent of the country is below 800 m in altitude. The highest peaks, at about 2500 m, are found on the northern border with Venezuela and in the southeast on the Atlantic coast. The vast Amazon Basin contains the world's largest area of tropical rainforest; the majority of it is Brazilian territory. FAO (2010a) and Government of Brazil (2010) both estimated Brazil's total forest cover in 2010 at 519 million hectares, including both tropical and non-tropical natural and planted forests; an estimated 354 million hectares of the total was in the Amazon.[a]

Forest types. Brazilian forests can be classified broadly as Amazon rainforest, Atlantic rainforest (*Mata Atlântica*) (28.8 million hectares), central *cerrado* savanna (70 million hectares), arid *caatinga* (46.8 million hectares) and the wetlands of the Pantanal (8.55 million hectares; Government of Brazil 2010).

The two main forest types in the Amazon are dense and open ombrophilous (humid) forests. The dense humid forests are characterized by large and medium-sized trees (with canopy up to 50 m and emergent trees up to 40 m) and abundant lianas and epiphytes. In the open humid forests the trees are more widely spaced and palm creepers and bamboos are more common.

The predominant vegetation in the *cerrado* is savanna (forested, arborized and steppe). Savanna formations also predominate in the Pantanal biome, which also contains savanna as well as small areas of semi-deciduous and deciduous forest. The *caatinga* comprises predominantly steppe savanna, interrupted by clusters of deciduous and semideciduous forest and savanna. To the north, pioneer formations occur, represented by marshes and swamps on the coast. The *Mata Atlântica* biome consists of humid (dense, open and mixed) and seasonal (deciduous and semi-deciduous) forests. Pioneer formations occur, represented by marshes and swamps along the coast, and savanna occurs in small areas in the northeast near the coast.[a]

Brazil has more mangrove forests than any country other than Indonesia, with about 1.3 million hectares, which is 8.5% of all mangroves. Mangroves occur on the northern coastline, intermittently in estuaries and coastal lagoons in the northeast, and south beyond the Tropic of Capricorn (Spalding et al. 2010).

Permanent forest estate. Brazil's tropical-forest PFE may be considered to comprise 117 million hectares of federal and state conservation units (*Sistema Nacional de Unidades de Conservação da Natureza* – SNUC – and *Sistema Estados Unidades de Conservação da Natureza*, respectively), 106 million hectares of Indigenous lands, 50.2 million hectares of legal reserves and permanent preservation areas on rural properties, and 36.1 million hectares of 'other public forest' protected by law.[1] This area includes the Amazon, *caatinga*, *cerrado* and *Mata Atlântica* biomes and may include some non-forest and some non-tropical forest. Box 1 shows the areas in each specific conservation unit category.

1 Federal and state conservation units and Indigenous lands include forest and other kinds of vegetation. For some categories the area may be under-estimated because of a lack of data on land under state responsibility (e.g. federal conservation units). 'Other public forests protected by law' refers to public forests listed in the National Register of Public Forests. They are not yet assigned to any function; however, according to Law 11 284/2006, public forest should be maintained as forests indefinitely.

Table 1 Permanent forest estate

Reporting year	Estimated total forest area, range (million ha)	Total closed natural forest ('000 ha)	PFE ('000 hectares)			
			Production		Protection	Total
			Natural	Planted		
2005*	444–515	489 515	98 100	3810	217 000	372 910
2010	**519**	**264 700**	**135 000**	**6650****	**175 000**	**316 650**

* *As reported in ITTO (2006).*

** *Being mostly privately owned and not required by law to be maintained as forest, strictly speaking this area is not part of the PFE but is included here to minimize confusion. Includes some non-tropical planted forest..*

Source: Government of Brazil (2010) , CNUC (2011), and personal communications – see endnote b.

The SNUC, which was established by Law 9985/00, is divided into two groups:

- Units of integral protection, whose purpose is to preserve nature – use does not involve the consumption, collection, damage or destruction of natural resources. Categories in this group are ecological stations, biological reserves, national parks, national monuments and wildlife refuges.
- Sustainable use units, which aim to reconcile nature conservation with sustainable use, involving the collection and use, commercial or otherwise, of a portion of a unit's natural resources. Categories in this group include national (and state) forests (*florestas nacionais* – FLONAs), extractive reserves and sustainable development reserves.

There are 69.4 million hectares of units of integral protection, 25.5 million hectares of FLONAs, 10.2 million hectares of sustainable development reserves and 12.3 million hectares of extractive reserves in the tropical PFE (J. Lorensi do Canto, pers. comm., 2011; CNUC 2011).[2] The estimate of protection PFE in Table 1 comprises the total area of forest in 'units of integral protection' plus the total area of Indigenous lands.

Under the Brazilian Forest Code (Law 4771/65), the following percentages (at least) of private land must be maintained under native vegetation (called 'legal reserves'), in addition to permanent protection areas (areas to be preserved along rivers, hills and others):

- 80% of rural properties located in forest areas in the Legal Amazon.[3]
- 35% of rural properties located in savanna areas in the Legal Amazon.
- 20% of rural properties located in forest or other vegetation in other (i.e. non-Legal Amazon) regions.
- 20% of rural properties in native grasslands in any region.

Legal reserves are forest areas that may be harvested for timber and other products on the basis of sustainable forest management plans (*planos de manejo florestal sustentável* – PMFSs – see below). The extent to which these restrictions are adhered to is unclear.

The total PFE reported here is considerably less than that reported for 2005, most likely due to differences in definition of what constitutes PFE rather than to a significant change in legal status or forest area. The Government of Brazil did not make an official submission for the 2005 survey; therefore, the data presented here for 2010 are likely to be more accurate than those given in ITTO (2006).

Forest ecosystem health

Deforestation and forest degradation. Brazil lost an estimated 2.19 million hectares of forest per year in the period 2005–10. This is an annual rate of deforestation of 0.42%, which is lower than the estimated annual rate of deforestation in the period 2000–2005 (0.57%) (FAO 2010b). In the period 2005–09 about 1.07 million hectares of forest was lost per year in the Amazon[a] and 929 000 hectares were lost per year in the *cerrado* (FAO 2010a). Brazil has an estimated 477 million hectares of primary forests (Table 2).

The Brazilian government's National Institute for Space Research (*Instituto Nacional de Pesquisas*

2 Data are for both federal and state lands.

3 The Legal Amazon was set by law for economic planning reasons. It comprises the states of northern Brazil (Acre, Amazonas, Amapá, Pará, Rondônia, Roraima and Tocantins), part of the states of Mato Grosso and Maranhão, and a small portion of the state of Goiás. It covers an area of more than five million km^2, which is about 61% of the Brazilian territory.

Box 1 Brazil's PFE, by tenure type and government jurisdiction

		Production PFE	Protection PFE	Total
		million ha		
Conservation units				
FLONAs/state forests	Federal	16.1	-	16.1
	State	9.40	-	9.40
Extractive reserves	Federal	12.3	-	12.3
	State	0.67	-	0.67
Sustainable development reserves	Federal	0.64	-	0.64
	State	9.53	-	9.53
Units of integral protection	Federal	-	35.8	35.8
	State	-	33.6	33.6
Subtotal		48.64	69.4	118.04
Indigenous lands			106	106
Legal reserves and permanent preservation areas on private land		50.2		50.2
Other public land		36.1		36.1
Total		**134.94**	**175.4**	**310.34**

Note: *Includes the Amazon,* caatinga, cerrado *and* Mata Atlântica *biomes; may include some non-forest and some non-tropical forest.*
Source: *CNUC (2011) and personal communications – seen endnote b.*

Espaciais) monitors forest cover in the Amazon by satellite using four operating systems: PRODES, DETER, DEGRAD and DETEX. These systems are complementary and are designed to meet different goals. PRODES (Program for the Calculation of Deforestation in the Amazon – *Monitoramento da Floresta Amazônica Brasileira por Satélite*) has measured the annual rate of clearcutting since 1988. Using Landsat satellite images, it can account for deforestation that takes place on areas greater than 6.25 hectares. DEGRAD (System for Mapping Forest Degradation –*Sistema de Mapeamento de Degradação Florestal*), which was developed in 2007, uses images from the Landsat and CBERS (China–Brazil Earth Resources Satellite) satellites to map areas in the process of deforestation where forest cover is not completely removed and therefore not counted by PRODES. DETER (System of Deforestation Detection in Real Time – *Detecção de Desmatamento em Tempo Real*) uses MODIS (Moderate Resolution Imaging Spectroradiometer) and CBERS satellite data to publish, on a monthly basis, maps of areas greater than 25 hectares which have either been completely deforested or are in the process of deforestation.

DETEX (Detection of Selective Logging Activities), developed with the support of the Brazilian Forest Service (*Serviço Florestal Brasileiro*), generates information for monitoring management plans in forest concessions (created by Law 11 284/06) and in public forests in general. Using images from Landsat and CBERS, multi-temporal DETEX studies have been conducted in national forests and forest concessions, especially in the vicinity of the BR-163 and BR-319 roads to identify instances of exploratory timber activity. All public forests in the Amazon have been monitored by this system since 2008.

An estimated 244 000 hectares of FLONAs were affected by fires in 2008, and a similar area was burned in 2007.[a]

Vulnerability of forests to climate change. Brazil is vulnerable to climate change, not least because of its fragile, biologically diverse ecosystems (Lèbre La Rovere & Pereira 2007). The Amazon forests and Pantanal wetlands are of particular concern. A number of studies suggest a drying trend in Amazon forests, such as an increased frequency of years with reduced precipitation, as was particularly the case in 1997, 1998, 2005 and 2010 (Perez 2011). Such dry years make spontaneous fires more frequent. These droughts have started to change the general view that Amazon forests can resist fire because of the moisture stored beneath the dense tree canopy. It has been suggested that extreme droughts could breach the flammability threshold of Amazon forests, triggering a feedback loop that leads to increasingly frequent wildfires (ibid.) and

*Table 2 Forest condition**

	PFE	Non-PFE	Total
	'000 ha		
Area of primary forest	-	-	477 000
Area of degraded primary forest	-	-	-
Area of secondary forest	-	-	36 500**
Area of degraded forest land	-	-	-

* *All forests.*
** *'Other naturally regenerated forest'.*
Source: FAO (2010a).

affecting vast areas of previously unburnt Amazon forests. Changing rainfall patterns, especially in the drought-affected northeast region of the country, could reduce the quality and quantity of water resources available for agriculture. The hydrological services of Amazon forests require further study to facilitate adaptation. The monitoring of climate variability and its effects on the Amazon forests is also important because of the crucial role that those forests play as the world's largest storage of terrestrial carbon.

SFM policy framework

Forest tenure. Even though much production forest is privately owned, under the 1988 Federal Constitution (Article 225) forests are considered to be a common asset for all inhabitants, and ownership and tenure disputes are a major problem. Private owners are only able to exercise their rights within the limits imposed by the 1965 Forest Code, which regulates the harvesting of timber resources. There are legal stipulations to set aside 'legal reserves' and 'permanent preservation areas' in private forest areas (Article 2). More than one-third of the tropical PFE is owned by Indigenous communities (Table 3).

Extractive reserves are state-owned areas in which use rights are granted to traditional extractive populations whose subsistence is based on the harvesting of naturally growing products such as latex, nuts, fruits and oils as well as on agriculture and animal-raising. The purpose of extractive reserves is to protect the livelihoods and cultures of those traditional extractive populations and to ensure the sustainable use of natural resources in the reserves. There are 62 extractive reserves in Brazil (mostly in the Amazon), comprising a total area of 12.96 million hectares – 12.3 million hectares of which are on federal lands and 667 000 hectares of which are on state lands (Box 2). Although timber harvesting is generally not permitted, these areas are counted as part of the production PFE (in total, 12.3 million hectares in the Amazon). All extractive reserves have a management plan prepared by the managing agency (the Chico Mendes Institute of Biodiversity Conservation).

Under the Federal Constitution, Indigenous lands (lands traditionally occupied by Amerindians) are defined as: "those where they live on a permanent basis, those used for their productive activities, those essential to the preservation of environmental resources necessary for their well-being and for their physical and cultural reproduction, according to their habits, customs and traditions". Amerindians have the permanent possession and "exclusive use of the riches of the soil, rivers and lakes" existing on their lands. Nevertheless, such lands constitute the property of the state and, as public goods of special

Box 2 Area of federal and state extractive reserves, by biome (ha)

Biome	Area of federal extractive reserves	Area of state extractive reserves
Amazon	11 597 193	667 438
Cerrado	107 249	-
Coastal	587 676	-
Mata Atlântica	1178	-
Total	**12 293 296**	**667 438**

Source: CNUC (2011).

*Table 3 Forest area, by tenure**

Ownership category	Total area	Of which PFE	Notes
	'000 ha		
State ownership (national, state or provincial government)	-	113 000	Includes federal conservation units, which comprise forest and other kinds of vegetation (and therefore may overestimate PFE in this category); in some cases the area may be an underestimate because of a lack of data for forests under state responsibility. Also includes 'Other public forests protected by law', which refers to public forests registered in the National Register of Public Forests. Such forests are not yet assigned to any function; according to Law 11284 (2006), however, public forest should be maintained as forests indefinitely.
Other public entities (e.g. municipalities, villages)	-		
Total public	**-**	**113 000**	
Owned by local communities and/or Indigenous groups	-	106 000	Includes forest and other kinds of vegetation. These forests remain the property of the state.
Privately owned by individuals, firms, other corporate	-	54 100	Includes 'legal reserves' and 'permanent preservation areas' on rural properties and forests under PMFSs in the Amazon and caatinga biomes.

* *Tropical forests only.*
Source: Government of Brazil (2010).

use, besides being inalienable and unavailable (can not be disposed of or alienated), they cannot be the object of use of any kind by anyone other than the Amerindians themselves.[a] Of the 106 million hectares of forest in the Amazon allocated to Indigenous communities, 1.75 million hectares have been 'bounded', 8.1 million hectares have been 'declared', 3.6 million hectares have been 'approved' and 92.2 million hectares have been 'regularized' (i.e. full rights have been secured).[a]

According to FAO (2010a), communities in Brazil have management rights in 160 million hectares of publicly owned forest (including indigenous lands outside the Amazon region).

In 2009 President Luiz Inacio Lula da Silva approved Law 11952, which provides for the legalization of occupied federal land in the Legal Amazon through the sale and grant of right of use of real estate. The aim of the law is to reduce legal uncertainty, which promotes the illegal appropriation of land, the intensification of agrarian conflicts and deforestation. Under the law, certain unallocated federal land will be transferred to municipalities in order to expedite its privatization. The law establishes size limits for areas to be privatized, the terms of payment and other legal and financial aspects.

Under the new law, squatters occupying up to 100 hectares of land will be given title to the land free of cost. Lots measuring between 100 and 400 hectares will be sold at a 'symbolic cost', and holdings of 400–1500 hectares will be sold at market prices. Larger lots of up to 2500 hectares will be auctioned to the highest bidder. Anything larger can only be sold with congressional approval.[4]

Criteria and indicators. The Government of Brazil participates in the Tarapoto C&I process coordinated by the Amazon Cooperation Treaty Organization and used the ITTO C&I in its submission to ITTO for this report.[a]

Forest policy and legislation. Brazil is a federation of 26 states, a federal district and more than 5500 local governments (municipalities – *municípios*). The adoption of a new constitution in 1988 prompted decentralization in the management of natural resources and the implementation of development programs. Considerable political and tax power and fiscal revenue shifted from the central government to states and municipalities, and privatization and economic liberalization policies were also pursued.

Forest-related legislation includes:

- Law 4771 (1965) – Forest Code (as amended).
- Law 5197 (1967) – Protection of Fauna.
- Law 6938 (1981) – National Environmental Policy.

4 www.illegal-logging.info/item_single.php?it_id=3493&it=news.

- Law 9433 (1997) – Water Resources Policy.
- Law 9605 (1998) – Environmental Crimes.
- Decree 3179 (1999), which establishes penalties for forest crimes.
- Decree 3420 (2000), creating the National Forest Programme.
- Decree 4340 (2002), which regulates articles of Law 4771 and various other laws. It also provides regulations for the exploitation, suppression and clear-cutting of forests and succeeding formations; PMFSs; forest replanting; and licences to transport forest by-products.
- Law 11 284 (2006) (the Public Forest Management Law), which provides for public forest management for sustainable production, creates the Brazilian Forest Service within the structure of the Brazilian Ministry of the Environment, establishes the National Forest Development Fund (*Fundo Nacional de Desenvolvimento Florestal* – FNDF), and makes other provisions.
- Resolution 378 (2006), which defines undertakings that may potentially cause national or regional environmental impact and makes other provisions; and subjects forest exploitation to permits issued by the Brazilian Institute of Environment and Renewable Resources (*Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis* – IBAMA).
- Resolution 379 (2006), which creates and regulates the database on forest management at the National Environmental System (*Sistema Nacional do Meio Ambiente*) level.
- Decree 6063 (2007), which regulates, at the federal level, provisions of Law 11 284.
- Resolution 406 (2009), which establishes technical standards to be adopted in the formulation, presentation, technical evaluation and implementation of PMFSs for logging purposes in native forests and their succeeding formations in the Amazon biome.
- A number of normative instructions relating to forest use.[a]

The enactment of the Public Forest Management Law in 2006 was a significant achievement. Previously, although large areas of forest are located on public land in Brazil, there was no regulatory framework to deal with their management. This made it difficult for the government to establish policies that could ensure the maintenance of those forests as an asset belonging to all Brazilians. In the case of the Amazon the situation was even more worrisome because for decades the advance of agriculture had led to large losses of forest cover and land-grabbing. In 2004, the federal government initiated the formulation of a legal framework to allow for the management of public land in a way that would halt land-grabbing, introduce a forest concessions system to maintain the capacity of the forests to provide goods and services in perpetuity, and serve as a socioeconomic development alternative. The 2006 law and subsequent resolutions, decrees and instructions were the result.

In 2004 the Government of Brazil announced its Action Plan to Prevent and Control Deforestation in the Amazon involving eleven ministries led by the President's Cabinet. The action plan comprises 144 actions under three main strategies: land-tenure and territory planning; environmental monitoring and control; and incentives for sustainable production. Under the action plan, by 2008 ten million hectares of Indigenous territories, 20 million hectares of protected areas and 3.9 million hectares of 'sustainable settlement' projects had been created and 66 000 illegal land titles had been cancelled.[b]

Institutions involved in forests. The Ministry of Environment (*Ministério do Meio Ambiente* – MMA) is responsible for forestry as well as for planning, coordinating and controlling activities related to the national environment policy and policies for developing the Amazon. It supervises the activities of IBAMA and the Brazilian Forest Service, chairs the National Council for the Environment (*Conselho Nacional do Meio Ambiente*) and takes part in the President's Chamber for Natural Resources Policies, which coordinates various aspects related to forests. Other agencies with responsibilities related to forest resources include the National Colonization and Agrarian Reform Institute (*Instituto Nacional de Colonização e Reforma Agrária*), and the Indian National Foundation (*Fundação Nacional do Índio*), which is responsible for the preservation of Amerindian culture. In 1999, a Secretariat for Biodiversity and Forests was created in MMA. Among other functions, IBAMA, which was established in 1985,

implements and coordinates the National Forest Program. In some states in the Legal Amazon and the Northeast Region, state-government institutions issue forest management permits and conduct state forest inspections.

The National Forest Commission (*Comissão Nacional de Florestas* – CONAFLOR), which was established by Decree 3420/00, is composed of 39 representatives distributed between the government (20 representatives) and civil society (19 representatives), including federal government agencies and entities, state environmental agencies, civil-society groups, forest industry, NGOs and educational and research institutions. CONAFLOR provides guidelines for the implementation of procedures in national forests and enables the participation of various interest groups in developing public policies for the forest sector.[a]

The Public Forest Management Law (2006) established the Brazilian Forest Service as an agency of the federal government under the MMA, with responsibility over public forest management for sustainable production; thus, it is responsible for concessions (i.e. timber harvesting and the extraction of NTFPs) in FLONAs and other public forests. The Brazilian Forest Service is also responsible for managing the FNDF and the National Register of Public Forests (*Cadastro Nacional de Florestas Publicás*). The goal of the National Register is to set up a database of geo-referenced data for the identification of public forests in order to provide public managers and the population in general with a reliable database on forest management.[a]

The main instruments used by the Brazilian Forest Service for the sustainable production and management of federal public forests are forest concessions and allotment to local communities. A forest concession is a chargeable warrant for the right to practise SFM for the exploitation of a forest's products and services. The allotment of public forests to local communities is carried out through the identification of areas occupied by traditional populations, such as Indigenous communities, slave-descendant communities (known as *quilombolas*) and settlements. The Brazilian Forest Service assists in the identification of those populations and encourages and promotes community forest management by providing technical support and capacity-building.[a]

A draft Bill before the Brazilian Congress would, if passed, transform the Brazilian Forest Service into an autonomous institution. As part of the Federal Government administration under the MMA, the Service currently lacks the necessary institutional conditions to efficiently carry out the tasks allocated to it under the law, thus hindering, for example, the speed at which concessions are assessed and approved (or otherwise). Currently, the Service has 240 employees, of whom only 56 are career public servants. As the Service consolidates itself, increasing institutional demands – such as the increasing number of concession applications – will require a speedy, dynamic process to build up and enlarge its workforce. According to an internal study, an additional 760 new positions of 'environment' career specialists and 62 new director-level positions will be needed by 2012.[a]

The Commission on Public Forest Management (*Comissão de Gestão de Florestas Públicas* – CGFLOP) is an advisory body of the Brazilian Forest Service which aims to advise, evaluate and propose guidelines for the management of public forests in Brazil, especially regarding the Annual Forest Concessions Plan (*Plano Anual de Outorga Florestal*). The CGFLOP, which was established by Law 11 284/06 and regulated by Decree 5795/06, is composed of 24 representatives appointed by the holders of the respective agencies, groups, organizations and sectors involved in the process and designated by the Minister of State for the Environment. The Commission meets at least twice a year or as requested by its chairman or at least one-third of its members.

Average total annual direct investment by the federal government in forest management, administration, research and human resource development in the period 2005–09 was about 141 million reais (R$), including R$56.1 million through the MMA, R$9.72 million through the Brazilian Forest Service and R$25.8 million through IBAMA. Some R$26.1 million was allocated to the Chico Mendes Institute of Biodiversity Conservation[a], which is responsible for the management of all federal conservation units.

The aim of the FNDF is to foster the development of forest-based sustainable activities in Brazil and promote technological innovation in the sector. Its main source of funds is revenue generated by forest concessions in compliance with the percentages

outlined in the Public Forest Management Law (2006). Moreover, the FNDF may receive donations from national and international public and private entities.

It was estimated that R$2.2 million would be allocated in 2010 for measures to bolster forest management. Based on estimated future revenue from forest concessions, the FNDF will have an allocation of R$4 million in 2012 and R$29 million in 2015.

FNDF resources are to be allocated primarily to projects in the following areas:

- technological research and development in forest management
- technical assistance and forest extension
- recovery of degraded areas with native species
- rational and sustainable economic use of forest resources
- control and monitoring of forest activities and deforestation
- capacity-building in forest management
- environmental education
- environmental protection and natural resources conservation.[a]

The Amazon Fund, which was established in 2008 by Decree No 6527, aims to attract donations for non-refundable investments in deforestation prevention, monitoring and combat, and also to promote the conservation and sustainable use of forests in the Amazon biome. Specifically it is designed to support projects in the following areas:

- public forests and protected areas management
- environmental control, monitoring and enforcement
- SFM
- economic activities developed as a result of forest sustainable use
- ecological–economic zoning, land-use planning and land regulation
- biodiversity conservation and sustainable use
- recovery of degraded areas.

In 2010 the Brazilian Development Bank established the 'Support to Reforestation, Recovery and Sustainable Use of Forest' program, the aim of which is to support the reforestation, conservation and forest recovery of degraded or converted areas and the sustainable use of native areas through SFM.

The Brazilian Agricultural Research Corporation (*Empresa Brasileira de Pesquisa Agropecuária* – EMBRAPA) spent an average R$2.37 million on forest-related research per year in 2005–09. In the same period the total annual research expenditure by the Ministry of Science and Technology, through such institutions as the National Institute of Amazonian Research (*Instituto Nacional de Pesquisas da Amazonia*), based in Manaus, the Mamirauá Institute of Sustainable Development and the Emílio Goeldi Museum, was R$21.3 million.[a]

Universities, large forestry enterprises, and NGOs such as the Amazon Institute of People and the Environment (*Instituto do Homem e Meio Ambiente da Amazônia*) also engage in forestry research. University education in forestry started in 1960; currently, 51 universities offer teaching and research in forest management.[a] There are about 7000 forest engineers working in Brazil, 1600 with master's degrees and 300 with PhDs.

Status of forest management

Forest for production

The forest management system adopted for Amazonian dense tropical rainforest is a polycyclic system involving the selective logging of commercial forest species in cutting cycles of 25–35 years. FMUs are usually divided into annual production units according to the cutting cycle adopted.

By law the use of natural forest resources on both private and public land requires the presentation of a PMFS to IBAMA and its approval by that body and/or the relevant state environment agency.

Since 2006 forest management (i.e. timber harvesting) has been permitted in Brazil's public forests through forest concession contracts that can span up to 40 years. Concessions are granted through a transparent tendering and/or bidding process for the production of timber and/or non-timber products or services. Each year the Brazilian Forest Service prepares an Annual Forest Concessions Plan, which is a major instrument of policy planning for forest concessions in public forests. A national policy to support community

forest management has also been implemented (Decree 6874/2009) with the aim of encouraging and organizing the country's forest management activities, and it also establishes minimum prices for NTFPs.

MMA Normative Instruction 5 (2006) introduced important changes to the parameters of forest management on both public and private land. The main features were:

- The maximum allowable harvest is 30 m^3 per hectare when harvesting is mechanized and 10 m^3 per hectare when the operation does not use heavy machinery, with harvesting cycles of 35 years and ten years, respectively.
- For those forest species whose minimum cutting diameter had not previously been determined, the minimum cutting diameter is set at 50 cm.
- At least 10% of each exploited tree species which could be harvested are to be left standing as seed bearers, selected in each 100-hectare working unit.
- A tracking system (chain of custody) is required for harvested trees.
- The use of waste wood is allowed.

Since September 2006, forest product transportation has been controlled through a national information system, IBAMA's Forest Origin Document system. Under it, forest products are tracked from their harvest to the final stage of marketing. The entire supply and transportation chain must be updated online in real time. The system has significantly improved the control of illegal logging in Brazil.[a]

A forest planning process called *Modeflora* (Digital Model of Forest Exploitation), hailed as a technological breakthrough in forest management, has been tested successfully by EMBRAPA researchers. It consists of the georeferencing and geomonitoring of all phases of forest management, from the preparation of a forest management plan to its implementation, combining the use of forest inventory techniques, operational research and a range of technologies such as global positioning systems (GPS), GIS, radar and satellite images (Figure 1). *Modeflora* enables a reduction of at least 30% in the cost of preparing and implementing forest management plans. It also reduces field error and increases the accuracy of tree-tracking and micro-zoning by enabling the production of maps at a scale of 1:15.[a]

In public forests under forest concession, the Brazilian Forest Service subsidizes the price of wood for those concessionaires who promote value-adding near the forest concession, the installation of permanent plots, and biodiversity monitoring. Nevertheless, despite the existence of pilot projects in SFM and technical standards for the adoption of best forest management practices in the Amazon, the level of adoption of these practices is still incipient.[a]

Control and law enforcement in the Amazon are extremely difficult because of the vastness of the area, poor infrastructure, a lack of capacity and the large number of actors contributing to deforestation and illegal logging. Other problems facing forestry in Brazil are the remoteness of many forests from centres of commerce and control; the weak economic competitiveness of SFM as a land use; the lack of competitiveness of the tropical timber industry, for various reasons; extensive degraded forests; lack of full-cost pricing and the abundant availability of low-cost timber; and a serious shortage of management skills (ITTO 2006).

The scarcity of information on forest management for business people and a lack of technical capacity are other barriers to the widespread adoption of SFM. Most employers still do not know the meaning of SFM and are unaware of the potential financial benefits of good forest management. The technologies adopted by these timber companies generally correspond to the practices used for decades in conventional exploitation.[a]

The enlargement of the agricultural frontier, which causes deforestation and is associated with illegal wood supply, continues to be a limiting factor to the promotion of forest management in the Amazon.[a]

Box 3 shows the planning process before the commencement of logging in the Amazon.

Silviculture and species selection. The main silvicultural process proposed for the Brazilian Amazon is as follows:

- *E minus 2 years* (where E = forest harvesting event) – delimitation and subdivision of the annual production unit (external delimitation and internal subdivision to facilitate the mapping of trees).

- *E minus 1 year* – forest inventory at 100% (i.e. the measurement of all commercial trees with dbh ≥ 40 cm).
- *E minus 1 year* – liana cutting (for commercial species above the minimum cutting diameter).
- *E minus 1 year* – installation and measurement of permanent plots.
- *E minus 1 year* – exploration planning (primary and secondary roads; pre-selection of trees based on inventory; preparation of map of annual production unit).
- *E minus 1 year* – opening of roads, sidings and marshalling yards (forest roads, bridges, drainage system, and 25x25 m marshalling yards).
- *E* – forest harvesting (reduced impact).
- *E plus 1 year* – assessment of damage caused by harvesting (evaluation of remaining trees, skid trails and cutting quality).
- *E plus 1 year*, *E plus 3 years*, and henceforth every five years – re-measurement of permanent plots.
- *E plus 4 years* – silvicultural treatments (e.g. girdling of non-commercial trees to make room for commercially promising trees).

As reported above, the maximum allowable harvest is 30 m^3 per hectare when harvesting is mechanized and 10 m^3 per hectare when the operation does not use heavy machinery, with harvesting cycles of 35 years and ten years, respectively.

Table 4 lists some commonly harvested tropical timber species.

Box 3 Flow-chart of Amazon logging planning process

Georeferencing of the forest area (owner/ concessionaire)
↓
Prior-authorization request made to relevant environmental agency (owner/concessionaire)
↓
Analysis and consideration of prior-authorization request (environmental agency)
↓
100% inventory carried out (owner)
↓
Technical analysis of the sustainable forest management plan (environmental agency)
↓
Development of PMFS (owner)
↓
Statement of responsibility on forest maintenance registration (*termo de responsabilidade de manutenção da floresta*) (owner)
↓
Authorization of the PMFS (environmental agency)
↓
Development of the annual operating plan (owner)
↓
Submission of the annual operating report (owner/concessionaire)
↓
Analysis of the annual report and technical inspections (environmental agency)

Table 4 Commonly harvested tropical species for industrial roundwood

Species	Volume (m^3) transported in 2007
Manilkara huberi (maçaranduba)	592 395
Dinizia excelsa (angelim)	390 330
Goupia glabra (cupiúba)	361 628
Hymenaea courbaril (jatobá)*	336 662
Erisma uncinatum (cedrinho)*	293 922

* *Also listed in ITTO (2006).*
Source: Personal communications – see endnote b.

Planted forest and trees outside the forest. Brazil's plantation estate comprises about 4.52 million hectares of *Eucalyptus* species, 1.79 million hectares of *Pinus* species, and 344 000 of other species (including *Acacia mearnsii*, *A. mangium*, *Schizolobium amazonicum*, *Tectona grandis*, *Araucaria angustifolia* and *Populus* spp), for an estimated total plantation area of 6.65 million hectares.[a] Significant areas of plantations (especially *Pinus* spp) are outside the tropics. There are also about 128 000 hectares of rubber (*Hevea brasiliensis*) plantation. Even though planted forests account for little more than 1% of the total forest area in Brazil, they make a substantial contribution to industrial wood production.

Forest certification. As of October 2010, a total of 6.16 million hectares of natural and planted forests had been certified under the FSC umbrella in Brazil. Of this, about 2.70 million hectares were natural tropical forest and 2.13 million hectares were planted tropical forest (FSC 2010); most of the remainder were non-tropical plantations. The certified natural forest includes 47 000 hectares in the Antimary State Forest in the state of Acre, which is being managed according to a management plan developed under an ITTO project.

The Brazilian forest certification system (*Certificação Florestal* – CERFLOR), was initiated in the 1990s and became operational for planted forests in 2003. As of 16 September 2010, a total of 1.25 million hectares of forest plantations were certified under CERFLOR, but the only CERFLOR-certified native-forest operation (73 000 hectares in the Amazonian state of Rondônia) was under suspension.[5] CERFLOR is endorsed by the PEFC.

Estimate of the area of forest sustainably managed for production. Brazil's native-forest concession system for public forests is still in an early stage of implementation, with only one concession (covering an area of 96 300 hectares) approved in the Amazon. In total, 2.94 million hectares of Amazonian forest and (295 000 hectares of *caatinga*) are subject to approved PMFSs; all extractive reserves are also subject to management plans. An estimated 2.70 million hectares of natural tropical forest are certified by the FSC (FSC 2010). On the available information, therefore, the total area of natural tropical production PFE considered to be under SFM is at least 2.70 million hectares (Table 5).

5 www.inmetro.gov.br/qualidade/cerflor.asp.

A rubber-tapper community in the Antimari State Forest, Acre, Brazil.

Timber production and trade. On average, an estimated 247 million m^3 of logs were produced annually in Brazil in the period 2005–08, comprising 81 million m^3 of logs from natural forests and 166 million m^3 of logs from plantations. FAO (2010a) estimated that over half of this is fuelwood.

Brazil produced an estimated 23.7 million m^3 of (non-coniferous) tropical logs for industrial purposes in 2009, down from a peak of 29.7 million m^3 in 2003. About 15.5 million m^3 of tropical sawnwood were produced in 2009 (up slightly from the 14.4 million m^3 produced in 2003), of which 1.06 million m^3 were exported. In the same year, Brazil produced about 600 000 m^3 of tropical plywood, down from a peak of 1.38 million m^3 in 2003 (ITTO 2010).

Brazil's production of tropical logs is less than one-quarter of total industrial roundwood production, which was 105 million m^3 in 2009. Log-processing capacity in the Legal Amazon declined from 10.4 million m^3 per year in 2004 to 5.8 million m^3 per year in 2009 (ibid.).

Non-timber forest products. Brazil owes its name to *brazilin*, a red dye from *Caesalpinia echinata*, and to the dye extractors, *brasileiros*. A very large number of NTFPs (e.g. food, medicinal plants, perfumes, dyes and tannins, natural rubber, Brazil nut, handicraft and construction materials, exudates, honey and wax) are used locally. About 45 700 tonnes of Brazil nut were harvested in 2009, and the export of this product was worth US$20.3 million.[a] About 121 000 tonnes of açai berries, 7890 tonnes of latex, 3790 tonnes of copaiba oil

Table 5 Management of the production PFE ('000 hectares)

Reporting year	Natural					Planted		
	Total	Available for harvesting	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
2005*	98 100	-	5250	1160	1360	3810	1350	1350
2010	**135 000**	**15 340**	**15 340****	**2700**	**2700**	**6650‡**	**3380†**	**3380†**

* *As reported in ITTO (2006).*

** *Comprises 3.04 million hectares under PMFSs in the Legal Amazon and 12.3 million hectares of extractive reserves, all of which are subject to management plans.*

‡ *Tropical and non-tropical.*

† *Tropical certified plantations (other tropical plantations may have management plans, but data were unavailable).*

and 644 tonnes of cumaru almonds were harvested in the Amazon in 2009.[a]

Forest carbon. Brazil has the world's largest forest carbon stock. Gibbs et al. (2007) estimated the total forest biomass carbon stock at 54 700–82 700 MtC and FAO (2010a) estimated it at 62 000 MtC. An estimated 54% of Brazil's GHG emissions come from land use and deforestation and 25% come from the agricultural sector (Lèbre La Rovere & Pereira 2007). In 2008 Brazil created the Amazon Fund (see above) as a tool to combat deforestation and promote sustainable development in the Amazon. The goal is a 70% reduction in deforestation by 2018 (compared with the average between 1996 and 2006). REDD+ is considered to be a major opportunity in efforts to achieve this target. Any project funded through the Amazon Fund must comply with Brazil's National Plan on Climate Change. Through international arrangements, for example with the Government of Norway, considerable funding is being provided to initiate the Amazon Fund and for the development of an effective forest monitoring system.

Brazil is closely engaged in the international REDD+ Partnership and is co-chairing this process in 2011. The country has been a participant in the Forest Carbon Partnership Facility since 2008 and is a recipient country of the Forest Investment Program. Significant investments in forest carbon are also being made at the state level. In Acre, for example, a US$100 million investment made through the Inter-American Development Bank was used to initiate, in the period 2007–10, a major investment promotion with the aim of creating a sustainable financing scheme for REDD+ in that western Amazonian state. Through REDDES, Brazil participates in and benefits from an ITTO project implemented by the Amazon Cooperation Treaty Organization for capacity-building on monitoring land use, land-use change and forests in the Amazon region. Table 6 summarizes Brazil's current forest carbon potential.

Forest for protection

Soil and water. The Amazon Basin produces 20% of the world's freshwater; it is therefore vital that its soil and water resources are properly protected. An estimated 243 million hectares of forest in Brazil are managed primarily for soil and water protection.[a]

Biological diversity. Brazil's forests contain a significant share of the world's biodiversity, including an estimated 56 000–62 000 higher plant (not including mosses, lichens and fungi) and mammal species. The Amazon is home to about 20% of the world's plant species, 20% of bird species and 10% of mammal species. Sixty-four mammals, 78 birds, five reptiles, 24 amphibians, eight arthropods and 14 plants found

Table 6 Forest carbon potential

Biomass forest carbon (MtC)	% forest with canopy cover >60%	Deforestation/ degradation potential to 2030	Enhancement of carbon sink capacity to 2030	Forest area change monitoring capacity	Forest/ GHG inventory capacity	Importance of forest fire/ biomass burning	Engagement in international REDD+ processes
54 700–82 700	51	+++	+++	+++	+++	++	+++

+++ high; ++ medium; + low; estimate of national forest carbon based on Gibbs et al. (2007); estimate of % total forest with canopy cover >60% based on UNEP-WCMC (2010).

in Brazil's forests are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species (IUCN 2010). Wood species in the Amazon considered endangered or threatened with extinction are *Amburana cearensis* var. *acreana (*cerejeira), *Peltogyne maranhensis* (pau-roxo), *Bertholletia excelsa* (castanheira), *Swietenia macrophylla* (mogno – also known as mahogany) and *Euxylophora paraensis* (pau-amarelo). There are also seven such species in the *Mata Atlântica* biome and two in the *cerrado/caatinga*.[a]

Brazil has 28 plant species listed in CITES Appendix I, 429 in Appendix II and 3 in Appendix III (UNEP-WCMC 2011), including mogno, cedro and a few other tree species for which production and trade is minimal. The Brazilian National Policy and Strategy for Biodiversity and the National Biodiversity Programme are designed to address the situation through *in situ* and *ex situ* measures and the management of biotechnology.

Protective measures in production forests. Measures taken to protect the production forests as part of the country's forest conservation strategy include a moratorium on the harvesting and sale of over-harvested species such as mogno and virola; the introduction and implementation of measures to control illegal logging through sophisticated devices for timber-tracking and satellite data transfer; limiting the area allowed for farming in forest properties in the Amazon; yield regulation in natural selection forests; forest restoration; the establishment of ecological corridors; incentives for municipalities that have environmental conservation areas through the transfer of a 'products and services tax'; and broadening the scope of eligible activities for CDM support.[a]

Extent of protected areas. There is uncertainty about the extent of protected areas in Brazil; partly this stems from differences in the definition of 'protected' and the extent to which extractive uses are permitted. The estimate of protection PFE given in Table 1 and Table 7 comprises conservation units of integral protection and Indigenous reserves. The estimate is considerably less than that reported in ITTO (2006), most likely due differences in definition of what constitutes PFE rather than to a significant change in legal status or forest area.

All conservation units of integral protection (i.e. federal and state lands in the categories national parks, biological reserves, ecological reserves, national monuments and wildlife refuge areas) must have management plans. These are technical documents which, depending on the purposes of the conservation unit, establish the limits of the unit and the rules for its management and use, including the installation of infrastructure. However, the status of these management plans is unclear: some of them are under preparation but, for others, the preparation process has not yet begun. Management plans for conservation units of integral protection require, among other things, studies on vegetation, wildlife and soils and socioeconomic surveys in order to support zoning and the identification of appropriate management practices.[b]

Estimate of the area of forest sustainably managed for protection. Data on the status of management of the protection PFE were unavailable for the purposes of this report (Table 7). However, vast areas of the Amazon are currently under no threat of deforestation or other significant human-induced disturbance due to their remoteness.

Socioeconomic aspects

Economic aspects. Forest-based industries contributed an estimated 3.4% to Brazil's GDP in 2007, down from 4.5% in 2003. An estimated 580 000 people were directly employed in the formal forest and wood products sector in Brazil in 2010[a], although data on the number of people employed in that part of the sector specifically based on natural tropical forests were unavailable for this report.

Table 7 Management of the protection PFE ('000 hectares)

Reporting year	Protection PFE	Attributed to IUCN categories I–IV	Allocated for soil and water	With management plans	Sustainably managed
2005*	271 000	19 000	-	-	-
2010	**175 000**	**40 200****	**243 000**	**-**	**-**

* *As reported in ITTO (2006).*

** *Amazon biome only. An additional 643 000 hectares in the* caatinga *biome, 5.23 million hectares in the* cerrado *biome and 2.21 million hectares in the* Mata Atlântica *biome are in IUCN categories I–IV.*

Source: CNUC (2011) and personal communications – see endnote b.

Livelihood values. The Indigenous communities in the Amazon, dwellers in extractive reserves, and *caatinga* forest users in the northeast depend in large measure on forests for subsistence. However, no data on the extent of this dependence were available for this report.

Social relations. There are 227 Indigenous societies in Brazil, with a total population of about 600 000 people. These people have rights to 106 million hectares of land in the Amazon, which is 13% of the national land area. Demarcation of the land is very slow, however, which leads to encroachment and conflict, and there is insufficient support for economic development (Sobral 2009).

The slow process of recognition and approval of tenure causes dissatisfaction on the part of Indigenous communities. Nevertheless, the situation has improved in some areas; Indigenous peoples' organizations are now both stronger and more numerous and Indigenous communities have started to grow, thus reducing fears of their extinction. On the other hand, the majority of Indigenous people still suffer from economic marginalization, malnutrition and inadequate assistance and protection (as they remain under the guardianship of the federal government). The *quilombolas* are another marginalized group with land rights: the government recognizes their right to the land where they live but, again, the process of formal recognition is slow (ibid.). The majority of the Amazon's inhabitants are recent settlers and differences in their backgrounds lead to frequent friction.

Summary

Significant advances have been made towards sustainable management in the Brazilian Amazon; for example, the area of certified natural forest has doubled since 2005. Despite continuing deforestation, clearance rates have declined dramatically in the last five years. Moreover, funds are being made available to improve forest management and protection, forest law enforcement is being strengthened, and new laws and regulations provide for improvements in forest management. A number of data-gathering services are greatly improving the availability and timeliness of forest-related information, although data on the management of forested protected areas were unavailable for this report. Efforts are also under way to clarify land tenure and to put FLONAs under management plans, and large areas of forest are managed by Indigenous and other local communities (although the process of recognition and approval of tenure is slow). Nevertheless, significant problems remain in the application of SFM in the tropical PFE. They include poor infrastructure; the remoteness of many forests from centres of commerce and control; the weak competitiveness of SFM as a land use; declining wood-processing capacity in the Amazon; and a lack of awareness about SFM – and its potential benefits – among timber operators. Given that development will continue in the region, probably at an accelerated rate, the Government of Brazil is pursuing several models to improve the competitiveness of natural forest management as a land use. It is also working to address institutional barriers to SFM and recent initiatives offer hope that the area of tropical PFE under SFM will expand significantly in the future.

Key points

- Brazil has a tropical-forest PFE of 310 million hectares, the largest in the tropics. Despite continuing deforestation, there are still huge forest resources in the Amazon.
- There has been a significant increase in the area of certified natural forest in the Amazon.
- At least 2.70 million hectares of natural tropical-forest production PFE are being sustainably managed; insufficient information was available to estimate the area of protection PFE so managed.
- Vast areas of the Amazon are currently under no threat of deforestation or other significant human-induced disturbance due to their remoteness.
- Since 2006, timber harvesting has been permitted in Brazil's public forests through forest concession contracts that can span up to 40 years; this system is in the early stages of implementation.
- A wide range of policies, strategies, laws and regulations have been developed to facilitate forest administration, improve timber legality and achieve SFM. Law enforcement has been strengthened, but the vastness of the resource and the spread of colonization make it difficult to control forest illegality.

- New laws have been enacted in an effort to improve the clarity of forest tenure in the Amazon and the management of public lands. Large areas of forest are allocated to Indigenous and *quilombola* communities, and a new law will increase opportunities for squatters to own land. Nevertheless, disputes over tenure remain a significant problem.

Endnotes

a Government of Brazil (2010).

b Personal communications with officials in the Brazilian Forest Service, 2008, 2010, 2011.

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COLOMBIA

Forest resources

Colombia has a land area of 114 million hectares and an estimated population in 2010 of 46 million people (United Nations Population Division 2010). It is ranked 77th out of 182 countries in UNDP's Human Development Index (UNDP 2009).

Colombia can be divided into five biogeographical regions: Amazonia, Orinoco, Andes, Caribbean and the Pacific, each of which is composed of a number of ecoregions. The Andes comprise the Eastern, Central and Western Cordilleras. The Pacific region is a coastal strip about 50 km wide between the Western Cordillera and the Pacific Ocean. The Amazon and Orinoco regions lie to the southeast and east of the Eastern Cordillera; their main rivers are the Putumayo and the Caqueta in the Amazon Basin and the Guaviare and the Meta in the Orinoco Basin. On the northern Caribbean coast, the Sierra de Santa Marta rises to over 5000 m above sea level.

FAO (2010a) estimated Colombia's total forest area at 60.5 million hectares, the Institute of Hydrology, Meteorology and Environmental Studies (*Instituto de Hidrologia, Meteorologia y Estudios Ambientales* – IDEAM) (2010) estimated the area of natural forest at 61.5 million hectares (Box 1) and Government of Colombia (2011) estimated it at 56.9 million hectares. IDEAM (2010) and FAO (2010) both estimated the area of planted forest at 405 000 hectares.

Forest types. The moist forest of the Darien Chocó on the Pacific coast covers about 4.9 million hectares. It includes terrace forests containing valuable timber species such as *Virola* spp, *Brosimum utile*, *Campnosperma panamensis*, *Jacaranda copaia*, *Couma macrocarpa*, *Tabebuia rosea* and *Humiriastym procerum*; there are also large tracts of swamp and 'catival' forests characterized by stands of *Prioria copaifera*.

Box 1 Forest cover, by biogeographical region

Region	Forest cover (million ha)
Andean	10.2
Pacific	4.9
Amazon	40.8
Orinoco	4.6
Caribbean	1.0
Total	**61.5**

Source: Derived from IDEAM (2010).

The various moist forest types of the Amazon cover about 40.8 million hectares, or 90% of Colombia's Amazonian territory. The main timber species are *Couma macrocarpa*, *Virola* spp, *Jacaranda copaia* and *Cedrela odorata*. The moist forests of the Orinoco cover about 4.6 million hectares.

In the Caribbean, the two main forest types – the moist forests of Urabá-Magdalena, and dry forests – have been reduced to about 1 million hectares, which is less than 20% of their initial area. The several types of submontane and montane Andean forests have also been reduced in size and, in total, now cover about 10.2 million hectares; common tree species include *Quercus humboltii* (roble) and *Podocarpus* spp. Colombia's mangroves cover an estimated 408 000 hectares (Spalding et al. 2010), more than 75% of which are on the Pacific coast.

Permanent forest estate. There is no formal PFE in Colombia; the estimates presented in Table 1 are indicative only. A forest law drafted in 2006 distinguishes between forest protected areas (*areas forestales de protección*) and forest production areas (*areas forestales de producción*), but this law has not been enacted (see below).

Forests in Colombia are classified as national forest reserves (*reservas forestales de orden nacional*) and

national parks (as part of the National Park System – *Sistema de Parques Nacionales Naturales* – SPNN). Other categories used for management are private reserves (*reservas naturales de la sociedad civil*) and integral reserves (*distritos de manejo integrado y de conservación*).

In 1959, Law 2 established seven national forest reserves covering 51.3 million hectares, of which 43.2 million hectares were still forested in 2002.[a] The SPNN includes 55 protected areas in IUCN categories I–IV, which cover nearly 12.6 million hectares (9.3 million hectares of which are forested[b]). An estimated 8.74 million hectares of national parks has been established on land originally designated as national forest reserves; thus, the forest area actually managed as national forest reserves is 34.8 million hectares.[b] Not all forest in national forest reserves is regarded as part of the PFE; in the absence of clearer data, therefore, the production PFE estimated in ITTO (2006) is used in Table 1 as the basis for the estimate for 2010.

Forest ecosystem health

Deforestation and forest degradation. Based on a visual classification of Landsat images made by IDEAM, FAO (2010b) estimated the average annual rate of deforestation in the period 2000–10 at about 101 000 hectares (0.17%) per year, significantly lower than the estimated 190 000 hectares (0.4%) per year estimated for the period 1990–2000. However, a specific study by IDEAM (2010) using high-resolution MODIS imagery indicated that about two million hectares of forests were lost between 2000 and 2007 – a deforestation rate of nearly 300 000 hectares per year.

Deforestation is highest in the Amazon (Caquetá, Putumayo and Guaviare rivers); the Pacific region (moist forest); the Andean region (sub-humid high-altitude forests, tropical dry Andean forests, pre-montane forests and forests in the Andean foothills) and the Caribbean region (sub-humid and dry forests in the plains, and riparian forests) (Government of Colombia 2008). According to Romero et al. (2008), the main cause of deforestation is colonization, including through small-scale and medium-scale agriculture, which contributes to about 73% of deforestation. In certain areas, illegal crops are another significant cause.

Small-scale logging is the most important cause of forest degradation: Romero et al. (2008) estimated that 42% of all logging carried out in Colombia is illegal. Table 2 shows an estimate of primary and secondary forest in Colombia.

Vulnerability of forests to climate change. Colombia's climate varies considerably between and within regions. In the Pacific region, for example, average annual rainfall varies between 3000 and 10 000 mm, depending on location. Changing

Table 1 Permanent forest estate

Reporting year	Estimated total forest area, range (million ha)	Total closed natural forest ('000 ha)	PFE ('000 hectares)			
			Production		Protection	Total
			Natural	Planted		
2005*	49.6–65.6	51 437	5500	148	8860	14 508
2010	**56.9–64.4**	**51 300****	**5500***	**405‡**	**9340**	**15 240**

* *As reported in ITTO (2006).*
** *Derived from Government of Colombia (2009) and personal communications (see endnote b).*
‡ *IDEAM (2010).*

Table 2 Forest condition

	PFE	Non-PFE	Total
	'000 ha		
Area of primary forest	-	-	8540
Area of degraded primary forest	-	-	-
Area of secondary forest	-	-	51 600*
Area of degraded forest land	-	-	-

* *'Other naturally regenerating forest'.*
Source: FAO (2010).

Box 2 Land ownership ('000 ha)

Category	State-owned (public)	Community-owned		
		Resguardos indígenas	***Consejos comunitarios***	**Area overlap***
Forest reserves	14 277	18 086	2454	1 area
National parks	5858	3478	2	-
Peasant reserves	501			-
Without category	10 741	4	1	some

* *i.e. between* resguardos indígenas *and* consejos comunitarios.
Source: Personal communications (see endnote b).

patterns in temperature and rainfall could lead to changes in forest ecosystems. For example, changes in humidity (in windward and leeward areas) could cause considerable change in mountain forest ecosystems, including cloud forest (*bosque de niebla)*. Pacific forests and cloud forests host a significant portion of the country's biodiversity and the consequences of their exposure to changing climatic patterns are unknown.

Forest fire has increased in frequency and intensity in recent years, possibly partly as a result of climate change. Colombia has prepared a map on the sensitivity of ecosystems to fire; the most sensitive are in the Orinoco and Amazon regions (IDEAM 2010). Generally, natural hazards affecting forests include those associated with the El Niño/Southern Oscillation phenomenon; hurricanes occasionally affect forests on the Caribbean coast.

SFM policy framework

Forest tenure. Since 1973 under Law 89/1890 the state has recognized the rights of Indigenous communities to land, and the 1991 Constitution recognizes the ancestral rights to land of Indigenous and Afro-Colombian traditional communities and their right to control and use their communal forest territories according to their social and cultural values. About half the country's forests (29.8 million hectares) are titled to Indigenous peoples (in what are known as *resguardos Indígenas*) in the wider Amazon region and Afro-Colombian communities in the Pacific region (in *consejos comunitarios*), and most of the remainder is state-owned (Table 3). Afro-Colombian and Indigenous communities have obtained titles to more than 35 million hectares of land, of which around 29.8 million hectares are forest. In some cases, there is overlap between these titles and national forest reserves (20.4 million hectares of overlap) and national parks (3.5 million hectares of overlap) (IDEAM 2010). About half a million hectares are designated as peasant reserves (*reservas campesinas*), which are set aside as special development areas for rural communities. Box 2 shows the breakdown of state and community owned forests in Colombia.

Criteria and indicators. Colombia has developed its own set of C&I for SFM based on the ITTO C&I and is also involved in the C&I process coordinated by the Amazon Cooperation Treaty

Table 3 Forest area, by tenure

Ownership category	Total area	Of which PFE	Notes
	'000 ha		
State ownership (national, state or provincial government)	31 377	-	Includes about 15.4 million hectares of state/federal forest land.
Other public entities (e.g. municipalities, villages)	0	-	
Total public	**31 377**	**-**	
Owned by local communities and/or Indigenous groups	29 867	-	Comprises 26.3 million hectares of Indigenous territories (*resguardos indigenas*) and 3.5 million hectares of Afro-Colombian land (*consejos communitarios*).
Private owned by firms, individuals, other corporate	200	-	Owned by companies or associations.

Source: Government of Colombia (2009), IDEAM (2010).

Organization. The Government of Colombia used the ITTO C&I in its submission to ITTO for this report.[a]

Forest policy and legislation. Colombia's principal forestry policy is defined in the National Forestry Development Plan (*Plan Nacional de Desarollo Forestal*) published in 2000, which is designed to span 25 years and comprises 16 sub-programs to promote planted forests and natural forest management. The National Biodiversity Policy (*Política Nacional de Biodiversidad*), issued in 1995, and its associated action plan, has three components – conserve, understand and utilize (*conservar, conocer y utilizar*) – and 92 actions.

In early 2006 the Colombian Congress passed and the President signed a new General Forest Law (*Ley General Forestal*, *Ley* 1021), replacing the 1959 forest law. This law was challenged, however, and declared unconstitutional by the Constitutional Court on the basis that it did not sufficiently take into account the requirements of the International Labour Organization's Convention 169 (Indigenous and Tribal Peoples Convention, 1989). As a consequence, in addition to the National Forestry Development Plan, the government's priorities with regard to forests are established under the 2007 law on a national development plan for 2006–10 (*Ley* 1151, 2007).[b]

Regulations for conservation and forest management include the Forest Law (1959), which established the seven national forest reserves, a 1974 decree (*Decreto* 2811), which adopted the National Code of Renewable Natural Resources (*Código Nacional de Recursos Naturales Renovables y de Protección al Medio Ambiente*), the 1993 General Environment Law (*Ley General Ambiental*, *Ley* 99), which adopted the National Environmental System, and a 1996 decree (*Decreto* 1791), which adopted a forest harvesting regime.

In 2010, Law 1377 was approved, which permits the use of planted forests for production purposes, even if they have been declared as protection forests. In order to improve efficiency and competitiveness it also eliminates the requirement that the owners of planted forests receive government permission to harvest their commercial plantations. Regulations that restrict the export of logs from natural forests have been in place for more than 15 years; only roundwood harvested in planted forests may be exported.

Institutions involved in forests. Law 99 (1993) created the Ministry of Environment, which replaced the former forest service (*Instituto de Desarrollo de los Recursos Naturales Renovables*). In 2001, the Ministry of Environment became the Ministry of Environment, Housing and Territorial Development (*Ministerio de Ambiente, Vivienda y Desarrollo Territorial*), now known as MINAMBIENTE. According to Law 1377 (2010), the Ministry of Agriculture and Rural Development (*Ministerio de Agricultura y Desarrollo Rural* – MADR) is the main agency for commercial plantation forestry, the formulation of policies for commercial forest activities, and the implementation of an incentive program (*Certificado de Incentivo Forestal*) to support commercial forest development. MINAMBIENTE formulates policy on the environment and renewable natural resources and establishes the broad guidelines, rules and criteria for the environmental regulation of land use, including forestry (in close collaboration with MADR with regard to commercial forest plantations).

Law 99 (1993) also created five entities to promote research on the conservation and sustainable use of biodiversity in Colombia: IDEAM; *Instituto de Investigaciones Marinas y Costeras 'José Benito Vives de Andreis'*; *Instituto de Investigación de Recursos Biológicos 'Alexander Von Humboldt'*; *Instituto Amazónico de Investigaciones Científicas*; and *Instituto de Investigaciones Ambientales del Pacífico 'John Von Neumann'*. These institutes have no specific functions in forestry, but they do influence forest management and conservation.[b] The National Corporation for Forestry Research and Development (*Corporación Nacional de Investigación y Fomento Forestal* – CONIF), created in 1974, supports the forest administration through capacity-building and research, and performs knowledge management functions in natural resource management.[b]

Colombia is one of the most decentralized countries in Latin America: 40% of total public expenditure is managed locally (by municipalities). The management of forests is part of the National Environmental System (*Sistema Nacional Ambiental*), which was established by Law 99 (1993) and consists of 33 autonomous regional corporations (*corporaciones autónomas regionales y las corporaciones de desarrollo sostenible*). These are responsible for the management and administration

of all natural resources in the area of their jurisdiction, including the granting of concessions, permissions and authorizations for forest harvesting (ITTO 2006).

International and Colombian NGOs play an important role in the development and monitoring of forest resources – they include WWF, The Nature Conservancy, Conservation International and *Fundación Natura*. Public universities, such as *Universidad Nacional de Colombia*, *Universidad de Tolima*, *Universidad Distrital Francisco José de Caldas* and *Universidad Industrial de Santander*, also have functions in forest research and development. There are no major forest industry associations and international donor support for forestry is relatively limited.

Status of forest management

Forest for production

Colombian regulations related to the harvesting of timber resources differentiate between public and private lands. For public land, access is obtained through permits and concession contracts; for private land, special authorizations are required. No forest concession has been allocated in natural forests in the last 25 years. Cutting permits, which include legal requirements for management procedures, are used widely in natural forests. When forests are converted to other land uses or for the development of infrastructure, the law stipulates compensation measures, generally in the form of protective planted forests. There is considerable legislation governing forest management, with detailed instructions on the preparation of management plans. However, the degree of control exercised by regional corporations in charge of forest management is not clear and there may be large differences in the way in which management standards are applied in different parts of the country (ITTO 2006). Work has started on the implementation of a national forest inventory, and remote sensing techniques are now used widely and the knowledge base about forest resources is improving.[b]

Silviculture and species selection. Forest harvesting is generally carried out under timber-licence contracts and authorizations granted to private owners by regional corporations. There are 19 regional corporations in major forest areas, which allocate, on average, about 100 cutting permits per year; nationwide, therefore, about 1900 cutting permits are granted annually.[a] Generally, there is no systematic application of silviculture, even though this is required for ongoing logging activities under *Decreto* 2811 (1974; Article 213) and *Decreto* 1791 (1996, Article 5b) (ITTO 2006).

IDEAM (2010) reported that more than 14 million m^3 were harvested in the period 2004–09. About 251 timber species are used, but nine species predominate. The average harvest in natural forest is in the range of 20–50 m^3 per hectare. Many timber species are subject to uncontrolled salvage logging, especially in the Pacific region, among them *Brosimum utile* (sande, huina), *Carapa guianensis* (andiroba), *Cedrela odorata* (cedro), *Prioria copaifera* (cativo), *Campnosperma panamensis* (sajo) and *Tabebuia serratifolia/T. rosea* (cedro rosado). Table 4 lists five commonly harvested timber species in Colombia.

Planted forest and trees outside the forest. The estimated planted forest area in 2010, both for production and for protection purposes, was 405 000 hectares. The main plantation species are *Pinus caribaea*, *P. oocarpa* and, in particular, *P. patula* (pino candelabro); these comprise 55% of the total planted forest area. Eucalypts (including *Eucalyptus globulus, E. camaldulensis* and *E. urophylla)* account for about 20% of the planted forest area, and *Acacia mangium* and other broadleaved species, in particular *Gmelina*

Table 4 Commonly harvested species for industrial roundwood

Species	Notes
Eucalyptus spp*	From commercial plantations; more than 500 000 m^3 per year.
Pinus spp (pino)*	At least four species; more than 200 000 m^3 per year.
Prioria copaifera (cativo)*	Often in nearly pure stands (*cativales*; more than 100 000 m^3 per year).
Campnosperma panamensis (sajo)	100 000+ m^3 per year (Cauca and Nariño regions).
Cariniana pyriformis (abarco)*	Widely distributed; outdoor and indoor use, furniture.

* *Also listed in ITTO (2006).*
Source: Government of Colombia (2009).

arborea and *Tectona grandis* (teak, teca), are also widely planted. Indigenous species used in plantations include *Cordia alliodora* (vara de humo), *Bombacopsis quinata* (ceiba tolúa), *Tabebuia rosea, Alnus acuminata* (aliso), *Lafoensia speciosa* and *Quercus humboltii* (roble) (ITTO 2006). The country intends to increase its planted forest area, particularly for production purposes, to 5 million hectares or more in coming years.[a]

The National Forestry Development Plan proposes that larger plots of degraded forest should be identified as potential production forest, but currently no large permits have been granted. Pilot projects have developed management plans and silvicultural interventions for certain areas, including three ITTO-supported field projects – in Guaviare (74 000 hectares, including 2500 hectares of managed natural forest), Chocó (2000 hectares of protective planted forest) and an area of 64 000 hectares of degraded natural forest and planted forest in San Nicolás/Río Negro. In the Amazon region there are pilot areas totalling about 120 000 hectares that include sustained-yield management (ITTO 2006). In all these pilot areas, forest management plans have been prepared and are being implemented through multi-stakeholder approaches. An estimated 200 000 hectares of protective plantations were established in the period 2002–2010.[b]

Forest certification. Voluntary certification is gaining ground in Colombia. In 2005 two planted forest areas covering 58 444 hectares were certified (ITTO 2006). In December 2010, three forest plantations covering an area of 96 167 hectares were certified by the FSC; in addition, a group community certification in natural forests has been issued in Chocó (comprising the Darién community and Dos Bocas Rio Sucio), covering a total area of 9742 hectares (FSC 2010). Thirty-five chain-of-custody certificates were valid in December 2010.

Estimate of the area of forest sustainably managed for production. Little information is available on the quality of natural forest management in Colombia. Data on the extent of natural forests under forest management plans are scarce, although about 19 million hectares of forest land have been classified or described under forest 'ordination' plans, which are the major planning instruments used by regional corporations to manage forest land.[b]

ITTO activities support forest management in a number of areas. The forest area influenced by the former ITTO project in San Nicolás/Río Negro continues to benefit from high forest management standards. These areas together cover about 50 000 hectares of natural forests. In addition, the small community managed certified forests in Chocó (9742 hectares) are counted in Table 5 as sustainability managed. Other initiatives that are implementing SFM-based approaches include the USAID-supported More Investment in Alternative Sustainable Development Program (*Programa Mas Inversión para el Desarrollo Alternativo Sostenible*), which funded five community forest projects in the Pacific region in the period 2007–10 over an area of about 120 000 hectares of natural forest. Also in the Pacific region (Department of Chocó) the United Nations Office on Drugs and Crime (UNODC) is funding the Monte Bravo project, which is supporting local communities to formulate a sustainable forest plan for 38 000 hectares of natural forest and to assemble an efficient system for extraction and wood processing. In addition, the European Commission has supported, since 2007, the projects *Bosques FLEG [Forest Law Enforcement and Governance] Colombia* and *Proyecto Forestal Guaviare* over an area of 97 000 hectares in the Amazon region. Thus, the total natural forest area considered to be under SFM in the production PFE is around 315 000 hectares.

Table 5 Management of the production PFE ('000 hectares)

Reporting year	Natural					Planted		
	Total	Available for harvesting	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
2005*	5500	2150	-	0	200	148	80	58
2010	**5500**	**-**	**-**	**9**	**315**	**405**	**150**	**96**

* *As reported in ITTO (2006).*

Timber production and trade. The production of industrial roundwood from natural and planted forests in 2009 was estimated at 2.05 million m^3, compared with 3.01 million m^3 in 2004 (ITTO 2011). Nearly all this timber served the domestic market. Industrial wood is used in Colombia for sawnwood, plywood, particleboard and pulp. An estimated 723 000 m^3 of sawnwood was produced in 2009, compared with 407 000 m^3 in 2005 (ITTO 2011). Overall, total domestic production is relatively low compared with the economic potential of the country. Fuelwood production is estimated at 10–12 million m^3 per year and has remained more-or-less stable in the past ten years.[a]

Non-timber forest products. More than 300 NTFPs are known in Colombia. A wide range of medicinal herbs are gathered and used locally and sometimes sold in local markets or even packaged for more distant markets.[a] Few data are available on the variety, value and production systems of NTFPs, however. *Guadua angustifolia* (guadua), a native bamboo, is used mainly for local housing construction but also by modern architectural designers and in handicrafts. In the departments of Caldas, Quindío, Risaralda, Tolima and Valle del Cauca the natural area of guadua is about 21 000 hectares, supplemented by 5100 hectares of plantations; total annual production exceeds 250 000 m^3 (CONIF 2004). The principal NTFPs harvested in natural forests are rubber, palm fruits (particularly *Mauritia flexuosa* – canangucha – and *Euterpe precatoria* – asahí), fruits from *Theobroma grandiflorum* (copoazu), *Euterpe oleracea* (palm hearts), *Chamaedorea* spp (xate leaves) for ornamental use, and wildlife, especially fish and reptiles. Coca, although illegal, is widely grown.

Forest carbon. Information on forest carbon in Colombia is relatively limited, with existing information at the national level distributed among various entities and institutions. Gibbs et al. (2007) estimated the total forest biomass carbon stock in the range 2529–10 085 MtC, Eggleston et al. (2006) estimated it at 11 467 MtC and FAO (2010) estimated it at 6805 MtC. IDEAM (2010) made a preliminary estimate at the tier 1 level for the five main biogeographical regions (Box 3), and estimated total biomass carbon stock at 7443 MtC. The carbon capture and storage potential of Colombia's forests through reduced deforestation and forest degradation and enhanced forest restoration and establishment is relatively high.

Box 3 Average forest carbon per hectare, by region

Region	Living biomass above ground (t/ha)	Carbon (t/ha)
Andes	251	126
Pacific	182	91.0
Amazon	257	128
Orinoco	203	101
Caribbean	245	122

Note: One tonne of carbon is equivalent to 3.67 tonnes of CO_2e.
Source: IDEAM (2010).

In partnership with ITTO, Colombia implemented one of the first projects on forest carbon storage and sequestration, starting in 1999. This project generated knowledge and experience on carbon accounting and the benefit-sharing issues surrounding a potential REDD+ mechanism; it is now integrated with the World Bank's Biocarbon Fund. Colombia is also participating in international REDD+ initiatives, including the Forest Carbon Partnership Facility (since 2008) and the REDD+ Partnership (since 2010). The Government of Colombia is an observer at UN-REDD. Table 6 summarizes Colombia's current forest carbon potential.

Forest for protection

Soil and water. Colombia is one of the ten most productive countries in terms of freshwater yield (ITTO 2006). Environmental campaigns have been

Table 6 Forest carbon potential

Biomass forest carbon (MtC)	% forest with canopy cover >60%	Deforestation/ degradation potential to 2030	Enhancement of carbon sink capacity to 2030	Forest area change monitoring capacity	Forest/ GHG inventory capacity	Importance of forest fire/ biomass burning	Engagement in international REDD+ processes
2529–10 085	60	+++	+++	++	++	++	++

+++ high; ++ medium; + low; estimate of national forest carbon based on Gibbs et al. (2007); estimate of % total forest with canopy cover >60% based on UNEP-WCMC (2010).

launched in major cities to inform communities about the importance of water conservation. Fifty-two protection forest areas have been classified, covering about 306 000 hectares.[a] In addition to the SPNN, over 3.8 million hectares of land are classified for their protective functions, comprising forest reserves (522 000 hectares), productive–protective forest reserves (252 000 hectares), integrated management districts (2.78 million hectares) and conservation districts (300 000 hectares). Through its system of regional corporations, the government promotes watershed reforestation projects: in the past 15 years, more than 310 000 hectares of new protective plantations have been established.[b] Many Colombian electricity and water companies charge customers an extra fee to cover the cost of watershed management.[a]

Biological diversity. Colombia has one of the highest levels of species diversity in the world, boasting some 55 000 plant species, of which one-third are endemic (Colombia is one of the top 20 countries in the world in this respect), as well as 1721 bird species and 205 reptile species. Forty-three mammals, 73 birds, 203 amphibians, four reptiles, one arthropod and 13 plants found in forests are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species (IUCN 2011). Six plant species are listed in CITES Appendix I, 250 plant species are listed in Appendix II and two species are listed in Appendix III (UNEP-WCMC 2011). Timber species listed in Appendix II include *Swietenia macrophylla, S. mahagoni* and *Guaiacum officinale*. At least 40 tree species in Colombia are threatened by over-exploitation[a], including, besides those listed in CITES appendices, *Aniba perutilis* (comino crespo), sande, *Cariniana pyriformis* (abarco), *Huberodendron patinoi* (carra) and *Humiriastrum procerum* (chanó).[a]

Extent of protected areas. The total extent of protected area in Colombia is 12.6 million hectares, including both forested and non-forested land (IDEAM 2010). The two main categories

Forest landscape restoration under the ITTO–Cornare forest carbon project in Valle San Nicolas.

of protected area are the SPNN and civil-society reserves. The SPNN comprises 55 protected areas in IUCN categories I–IV, covering nearly 10.3 million hectares (9% of the country's land area). Thirteen percent of the Amazon region and 13% of the Andean region are in protected areas, of which 9.34 million hectares are forested (IDEAM 2010, WCMC-UNEP 2010). National parks overlap about 40% of the territories owned by Indigenous communities, or about 1 million hectares (Kernan et al. 2006). No data are available on the connectivity of the protected-area system. According to UNEP-WCMC (2010), about 8.3 million hectares of protected areas in IUCN classes I–IV have a crown cover of 60% or more.

Estimate of the area of forest sustainably managed for protection. In some areas the integrity of forest protected areas is secure but in other areas it is threatened by a lack of control, the activities of guerrillas and paramilitaries, and drug-trafficking. It is considered that the 456 000 hectares of forests that fulfil particular soil and water protection functions are sustainably managed because they are covered by management plans and their management is financed partly by payments for ecosystem services (Table 7).[c] Large tracts of other protection forest may also be secure due to their remoteness.

Table 7 Management of the protection PFE ('000 hectares)

Reporting year	Protection PFE	Attributed to IUCN categories I–IV	Allocated for soil and water	With management plans	Sustainably managed
2005*	8860	8860	312	-	-
2010	**9340**	**9340**	**456****	**456**	**456**

* *As reported in ITTO (2006).*

** *Comprises water and soil protected areas and special reforestation areas for water and watershed protection.*

Socioeconomic aspects

Economic aspects. Although forests cover more than half of Colombia, their contribution to its GDP is only about 1%.[a] This is due partly to the absence of large-scale timber concessions and related industries and to widespread uncontrolled deforestation and degradation, which makes wood abundant and keeps domestic prices for timber and fuelwood low. In Colombia, there is little price incentive for natural forest management.[a] The trade balance in forest products is negative because of the import of pulp and paper, although the gap declined from US$280 million in the 1990s to US$50 million now.[a] It is estimated that the forest sector provides employment for 54 000 people, comprising 24 000 in forest industry and 30 000 in reforestation (ITTO 2006).

Livelihood values. Hundreds of plants are used by local communities for medicinal purposes. The domestication of wild animals is another important economic activity, including species as different as crocodiles and butterflies. The gathering of ornamental plants, particularly orchids, is important in the low-level cloud forest and contributes locally to livelihoods. Illegal coca production and trade remain the most attractive economic activities for many colonists living in the foothills of the Andes in the agricultural frontier areas of Alto Putumayo, Alto Caquetá, Macarena, Guaviare, Nariño and Magdalena Medio. This is despite a sharp decrease in production area, from more than 170 000 hectares in 2000 to 81 000 hectares in 2008 (UNODC 2009).

Social relations. The main forest zones are inhabited nearly exclusively by Indigenous or Afro-Colombian communities. Their traditional lifestyles are linked closely to the use of forest resources through shifting cultivation and hunting, fishing and the gathering of forest products. The 1991 Constitution and laws 99 and 70 (1993) recognize this and make specific reference to such traditional forest uses. There are conflicts over timber resources and illegal crops between local forest users and the armed forces of various factions. A considerable number of Colombian Indigenous and Afro-Colombian organizations are active in the national dialogue on forests, including the *Organización Nacional de Indígenas de Colombia*, the *Consejo Regional Indígena del Cauca*, the *Asociación de Cabildos Indígenas del Norte del Cauca* and the *Organización Indígena de Antioquia*. Representing Afro-Colombian communities are the *Proceso de Comunidades Negras*, the *Conferencia Nacional de Organizaciones Afrocolombianas*, the *Asociación de Afrocolombianos Desplazados* and the *Movimiento Nacional Cimarrón*.

Summary

Nearly the entire natural forest estate of Colombia is officially protected and the main forest products are ecosystem services or forest products other than timber. The 1991 Constitution recognizes the rights of Indigenous peoples and Afro-Colombians over their territories and their right to control and use their communal forest territories according to their social and cultural values. Forests in Colombia are administered within the wider context of environmental management, and existing policy goals emphasize protection and conservation functions as well as forest restoration and forest land rehabilitation. Generally, there is little control over forest resources on the ground and illegal activities in forest areas appear to be widespread. Large forest tracts remain inaccessible for legal management activities because rebels and paramilitaries exercise control over them. Despite these difficulties there is progress in the collection of data on tropical forests and biodiversity, the demarcation of property boundaries and the provision of land titles, the implementation of conservation programs, and the enforcement of land-use plans and regulations.

Key points

- Colombia has an estimated PFE of 15.2 million hectares (compared with 14.5 hectares in 2005), comprising 5.5 million hectares of potential production PFE (the same as in 2005, mainly degraded forests available for plantations), 9.34 million hectares of protection forest (compared with 8.86 million hectares in 2005) and 405 000 hectares of planted forest (compared with 148 000 hectares in 2005).
- At least 771 000 hectares of natural forest, comprising 315 000 hectares of production PFE and 456 000 hectares of protection PFE, are considered to be under SFM; about 9000 hectares of community-managed natural forest is certified. Forest land-use plans exist over an area of about 19 million hectares.

- Combined, Indigenous communities in the Amazon region and Afro-Colombian communities, mainly in the Pacific region, own nearly 30 million hectares of natural forests, nearly half the total forest estate.
- No specific standards have been established for large-scale timber production forestry and no policy for timber concessions is in place.
- There are well-established systems for protected areas and biodiversity monitoring.
- The wider role of forests in providing ecosystem services (such as hydrological services) is recognized in Colombia and considerable areas of forest benefit from payments for them.

Endnotes

a Government of Colombia (2009).

b Discussion and information exchange with the sustainable forest management group (*Grupo de Desarrollo Sostenible de Bosques*), *Dirección de Ecosistemas, Ministerio de Ambiente, Vivienda y Desarrollo Territorial*, 2011.

c ITTO estimate.

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ECUADOR

Forest resources

Ecuador has a land area of 27.7 million hectares and an estimated population in 2010 of 13.7 million people (United Nations Population Division 2010). Ecuador is ranked 80th out of 182 countries in UNDP's Human Development Index (UNDP 2009). The country comprises four main biogeographical zones: the Andean mountains (sierra); the Pacific coast; the Amazon Basin; and, 1000 km from the coast in the Pacific Ocean, the Galapagos Islands. FAO (2010a) estimated the forest area at 9.87 million hectares in 2010, which is 36% of the land area. The Government of Ecuador (2009) estimated the total forest area at 11.2 million hectares.

Forest types. There are three major forest types: Amazon rainforest, comprising about 62% of the forest estate; montane (*sierra*) forests of various types in the Andes (on the western and eastern slopes, at lower and upper levels, and towards the Andean high peaks), comprising about 21% of the forest estate[a]; and tropical rainforest in the coastal plains of the Pacific region (mainly in Esmeraldas Province), which contains about 17% of the forests. Mangrove forests were once widespread but now cover only about 158 000 hectares (Spalding et al. 2010).

The most common commercial species in the more humid northern part of the country are *Protium* and *Dacryodes* spp, Laureaceae, *Brosimum utile, Inga* spp, *Pourouma chocoana* and *Ceiba pentandra* (kapok). The main commercial species in the drier semi-humid forests in central areas and the south coast are *Cordia alliodora* (laurel), *Pseudosamanea guachapele, Tabebuia* spp and various Bombacaceae (e.g. *Ceiba* and *Bombax* spp, and balsa – *Ochroma lagopus*).

Permanent forest estate. Ecuador has not defined a PFE but there is a clear distinction between forests for (potential) production and forest for protection, and the latter is clearly delimited.[a] The Government of Ecuador (2009) estimated the total area that is potentially used as production forest at 4.51 million hectares and the total area of protected forests at 6.55 million hectares, but the production forest area that can be considered as permanent forest estate is only about 2 million hectares (Table 1).[a] Protection forests are classified in the national system of protected areas (*Sistema Nacional de Áreas Protegidas* – SNAP). The area of forest that might be considered PFE is about 8.7 million hectares[a], most of it part of the SNAP. Only a small portion of the production PFE is considered economically harvestable due to steep slopes in mountainous terrain, low timber density, difficulty of access, and social constraints (ITTO 2006). There are about 175 000 hectares of planted forests.[a]

Forest ecosystem health

Deforestation and forest degradation. Ecuador has the highest rate of deforestation of any South American country. This is due to a number of factors, including policies favouring the development of pastures and commercial agriculture; colonization; oil and timber exploration; insecure land tenure; and weak public institutions. Aquaculture for shrimp production has expanded rapidly on the Pacific coast in the past 15 years and is responsible for the loss of nearly 80 000 hectares of mangrove forests.[a] FAO (2010b) estimated the annual loss of forest cover between 2005 and 2010 at an average 198 000 hectares (1.89%) per year. In relative terms, deforestation is highest in the dry forest of the southern coastal region (more than 2% per year[a]), but it is also high in the humid tropical lowland forests of the Pacific coast and is increasing in the Amazon region.

Table 1 Permanent forest estate

Reporting year	Estimated total forest area, range (million ha)	Total closed natural forest ('000 ha)	PFE ('000 hectares)			
			Production		Protection	Total
			Natural	Planted		
2005*	8.4–11.4	10 854	3100	164	4300	7564
2010	**9.87–11.2**	**5813****	**1964‡**	**175**	**6554†**	**8693**

* *As reported in ITTO (2006).*

** *Calculated using the ratio of forest with greater than 60% forest cover estimated by UNEP-WCMC (2010) (58.9%) and the total natural forest area as estimated by FAO (2010a).*

‡ *Includes harvested areas in state forests (*patrimonio forestal del estado*), as reported by Government of Ecuador (2009).*

† *Includes public protection forests and the area in SNAP. Some of this area may no longer be forested.*[a]

Illegality and corruption contribute indirectly to deforestation and biodiversity loss by undermining enforcement by government institutions (USAID 2006).

Table 2 summarizes forest condition. Intact or slightly degraded primary forests cover about 3.9 million hectares, and secondary forests and scrublands (*matorrales*) together cover about 6.3 million hectares. Most of the secondary forests are in the Pacific coast region.[a]

Vulnerability of forests to climate change. Ecuador is highly vulnerable to the impacts of climate change due to its geographical location, rugged topography and exposure to El Niño events, as well as to the dependence of key economic sectors on resources that are affected by climate. Many population centres are at high altitudes and rely particularly on receding alpine glaciers and high-elevation forests and grasslands for their water supply. High-altitude ecosystems are likely to suffer more from climate-change impacts than lower-lying areas (IUCN 2009). Uncontrolled forest fires are a major threat, particularly on the Pacific coast; landslides in mountainous regions are also common after heavy rainfall.

SFM policy framework

Forest tenure. Most of Ecuador's forests are owned by local communities and Indigenous groups (ancestral Indigenous or Afro-Ecuadorian), although the majority are not subject to official land titles. The National Strategy for Sustainable Forest Development (*Plan Nacional de Desarrollo Forestal Sostenible*) 2007–2011 includes legal provisions for the allocation of forests to Indigenous communities, farmers and other groups already in possession of forest lands on the condition that they guarantee the sustainable management and conservation of the allocated forests.[a] The country's 2008 Constitution also fully recognizes the rights of Indigenous communities (see below).

There is a great deal of overlap between the areas in the SNAP and private and Indigenous lands. International support is needed to help secure tenure, mark boundaries and establish participatory surveillance systems over 1.6 million hectares of Indigenous land.[a] Table 3 summarizes the forest-tenure situation.

Criteria and indicators. Ecuador established its own set of C&I for SFM based on those of ITTO. This has been used in strategic planning but today its use is limited.[a] The Government of Ecuador used the ITTO C&I in its submission to ITTO for this report.[a]

Table 2 Forest condition

	PFE	Non-PFE	Total
	'000 ha		
Area of primary forest	-	-	3900
Area of degraded primary forest	-	-	1300
Area of secondary forest	-	-	1200
Area of degraded forest land	-	-	3800

Source: Derived from Government of Ecuador (2009).

Table 3 Forest area, by tenure

Ownership category	Total area	Of which PFE	Notes
	'000 ha		
State ownership (national, state or provincial government)	3940	-	State production forests and SNAP/*patrimonio forestal del estado*.
Other public entities (e.g. municipalities, villages)	-	-	Municipalities regulate freshwater protection and thus also large parts of protection forests.
Total public	**3940**	**-**	
Owned by local communities and/or Indigenous groups	6830	-	Includes forested areas and formerly forested areas now used as village agricultural land.
Private owned by firms, individuals, other corporate	40	-	Mainly forest plantations; agroforestry plantations are not considered forest land.

Source: Based on ITTO & RRI (2009).

Forest policy and legislation. Ecuador's 20th constitution since 1830 was approved in September 2008. The rights established by its Article 84 enfranchise thousands of Indigenous people, many of them living in forested areas. Along with Indigenous rights, the Constitution recognizes the rights of nature[a] and the role of the state in the conservation, sustainable use and restoration of fragile ecosystems such as the *páramo* (non-forested sub-alpine areas), humid areas, mangroves, cloud forests and tropical dry and humid forests (Article 406). Article 407 prohibits extractive activities in protected areas, including timber harvesting.[b]

The Forest Law (*Codificación de la Ley Forestal y de Conservación de Áreas Naturales y Vida Silvestre,* L.74-PCL. RO 64*)*, which dates from 1981, assigns the ownership and control of all forest resources to the national government. The provisions of the Forest Law were never fully implemented, however, and many substantial changes in the administration and control of Ecuador's forests have been made by the Ministry of Environment (*Ministerio del Ambiente*).[a] The Forest Law provides the legal basis for the SNAP and for the protected-area system that was created under Article 86 of the 1998 Constitution (*patrimonio de áreas naturales del estado* – PANE).

A new forest law based largely on the examples of Chile and Costa Rica was prepared in 2001 but never approved.[a] The Forest Law (1981) is under revision to reflect the new orientation of the state as defined by the new Constitution.[b] The baseline of the revision is the National Strategy for Sustainable Forest Development 2007–2011, a multi-stakeholder document that lays out a vision for SFM and forest conservation and which recognizes the important role of local communities and other sectors in achieving SFM.[b]

The National Forest and Reforestation Programme (*Plan Nacional de Forestación y Reforestación*), which was approved in September 2006, includes among its goals the creation of 750 000 hectares of new industrial forest plantations, 150 000 hectares of agroforestry schemes and 100 000 hectares of protective plantations in a 20-year period.

In September 2008, the Ministry of Environment launched its *SocioBosque* Program as one of the elements of a national REDD framework (see below). *SocioBosque* provides economic incentives to landowners who voluntarily decide to protect their forest. *SocioBosque* aims to preserve natural forests and other native ecosystems and thereby protect their ecological, economic, cultural and spiritual values. It also aims to achieve a significant reduction in deforestation and associated emissions of GHGs. *SocioBosque* is fully financed by public funds but additional funds are required from international sources, including those associated with REDD, in order to fully accomplish its goals.[a]

Institutions involved in forests. Many Ecuadorian government institutions have responsibilities related to forests and the conservation of biodiversity. At the national level, the Ministry of Environment and its Forest Service (*Dirección Forestal*, under the *Sub-Secretaría del Patrimonio Nacional*) administers forests and protected areas, enforces the Forest Law and international treaties, implements international conservation projects, and approves environmental assessments. Through Executive Decree 931 of February 2008, responsibility for industrial plantations and agroforestry was assigned to the Ministry of Agriculture, Aquaculture and Fisheries (*Ministerio de Agricultura, Acuacultura y Pesca*), which subsequently created in the same year a specific institution (*Unidad para el Desarrollo*

Forestal del Ecuador – PROFORESTAL) to fulfill this task. The Ministry of Environment is responsible for the program to establish and manage protective plantations (*Programa de Plantaciones para la Protección y Conservación de los Recursos Naturales*).

The principal state institution in charge of the planning and operation of production forestry is the National Secretariat for Planning and Development (*Secretaría Nacional de Planificación y Desarrollo* – SENPLADES), which is in charge of the implementation of the overall development plan for Ecuador. SENPLADES closely coordinates forest planning with the Forest Service and PROFORESTAL.

Ecuador has more than 60 non-profit environmental NGOs. Some, such as *Fundación Natura*, are large, while others may consist of only a few people working on a specific environmental problem in a restricted geographic area. Indigenous organizations have a profound impact on the conservation of biodiversity and forests because they represent the owners of over 6 million hectares of land, much of it in the biodiversity-rich Amazon.

Many Ecuadorian businesses are involved in the extraction and processing of natural resources. National and international companies involved in oil production, mining, tourism, agribusiness and the wood industry, for example, can stimulate deforestation and forest degradation. Oil is particularly important to Ecuador's economy. Oil exploration, extraction, transport and processing can cause large-scale, permanent direct and indirect negative impacts on forests.

Forest-owners and timber industries are organized in associations (*Asociación Ecuatoriana de Industriales de Madera* – AIMA, *Asociación Ecuatoriana de Productores de Teca y Maderas Tropicales* – ASOTECA and others) and special initiatives (e.g. *Corporación de Manejo Forestal Sustentable* – COMAFORS). They play an active part in policymaking and forest development. Eight universities offer forestry education, including *la Escuela Superior Politécnica de Chimborazo*, *Universidad Técnica Estatal de Quevedo*, *Universidad Técnica de Esmeraldas*, *Universidad Nacional de Loja*, *Universidad Agraria del Ecuador*, *Universidad Técnica del Norte*, *Universidad Estatal del Sur de Manabí* and *Universidad Internacional SEK*.[a]

Status of forest management

Forest for production

Forest use is regulated through a number of norms dealing with forest management, particularly:

- Rules on Sustainable Forest Management for Timber Harvesting in Moist Forests (*Normas para el Manejo Forestal Sustentable para Aprovechamiento de Madera en Bosque Húmedo – Acuerdo Ministerial* 039, 2004).
- Rules for Timber Harvesting in Plantation Forests and Trees in Agroforestry Systems *(Normas para el Aprovechamiento de Madera en Bosques Cultivados y de Árboles en Sistemas Agroforestales – Acuerdo Ministerial* 040, 2004).
- Rights to Timber Harvesting *(Derecho de Aprovechamiento de Madera en Pie – Acuerdo Ministerial* 041, 2004).
- Directives on Log-scaling for Forest Control at Road Checkpoints *(Instructivo de Cubicación de Maderas para Controles Forestales en Vías Terrestres – Acuerdo Ministerial* 053, 2001).

Forest harvesting in state production forests requires a forest inventory, the preparation of a forest management plan, the physical demarcation of concession limits, social payments and payments for silvicultural treatments. A forest-control entity called *Vigilancia Verde* has been in place since 2001 with the overall task of supervising the flow of forest products from the forest to the marketplace. Another body, *Regencia Forestal*, was created to increase the transparency of *Vigilancia Verde*, to provide technical assistance and support law enforcement in forest operations, and to oversee the implementation of C&I in forest management.

There is no coordinated approach to natural forest management in Ecuador; many potential management techniques have not yet been put into practice. Before 1980, several licensed logging concessions operated in defined areas with specified annual yields. The legal and practical provisions were similar to those operating in many other countries and, as elsewhere, there were serious difficulties of control, supervision and protection. Concession management was abandoned in the early 1980s (ITTO 2006). Ecuador now uses a system of short-term logging licences which, in addition to its impact on the quality and efficiency of logging operations, has encouraged foresters to

consider other ways of ensuring future long-term supplies of timber, particularly through the development of forest plantations and agroforestry. There is strong pressure on the natural-forest resource from informal and illegal operators, who resist regulations they see as unrealistic. Illegal logging is therefore widespread; it is estimated, for example, that 85% of the *Cedrela odorata* (cedro) harvested in the Ecuadorian Amazon is illegal.[a]

Most timber harvesting today is done on Indigenous and small-farmer community lands and private lands. Legal harvesting is carried out under three kinds of permit: cutting permits (the great majority until 2005 – ITTO 2006); areas harvested according to simplified forest management plans (*Programas de Aprovechamiento Forestal Simplificado* – PAFSIs), which mainly involve non-mechanized extraction; and areas with integrated management and sustainable management areas (*Programas de Aprovechamiento Forestal Sustentable* – PAFSUs), which involve relatively large areas that are suitable for industrial harvesting. In 2009, 921 forest management permits (PAFSIs and PAFSUs) were issued (up from 815 in 2008). In 2008, a total of 205 000 m^3 of timber were harvested from about 10 000 hectares in PAFSUs and 259 000 m^3 from about 29 000 hectares in PAFSIs.[a]

Silviculture and species selection. Diameter limits are assigned for each harvestable species and are relatively low: for example, the limit is 40 cm for cedro and 35 cm for *Tabebuia chrysantha* and *Myroxylon peruiferum*.[a] Post-harvesting treatments in natural forests are compulsory and include liberation thinning, the cutting of lianas and, based on a silvicultural assessment, enrichment planting.[a] About 120 timber species are used in the domestic market. The prime species harvested are from forest plantations (eucalypts and pines). In natural forests, 80% of the harvested volume comes from about 25 species (ITTO 2006). Besides those listed in Table 4, important commercial species are

Semi-natural production forest in Ecuador, with *Cordia alliodora* and *Terminalia* spp.

Virola spp, *Otoba glycycarpa* (sangre de gallina), *Cedrelinga catenaeformis* (chuncho), *Podocarpus* spp and *Prumnopitys* spp (romerillo, azucena) from the southeastern forests, and *Tratinnickia glaziovii* (copal).

Planted forests and trees outside the forest. The creation of new forests and agroforestry plantations is a major goal of Ecuador's forest and environmental policy, and PROFORESTAL was created to fulfill ambitious industrial-plantation and agroforestry targets. The total state budget allocated to this purpose in 2008 was US$15 million.[a] The total area of planted forest in 2008 was about 175 000 hectares, which was 11 000 hectares more than reported in 2005 (ITTO 2006). About 80% of the plantations are composed of eucalypt and pine species and located in the Andes; the remaining 20% is mainly in the coastal region and largely comprises balsa and a range of other indigenous species such as laurel, *Schizolobium parahybum* (pachaco), *Jacaranda copaia*, *Parkia multijuga* (cutanga), chuncho and *Hyeronima alchornoides* (mascarey). Some certified plantations and agroforestry schemes are now exploiting these

Table 4 Commonly harvested species for industrial roundwood

Species	Notes
Eucalyptus globulus (eucalipto)	From plantations in mountainous areas, 190 000 m^3 in 2008.
Ochroma lagopus (balsa)	From plantations more than 40 000 m^3 annually.
Brosimum utile (sande)*	The main natural forest species in the Pacific region.
Cordia alliodora (laurel)*	From secondary forests, pastures and plantations.
Pinus radiata and P. patula (pino)*	From forest plantations in mountainous regions.

* *Also listed in ITTO (2006).*
Source: Government of Ecuador (2009).

resources. *Tectona grandis* (teak, teca), *Acacia mangium* and *Gmelina arborea* are planted in lowland areas and *Alnus acuminata* (aliso) is planted in the mountains.

Forest certification. As of mid 2010, five FMUs managing planted forests and semi-natural forests were certified under the FSC, covering a total area of 41 200 hectares (FSC 2010). No natural forests were certified.

Estimate of the area of forest sustainably managed for production. The estimated area of natural-forest production PFE under SFM is at least 176 000 hectares (Table 5), comprising forests that are currently managed under PAFSUs with adequate supervision by authorities and some semi-natural forest stands that have been managed for more than 20 years.[a] The latter areas include private forest lots and planted and natural forests in the sierra managed by communities.

Timber production and trade. It is estimated that about 4.8 million m^3 of roundwood was extracted annually from Ecuadorian forests between 2006 and 2008[a], including for fuelwood. Of the total in 2006 an estimated 460 000 m^3 of industrial roundwood was harvested in tropical natural forests and 480 000 m^3 were harvested in planted forests.[a] Total industrial log production in 2009 was estimated at 711 000 m^3, down from 1.81 million m^3 in 2000 (ITTO 2011). In 2009 Ecuador exported about 74 000 m^3 of logs, 55 000 m^3 of sawnwood, 3000 m^3 of veneer and 67 000 m^3 of plywood (ibid.). There are two large wood industry groups in Ecuador – Durini and Alvarez-Barba – and hundreds of smaller formal and informal wood-using enterprises (USAID 2006).

Non-timber forest products. At least 589 species are used as NTFPs in Ecuadorian forests, of which 79 species are used for their edible fruits, 68 species for their leaves, 28 species for their flowers, 19 species for their roots (mainly as medicines), 25 species for their bark and 19 species for their seeds (Añazco et al. 2004). NTFPs of commercial importance include *Guadua* (bamboo); latex; gum; palm products, particularly palm hearts; and medicinal plants. Tagua (vegetable ivory), the seed of the palm *Phytelephas macrocarpa*, is used commercially in handicrafts, as are fibres of *Bactris gasipaes* and *Carludovica palmata* (paja toquilla). Widely used NTFPs in Ecuador's Amazon forests include *Genipa americana*, a natural colorant; *Poulsenia armata* and *Byrsonima japurensis* for their fibre; *Caryodendron orinocense* and *Plukenetia volubilis* as vegetable oil; and *Uncaria tomentosa*, *Croton lechleri* and *Strychnos peckii* for medicinal purposes.[a] On average, exports of NTFPs were worth US$13 million per year between 2006 and 2008.[a]

Forest carbon. One of the objectives of the National Development Plan, designed under the leadership of SENPLADES, is the cessation of deforestation. The Ministry of Environment has identified the following elements of a national REDD strategy: forestry control; management information systems; a GHG monitoring system; land-tenure regularization in forest areas; SFM; afforestation and reforestation; and an appropriate legal and institutional framework. *SocioBosque* is an important element of the strategy.

According to national carbon inventories, Ecuador's forests and other wooded land contain about 420 MtC, of which 320 MtC are in natural forests.[a] Gibbs et al. (2007) estimated the national-level forest biomass carbon stock at 351–1379 MtC, and Eggleston et al. (2006) estimated it at 2071 MtC. Ecuador has the highest deforestation rate in Latin America, resulting in significant carbon emissions, mainly in the lowlands; it has considerable potential for carbon capture and storage (Table 6). The Government of Ecuador is taking firm

Table 5 Management of the production PFE ('000 hectares)

Reporting year	Natural					Planted		
	Total	Available for harvesting	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
2005*	3100	-	65	0	101	164	65	21
2010	**1964**	**115**	**86**	**0**	**176****	**175**	**90**	**41**

* *As reported in ITTO (2006).*

** *includes 21 000 hectares of semi-natural forest as enrichment plantings with local species in natural forest areas.*

Table 6 Forest carbon potential

Biomass forest carbon (MtC)	% forest with canopy cover >60%	Deforestation/ degradation potential to 2030	Enhancement of carbon sink capacity to 2030	Forest area change monitoring capacity	Forest/ GHG inventory capacity	Importance of forest fire/ biomass burning	Engagement in international REDD+ processes
351– 1379	59	+++	++	++	+	++	+++

+++ high; ++ medium; +low; estimate of national forest carbon based on Gibbs et al. (2007); estimate of % total forest with canopy cover >60% based on UNEP-WCMC (2010).

steps towards REDD (Chiu 2009). For example, it is preparing a low-carbon development plan for 2010–2012 and a national REDD+ strategy with support from the German government and Conservation International (Government of Norway 2010). Ecuador is also involved in the UN-REDD process and the REDD+ Partnership and the government has established permanent forest monitoring facilities through the Center for Remote Sensing.

Forest for protection

Soil and water. Protection and protected forests are regulated through the 2003 Environmental Law (*Texto Unificado de Legislación Ambiental, Libro III: Del Régimen Forestal, DE-3516*) and the 1999 Law of Environmental Management (*Ley de Gestión Ambiental* 37, RO-245). There are 162 registered protection forests in Ecuador, covering an area of about 2.3 million hectares.[a] Protection forest lands include state land as well as privately owned or occupied land on steep slopes or water catchments and other areas unsuitable for agriculture or livestock production. Municipal governments provide drinking water and protect forests for this purpose. The provision of clean, abundant water is an ecosystem service that may help pay for conservation; for example, Quito's water fund, FONAG, is paying part of the cost of protecting and restoring the Cayambe–Coca Ecological Reserve.

Biological diversity. Ecuador has a wide range of ecosystems and is considered a megadiverse country. It has more than 20 100 plant species, of which 5317 are endemic[a], and there are also at least 369 native mammals, 1616 birds, 394 reptiles and 415 amphibians. Most of the 1435 species found in forests (34 mammals, 56 birds, 155 amphibians, eleven reptiles, one arthropod, twelve molluscs and 1166 plants) that are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species are endemic to the Galapagos Islands (IUCN 2011). On the mainland, 14 species are so listed (ibid.). Eight plant species are listed in CITES Appendix I and 584 in Appendix II (UNEP-WCMC 2011). *Swietenia macrophylla* and *Cedrela* spp are protected under national law.[a]

Protective measures in production forests. Amendments made in 2004 to the 1981 Forest Law introduced new harvesting rules in accordance with reduced impact logging as a prerequisite for harvesting. Logging is prohibited within specified distances of waterways, lakes and rivers, on slopes greater than 45%, in the highest areas of micro-watersheds (*línea de cumbres de microcuencas primarias*), and in various 'special areas'.[a]

Extent of protected areas. The 2008 Constitution defines, in its Article 405, a new sub-category of the SNAP, the PANE, which includes 35 special protected areas, including major national parks, reserves and wildlife preservation areas. On the Ecuadorian mainland, protected areas cover 4.67 million hectares (17% of the total land area), distributed in various categories defined by law (national parks, biological reserves, ecological reserves, geo-botanical reserves, bird reserves, wildlife reserves, etc). The protected area estate also includes about 2 million hectares of soil and water protection areas, mostly forested, classified in IUCN categories V and VI.[a] The total protected area comprises non-forested areas and also 1.55 million hectares of lowland rainforest. In addition, the biological reserve of the Galapagos Islands covers 14.1 million hectares of land and marine ecosystems.

Some protected areas are threatened by encroachment. For example, Podocarpus National Park, a unique montane primary forest relict of more than 120 000 hectares, is threatened by illegal gold-mining and associated mercury contamination.

There are three major biosphere reserves besides Galapagos – Yasuní, Sumaco Napo Galeras, and Podocarpus–El Condor – which, combined, cover nearly 3 million hectares. There are also five biological corridors in mainland Ecuador (*corredor ecológico Llanganates-Sangay*, *corredor biológico Awacachi*, *corredor ecológico Cuyabeno-Pañacocha*, *corredor de conservación comunitaria El Ángel-Golondrinas*, and *corredor ecológico Antisana-Llanganates*) connecting 20 protected areas.[a]

Estimate of the area of forest sustainably managed for protection. Little information was available for this report on the quality of management in the protection PFE (Table 7). About 2.21 million hectares of protected areas reportedly had management plans in 2009.[a] The 129 000-hectare Condor Biosphere Reserve, part of a transboundary conservation area on the border with Peru, was threatened by the expansion of unsustainable agriculture and cattle-ranching, but its integrity has been substantially improved through a project supported by various donors, including ITTO. Forest management planning has advanced in the Yasuni National Park (985 000 hectares) in the Napo region. A United Nations-administered international trust fund, initiated through *SocioBosque*, has been put in place to guarantee payments for non-exploitation of the considerable oil reservoirs in the core area of Yasuni (500 000 hectares). The core areas of the Condor Biosphere Reserve and Yasuni National Park, both nearly 100% forested, are counted in Table 7 as sustainably managed.

Socioeconomic aspects

Economic aspects. The GDP of Ecuador was US$108 billion in 2009, of which forest-based activities contributed about 2% (USAID 2006). However, data are quite unreliable due to the high level of informality in the forest sector. The forest and timber industry is characterized by a high number of small timber extractors and wood-processing units with low capital input and by poor working conditions; it has difficulty delivering high-quality processed products. It is estimated that there are more than 500 units of active extractors and timber companies, most of them producing less than 2000 m^3 annually. An estimated 235 000 people are in employment linked to the forest and timber industry, which is 8% of the country's active economic population.[a]

Livelihood values. Forests have great value for local forest-dwellers, with hunting and fishing the most important activities. Forests are also considered as a land reserve and are converted for subsistence agriculture. About 7.5 million hectares of forest are used directly or indirectly by Indigenous communities to provide at least part of their livelihoods.[a] It is estimated that about 850 000 people depend directly on forest resources for their livelihoods.[a]

Social relations. The country's population consists of four broad groups – Mestizo (65%); Amerindian (25%); Spanish descendant (7%); and Afro-Ecuadorian (3%) – each of which has a unique culture. Amerindian groups play a particularly important role in the management of forests and the conservation of Ecuador's biodiversity because they control large areas of forested land. Conflicts over oil exploitation and illegal harvesting are widespread and illicit crops are found in certain forest areas (ITTO 2006). Recently, as part of the *SocioBosque* program, Indigenous communities and organizations signed 20-year agreements with the Ministry of Environment under which, in return for preserving native forests, landowners receive annual incentive payments from the government. These agreements reinforce existing titles.

Table 7 Management of the protection PFE ('000 hectares)

Reporting year	Protection PFE	Attributed to IUCN categories I–IV	Allocated for soil and water	With management plans	Sustainably managed
2005*	4300	1790	2403	513	-
2010	**6554****	**4670‡**	**2355**	**2211**	**629**

* *As reported in ITTO (2006).*

** *Includes water and soil protection forests and protected areas. UNEP-WCMC (2010) estimated the total area of forested protected areas at 2.085 million hectares. Partly there is overlap of areas in the various categories.*

‡ *Includes the land area of the Galapagos Islands, not all of which is forested.*

Summary

Ecuador, a megadiverse country, suffers the highest rate of deforestation of any Amazonian country – primarily as a result of increased access, colonization, oil and timber exploration, a lack of incentives for conservation, insecure land titles, and weak public institutions. Ecuador has a large, often contradictory and unclear body of laws and regulations that affects the sustainable management of its biodiversity and tropical forests and which usually is only partially enforced. The Forestry Law is under revision, taking into account the new framework provided by the 2008 Constitution. SFM is a long way from being achieved in most of Ecuador's production and protection forests. On the positive side, there is a declared political willingness to increase the country's capacity to manage and conserve forest resources sustainably.

Key points

- Ecuador has no officially designated PFE. An estimated 8.69 million hectares of forest might be considered to constitute a PFE (compared with 7.56 million hectares in 2005), comprising 1.96 million hectares of natural production forest (compared with 3.10 million hectares in 2005), 6.55 million hectares of protection forest (compared with 4.30 million hectares in 2005) and 175 000 hectares of planted forest (compared with 164 000 hectares in 2005).
- An estimated 176 000 hectares of the production PFE is under SFM. No natural forest is certified. About 2.21 million hectares of protected areas have valid management plans and an estimated 629 000 hectares of the protection PFE is under SFM.
- Information on the forest sector is often poor and contradictory.
- There is strong pressure on the forest from informal and illegal operators resisting change towards SFM, and illegal logging is widespread in all three forest regions.
- Pronounced social and ethnic divisions complicate SFM and forest conservation. In many cases, and despite new legislative provisions, forest tenure remains unclear.
- There is a discrepancy between forest regulations and actual harvesting practice. The high rigour of legal provisions for harvesting operations may push forest users towards illegality.
- Considerable efforts have been undertaken in recent years in the management of the protection PFE and there is increased political support for forest conservation. The emergence of REDD+ could further strengthen the management of the protection PFE.

Endnotes

a Government of Ecuador (2009).

b Ministry of Environment website, accessed October 2010. Available at www.ambiente.gov.ec.

e Personal communications with officials in the Government of Ecuador, 2010.

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GUATEMALA

Forest resources

Guatemala has a land area of about 10.9 million hectares and an estimated population in 2010 of 14 million people (United Nations Population Division 2010). It is ranked 78th out of 182 countries in UNDP's Human Development Index (UNDP 2009).

The country can be divided into three main biogeographical regions. The first, where most of the population lives, comprises highlands made up of several mountain chains stretching from the border with Mexico southwards to the border with Honduras. The highest peaks are steep volcanic cones reaching more than 4000 m above sea level; the country's main conifer forests are found there. The second is the Pacific plain, stretching along the Pacific coast, which is characterized by rich volcanic soils and is highly developed for agriculture. The third, the Petén, is a flat, low-lying region in the north of the country bordering Mexico and Belize. This is mainly a limestone plateau covered with dense humid tropical forests, swamps and grasslands, and features the ruins of ancient Mayan cities. Recent estimates of Guatemala's forest area range from 3.66 million hectares (FAO 2010a) to 4.55 million hectares (Government of Guatemala 2010, based on 2003 satellite cover interpretation).

Forest types. Ten physiographic regions, seven biomes, 14 ecoregions, 66 ecosystems and 14 life zones have been identified in the country.[a] Forests in Guatemala are classified as conifer forests, broadleaved forests, mixed forests and mangrove forests. Their characteristics and distribution are as follows:

- Closed natural pine forest in the highlands (*bosque de pino denso*) – these are dominated by one or several *Pinus* spp (pine species), *Abies guatemalensis* (pinabete), *Cupressus lusitanica* (cypress), *Taxodium mucronatum* (sabino) or *Juniperus comitana* (juniperus). The most commercially important species is *Pinus oocarpa*. The closed natural pine forests cover about 300 000 hectares and can be found in Huehuetenango, San Marcos, Quiche, Baja Verapaz and Totonicapan.
- Broadleaved forest *(bosque latifoliado)* – in this tropical humid forest type, more than 300 tree species have so far been identified, but two genera, *Dialium* and *Brosimum*, predominate. The largest areas of broadleaved forest are in the Petén but there are also areas in Alta Verapaz, Izabal, Quiche and Huehuetenango. They cover more than 3 million hectares.
- Mixed hardwood and pine forest (*bosque mixto*) – these cover about 600 000 hectares, composed of two main tree associations: pine–oak, and *Liquidambar styraciflua* (liquidambar). Cypress, Betulaceae (*Ostyra* spp and *Alnus* spp) and Lauraceae (*Ocotea* spp, *Nectandra* spp and *Persea* spp) occur in this forest type. It is predominantly found in Quiche, Huehuetenango, Alta Verapaz, Chiquimula and Zacapa.
- Relicts of mangrove forest (*bosque de manglar*) cover about 17 700 hectares on the Pacific coast, particularly in estuaries and lagoons (Spalding et al. 2010). The largest areas are in the departments of Retalhuleu, Santa Rosa, Escuintla, Jutiapa, Suchitepequez and San Marcos.

Permanent forest estate. The estimated total area of PFE is 2.46 million hectares[a] (Table 1), comprising 1.14 million hectares of production forest, 1.24 million hectares of protection forest and 85 000 hectares of planted forest.[b] The distribution of the PFE by forest type is as follows: tropical

hardwood forest – 1.7 million hectares; conifer forest – 100 000 hectares; mixed hardwood and pine forest – 130 000 hectares; and open woodlands and secondary forests – at least 500 000 hectares (ITTO 2006).

Forest ecosystem health

Deforestation and forest degradation. According to FAO (2010b), Guatemala lost about 56 000 hectares per year in the period 2006–2010, an annual deforestation rate of 1.47%. Overall, between 1990 and 2010, Guatemala lost 23% of its forest cover, or around 1.1 million hectares (FAO 2010b).

There has been deforestation in the conifer forests of the highlands for centuries, but today it mostly takes place in the Petén. Large-scale deforestation started there in the 1970s as a result of a land colonization program initiated by the government and accelerated in the 1980s, when entire villages of Indigenous people sought refuge during the country's civil war (ITTO 2006). An estimated 78% of the deforestation in the Petén is caused by shifting cultivation and the remainder is caused by cattle-ranching and other causes, such as mineral and petroleum development.[a] The degradation and fragmentation of forests result from widespread illegal logging and fuelwood gathering, unmanaged fires and drug-trafficking.[a] The country has about one million hectares of secondary forests (*bosques secundarios, arbustales*). Table 2 indicates forest condition; about 37% of the total forest area is considered to be more-or-less intact.[a]

Vulnerability of forests to climate change. Possible consequences of climate change in Guatemala include variations in precipitation and temperature patterns, accompanied by changes in soil moisture, soil chemistry and species composition and structure. Local and national hydrological cycles could be disrupted, and surface water supplies could become unreliable (Government of Guatemala 2001). Observations in the Petén suggest that lakes and other water bodies there are recording consistently lower volumes than previously. A change in climate could directly affect the productivity of agriculture and forestry and diminish livelihoods (Tolisano & López-Selva 2010). Climate change could also have a significant impact on conservation needs and priorities. For example, under some future climate scenarios, a considerable number of protected areas will no longer be able to fulfill their role of protecting representative habitat for species targeted for conservation (Mansourian et al. 2009). As a consequence, changes to forest management may be required, including habitat restoration with a focus on resilience.

Table 1 Permanent forest estate

Reporting year	Estimated total forest area, range (million ha)	Total closed natural forest ('000 ha)	PFE ('000 hectares)			
			Production		Protection	Total
			Natural	Planted		
2005*	2.85–4.29	2824	1140	71	1240	2451
2010	**3.65–4.51**	**1850****	**1140**	**85‡**	**1240**	**2465**

* *As reported in ITTO (2006).*

** *Calculated using the ratio of forest with greater than 60% forest cover estimated by UNEP-WCMC (2010) (50.6%) and the total natural forest area as estimated by FAO (2010a).*

‡ *According to Government of Guatemala (2010), with the entire area situated in the PFE. FAO (2010a) estimated the total planted forest area at 173 000 hectares, which probably includes tree plantations on agricultural land.*

Table 2 Forest condition

	PFE	Non-PFE	Total
	'000 ha		
Area of primary forest	-	-	1620
Area of degraded primary forest	-	-	1800
Area of secondary forest	-	-	1000
Area of degraded forest land	-	-	1100*

* *Corresponds to the total area deforested since 1960.*

Source: Derived from Government of Guatemala (2010).

SFM policy framework

Forest tenure. Forest ownership in Guatemala may be public or private. An estimated 1.5 million hectares of forest are owned by local and Indigenous communities, 1.4 million hectares are national forests, and about 930 000 hectares are municipally/communally owned (Table 3). Indigenous communal lands (known as *ejidales*) have special status by law. Because of the civil war (which ended formally in 1996), the ownership of about 212 000 hectares of forest is uncertain, although some of this area is owned privately. Land tenure was complicated by the displacement in the 1980s and 1990s of more than one million people from their traditional lands (ITTO 2006) and by the existence of a number of overlapping claims. Despite recent efforts, therefore, tenure rights, particularly among the poor, remain insecure.

Under *Programa de Incentivos para Pequeños Poseedores de Tierras de Vocación Forestal o Agroforestal* (PINPEP) Law No 3937 (*Decreto* 51), which was approved in late 2010 (Rights and Resources Initiative 2011), the National Forest Institute (*Instituto Nacional de Bosques* – INAB) has established a program of incentives for small-scale owners of land with forestry or agroforestry potential to engage in natural forest management and agroforestry. Under the program, economic incentives are available to small-scale landowners with secure property titles in natural forest for up to five years to support approved forest management initiatives, and to small-scale landowners proposing agroforestry activities on land suitable for forestry.[a]

Criteria and indicators. Guatemala is involved in the Lepaterique C&I process of Central American countries. For the last decade the country has been engaged in a major effort to test and adopt FSC standards as a binding instrument for monitoring forest management. The country has also adapted the ITTO C&I to use as an instrument for monitoring progress towards SFM at the national level. The Government of Guatemala used the ITTO C&I in its submission to ITTO for this report.[a]

Forest policy and legislation. The present forest law (*Decreto* 101-96 *Ley Forestal*, October 1996) emphasizes the importance of reforestation and forest conservation and makes reference to SFM (Article 48). New implementation rules for this law were approved in December 2005 (Resolution 01/43), including with respect to the system of incentives for forest management.[a] The Law on Protected Areas (*Ley de Áreas Protegidas*, *Decreto* 4-89, 1989), amended in 1996 and 1997, regulates the Guatemala System of Protected Areas (*Sistema Guatemalteco de Areas Protegidas* – SIGAP).

The ministry in charge of rural development until 2000 (*Ministerio de Agricultura, Ganadería y Alimentación* – MAGA) established an environmental policy in 1998, identifying sustainable development as its primary goal. The current forest policy, which was formulated in 1999, promotes the concept of productive management of natural forests (*fomento al manejo productivo de bosques naturales*), with the aim of making natural forests a feature of economic development in order to conserve biodiversity and improve the living conditions of forest-dependent people. The policy also defines policies for forest biodiversity and protected areas.[a] A national strategy for the conservation and sustainable use of biodiversity was approved in 1999.

Table 3 Forest area, by tenure

Ownership category	Total area	Of which PFE	Notes
	'000 ha		
State ownership (national, state or provincial government)	1367	-	Legal forest estate owned and administered exclusively by government.
Other public entities (e.g. municipalities, villages)	934	-	Community-managed, but governments invariably retain strong authority.
Total public	**2301**	**-**	
Owned by local communities and/or Indigenous groups	1531	-	Privately owned forest lands where rights cannot be unilaterally terminated by government.
Private owned by firms, individuals, other corporate	212	-	Other lands, including individually owned forests and also forests with unclear ownership.

Source: Derived from Government of Guatemala (2010).

Based on the forest policy, a strategic plan was developed that includes financial mechanisms such as incentive payments for reforestation (e.g. PINPEP), afforestation/reforestation under the CDM, and payments for ecosystem services, especially water. In 2009, the National Policy for Rural Development (*Política Nacional de Desarollo Rural Integral*) was approved that addresses forests as an integrated element in rural landscapes.[a] The national climate-change policy (2009) emphasizes the role of forests in reducing GHG emissions, particularly through REDD+.[a]

Institutions involved in forests. Through a congressional decree approved in December 2000 (*Decreto* 90-2000), the Ministry for Environment and Natural Resources (*Ministerio de Ambiente y Recursos Naturales* – MARN) shares authority over natural resources with MAGA. However, the relative responsibilities of the two ministries for forest management remain unclear.[a]

INAB was created in 1996 as an independent and decentralized state agency. It is responsible for developing SFM in natural forests and for the establishment and management of planted forests. MAGA chairs INAB's board (*junta directiva*), which also comprises representatives of MARN, the private sector, civil society and the national association of municipalities. INAB is supported through a national incentive program (*Programa de Incentivos Forestales* – PINFOR). INAB is also responsible for forest inventories and the preparation of forest management plans in both planted and natural forests.

The National Council of Protected Areas (*Consejo Nacional de Areas Protegidas* – CONAP), established under MARN in 1989, is responsible for managing SIGAP, including the Maya Biosphere Reserve in the Petén, the largest tract of closed humid tropical forest in Guatemala, and the Sierra de las Minas Biosphere Reserve. CONAP is also responsible for the delivery and supervision of long-term community and industrial concessions, particularly in the multiple-use zone of the Maya Biosphere Reserve. Some of the communities that became involved in forest management under this concept have managed, with international support, to certify their forest operations.[a]

The forest industry is represented politically by *Gremial Forestal de Guatemala*, which is also a member of the INAB board. The *Cluster Forestal* is a multi-sectoral forum that promotes the role of forests in Guatemalan society. The National Association of Municipalities (*Asociación Nacional de Municipalidades*) represents local governments on the boards of INAB, CONAP and MARN. Local governments are taking increasing responsibility for the management of forests under a process of decentralization that is an expression of national reconciliation after the civil war. Each national institution has its own criteria for decentralization. Municipalities are required to create environmental offices and are encouraged to conduct reforestation projects; municipalities can keep 50% of the revenues from concessions and harvesting licences (ITTO 2006). By the end of 2006, a total of 108 municipal forest offices had been established.[a]

An association of NGOs (*Asociación Nacional de Recursos Naturales y Medio Ambiente*) participates in the supervisory committee of INAB and in the consultative groups of MARN and CONAP. Another association, the National Council for Sustainable Forest Management Standards (*Consejo Nacional de Estándares de Manejo Forestal Sostenible para Guatemala*) maintains a national dialogue on forests and promotes forest management standards and certification.

Status of forest management

Forest for production

Forest management goals vary throughout the country. The community forests in the highlands consist mainly of coniferous or mixed forests and principally produce fuelwood and construction wood for household consumption and the domestic market.[a] In contrast, community forest operations in the tropical broadleaved forests of the Petén produce timber from both high-value and lesser-known species for national and international markets, as well as NTFPs (Tolisano & López-Selva 2010).

The Maya Biosphere Reserve was created in 1990 and covers an area of 2.11 million hectares. It has three zones: the core zone, consisting of national parks and biotopes (747 800 hectares); the multiple-use zone, where forest concessions are located (864 300 hectares); and the buffer zone, where cooperatives and municipal common lands are located and where land use is generally restricted (about 500 000 hectares). About 540 000 hectares of forests have been granted as forest concessions in the multiple-use zone[a]; these concessions constitute

the largest FMUs in the country. Of the 18 FMUs nationally, twelve are community concessions, four are cooperatives or municipal common lands in mountainous areas, and two are industrial concessions situated in the Petén.[a] All concessions are required to obtain FSC forest certification within three years of their establishment (Stoian & Rodas 2006).

The 1996 Forest Law made the preparation of forest management plans compulsory for long-term forest users. Timber harvesting in the PFE requires an approved forest management plan and a licence issued through INAB; INAB-approved forest management plans are required for planted forests, including agroforests. Forest concessions in the Maya Biosphere Reserve must fulfil similar review and licensing procedures, but through CONAP.[a] Some operators have cited the overlap in forest management responsibilities between INAB and CONAP as a bureaucratic complication.[a]

INAB has adopted a methodology prepared by the former Regional Forest Program for Central America and the Tropical Research and Higher Education Centre (*Centro Agronómico Tropical de Investigación y Enseñanza*) involving the preparation of simplified management plans for hardwood forests and forest management plans for Central American conifer forests (ITTO 2006). In 2008, a total area of 692 200 hectares in the PFE was covered by management plans[a], 483 000 hectares of which were in tropical hardwood forests, 172 000 hectares of which were in mixed forests and 37 200 hectares of which were in pine forests. These areas are unchanged since 2005 (ITTO 2006).

The most serious problem in forest management is extensive small-scale illegal logging of single trees. In the tropical hardwood forests, *Swietenia macrophylla* (caoba) and the various species of *Cedrela* are the species most targeted by illegal logging. In the highlands, illegal logging particularly threatens pinabete and cypress (ITTO 2006).

Silviculture and species selection. Forest concessions in the Petén are managed according to a polycyclic silvicultural system with a cycle of 30–40 years.[a] The logging intensity is 1.5–3 trees (3–4 m^3) per hectare. Thirty per cent of commercial trees must be kept as seed trees.[a] The minimum cutting diameter for caoba and *Cedrela odorata* (cedro) is 60 cm (55 cm in certain FMUs); for other species it is 45 cm.

Of the 424 known indigenous tree species, 320 are considered to be suitable for certain uses (ITTO 2006); about 25 species are traded. Traditionally important commercial species in the mountainous areas are pines (*Pinus oocarpa, P. pseudostrobus and P. maxiinoi*), cypress and *Quercus* spp (roble). Caoba and cedro are the main commercial species in the hardwood forests of the Petén; despite heavy logging in the past 60 years or so, both species occur in abundance in all forest layers (ITTO 2006). Table 4 shows five species that constitute the most commonly harvested species for industrial roundwood.

Planted forest and trees outside the forest. The total planted forest area in 2008 was estimated at 85 000 hectares[a], an increase of about 14 000 hectares over the estimate in ITTO (2006). Most plantations consist of local pine species. About 2.2 million hectares of non-forested land are considered suitable for tree-planting.[a]

Relatively small areas of tree plantations are scattered throughout the country; these are often established without a clear purpose (ITTO 2006). Four conifer species (*P. caribaea, P. maximinoi, P. oocarpa* and *C. lusitanica*) and two broadleaved species (*Tectona grandis* – teak, teca – 4000 hectares, and *Gmelina arborea*) make up 70% of existing plantations, and *Hevea brasiliensis* is planted for both rubber and timber (ibid.). The forest policy seeks to encourage the establishment of 15–20 000 hectares per year through the use of incentives in order to generate wood and other products for the forest industry and local consumption.[a]

Table 4 Commonly harvested species for industrial roundwood

Species	Notes
Swietenia macrophylla (caoba)*	50% of total export value in 2008, 17% in volume.
Lonchocarpus castilloi (manchiche)*	Mainly for domestic use.
Calophyllum brasiliense (santa maría)*	Mainly for domestic use.
Bucida buceras (pucte)*	Exported for flooring and parqueting.
Pinus spp (tajibo)*	Most important timber for domestic use.

* *Also listed in ITTO (2006).*
Source: Government of Guatemala (2010).

Forest certification. The National Council for Sustainable Forest Management Standards has developed national certification standards for both natural and planted forests, which are now implemented throughout the country.[a] With international support, considerable effort was made in the period 2002–05 to certify forests in the PFE. By December 2005, a total area of 522 870 hectares in 15 FMUs had been certified under the FSC umbrella (ITTO 2006). In December 2010, there were eight FSC certificates, of which two were group certificates and six were certified FMUs in community concessions; the total certified area was 481 440 hectares (FSC 2010), the majority of which was in the Maya Biosphere Reserve.

While there has been only a relatively small decline in the certified forest area since the last survey, there is a concern that the trend is downward rather than up. In particular, the considerable transaction costs incurred by local communities to maintain certification status, and the lack of adequate price premiums for certified timber and timber products, raise questions over the long-term viability of certification in the Guatemalan context.

Estimate of the area of forest sustainably managed for production. About 700 000 hectares of the production PFE are under some sort of management, of which about 260 000 hectares are conifer and mixed forests, both natural and planted. Assessments of the management of community forest concessions indicate that forest management is being applied in most of these community forests. At least 630 000 hectares of natural-forest production PFE are considered to be under SFM (Table 5), comprising the certified forests and those natural pine forests and mixed forests managed according to defined management principles.[b]

Timber production and trade. Total roundwood production, including for fuelwood, was estimated at 16 million m^3 in 2008 (Tolisano & López-Selva 2010). Total industrial roundwood production in 2009 was 443 000 m^3 (of which an estimated 363 000 m^3 was coniferous), slightly more than the estimated 419 000 m^3 in 2004 (ITTO 2011). Approximately 90% of harvested timber is destined for the national market. Total sawnwood production declined from about 200 000 m^3 in 2000 to 54 000 m^3 in 2009 (ibid.); however, the data are unreliable and it is estimated that a large part of the timber production is processed by the informal sector and thus is not recorded in official statistics.

About 75% of total sawnwood production is exported to other countries in Central America and the Caribbean and to North America, mostly as certified products. Caoba is the most important export species by value, followed by *Calophyllum brasiliense* (santa maría), *Cybistax donnell-smithii* (palo blanco), cedro and *Castilla elastica* (castilla). A considerable volume of timber – up to 30–50% of the official roundwood production – is harvested illegally (Stoian & Rodas 2006). Fuelwood and charcoal are important products in local markets.

Non-timber forest products. Among internationally traded NTFPs are pine resin, pine seeds from mountain forests, copal (*Bursera bipinnata, Protium copal* and other species), xate leaves (from the *Chamaedorea* palm), *Pimenta dioica* (pimiento) and chicle gum (*Manilkara zapota* – a dominant tree in the primary forests of the Petén). An estimated 4.2 million pounds of xate and 300 000 pounds of chicle gum are produced annually, worth US$660 000 and US$ 310 000, respectively.[a] Community concession-holders have long-standing experience with forest enterprises through the management, harvesting and marketing of NTFPs, in particular chicle gum and xate. Another species used as an NTFP is hombre grande (*Quassia amara*), a natural biocide used in organic agriculture in the Petén.

Table 5 Management of the production PFE ('000 hectares)

Reporting year	Natural					Planted		
	Total	Available for harvesting	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
2005*	1140	540	697	520	672	71	27	8
2010	**1140**	**540**[**,‡]	**697**[‡]	**481**	**630**	**85**	**27**[‡]	**0**

* *As reported in ITTO (2006).*

** *Comprising timber concessions, community concessions and community forests.*

‡ *Since more recent data were unavailable, assumed unchanged since 2005 (as reported in ITTO 2006).*

Forest carbon. It is estimated that more than 60% of Guatemala's GHG emissions are caused by deforestation and forest fires (Government of Guatemala 2008). Thus, efforts to reduce deforestation and unmanaged fires could produce a significant reduction in national GHG emissions. Gibbs et al. (2007) estimated national-level forest biomass carbon stock in the range 787–1150 MtC. FAO (2010a), in contrast, estimated it at only 281 MtC.

Guatemala is one of 37 countries selected by the Forest Carbon Partnership Facility to prepare its national REDD+ strategy, and the country's readiness idea note was approved in 2008. Guatemala has been participating in the REDD+ Partnership since 2010 and is an observer in UN-REDD. Table 6 summarizes Guatemala's current forest carbon potential.

Forest for protection

Soil and water. In Guatemala, *in situ* and *ex situ* biodiversity and forest conservation is carried out under the jurisdiction of MARN, the associated National Council for Protected Areas, and INAB. The system of protected areas, SIGAP, comprises nearly 950 000 hectares of special protection forests (*zonas de amortiguamiento*).[a] An estimated 201 900 hectares of forest land are managed primarily for soil and water protection; this includes the area managed by PINFOR (18 200 hectares) and several pilot forests (13 000 hectares), as well as 24 700 hectares of protected forests in the Manantiales reserve and the forest area of the Sierra de la Minas Biosphere Reserve (146 000 hectares of a total protected area of 236 000 hectares).[a] The Direct Forest Support Pilot Program (*Programa Piloto de Apoyos Forestales Directos*) finances the sustainable protection and conservation of natural forests by providing payments for conservation activities to protect watersheds, particularly natural forests, and water resources. Such payments are designed to reduce the conversion of forest land to agriculture and to improve the security of water supplies in rural areas. Payments are provided to beneficiaries for five years. An estimated 220 registered owners are now participating in the project, with more than 33 000 hectares of natural forest under protection.[a]

A specimen of caoba (*Swietenia macrophylla*) in the Petén.

Biological diversity. Guatemala is a very biodiverse country, with flora and fauna representative of both temperate and tropical America. CONAP (2008) reported the total number of plant species in Guatemala at 10 364 species, although it also noted that floristic research in Guatemala is at an early stage of development. There are 6463 known species of flowering plant, 28 species of conifer, 637 species of fern, 527 species of orchid and 519 species of moss (ibid.). The most recent count of vertebrate fauna reported 3025 species, including 735 bird species, 244 mammal species, 143

Table 6 Forest carbon potential

Biomass forest carbon (MtC)	% forest with canopy cover >60%	Deforestation/ degradation potential to 2030	Enhancement of carbon sink capacity to 2030	Forest area change monitoring capacity	Forest/ GHG inventory capacity	Importance of forest fire/ biomass burning	Engagement in international REDD+ processes
787–1150	51	++	++	+	+	++	++

+++ high; ++ medium; + low; estimate of national forest carbon based on Gibbs et al. (2007); estimate of % total forest with canopy cover >60% based on UNEP-WCMC (2010).

amphibian species, 243 reptile species, and 1033 fish species (IARNA 2009). Thirteen mammals, nine birds, seven reptiles, 81 amphibians, three invertebrates and five plants found in forests are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species (IUCN 2011). Two plants (including the conifer *Abies guatemalensis*) are listed in CITES Appendix I, 288 (including *Swietenia macrophylla* and *S. humilis*) are listed in Appendix II and two are listed in Appendix III (UNEP-WCMC 2011).

According to the list of endangered species published by CONAP, there was an increase of 1.3% in the number of endangered plant species from 1999 to 2006 (CONAP 2008).

Protective measures in production forests. Concession-holders are required, among other things, to conserve seed trees, set aside areas from which tree-felling is excluded, make special provisions for biological corridors, regulate hunting, and conserve endangered plants and animals (ITTO 2006).

Extent of protected areas. Legally protected areas (i.e. those in the SIGAP), comprising both forest and non-forested land, cover about 3.3 million hectares (Box 1), or 30% of the national territory. This is about 200 000 hectares more than reported in ITTO (2006). However, some of the ecoregions specified in Box 1, although nominally forest, are likely to be partly without forest cover. Forty-seven of the 121 protected areas in Guatemala are inter-connected.[a] About 1.2 million hectares of those protected areas are considered to be part of the PFE (ITTO 2006). Forty-three reserves in the SIGAP are smaller than 1000 hectares and five are larger than 100 000 hectares. More than 150 private natural reserves covering about 30 000 hectares are registered with CONAP, and several additional properties are in the process of being registered.[a] CONAP maintains responsibility for legally recognizing private natural reserves and INAB collaborates with reserve operators on projects, including payments for ecosystem services.[a]

Estimate of the area of forest sustainably managed for protection. Little information is available for estimating the extent of protection PFE under SFM. Those areas protected for water and soil conservation are considered to be under SFM because they are subject to well-resourced management programs, as are the 30 000 hectares of private reserves, which are mostly used for ecotourism (Table 7).

Socioeconomic aspects

Economic aspects. Guatemala's forest sector is estimated to contribute approximately 2.5% of GDP through the production of timber and NTFPs. It generates an estimated 37 000 jobs, involving about 1.5% of the economically active population.[a]

Livelihood values. Hunting and the gathering of edible plants such as *Manilkara zapota* have been of great importance for the Mayan culture for centuries. In the humid forest zone, both

Box 1 Distribution of Guatemala's protected areas, by ecoregion

Ecoregion*	Extent of SIGAP protected areas (ha)	% of total ecoregion
Atlantic humid forests	172 800	22
Pine-oak forests	234 000	8
Motagua Valley thornshrub	46 000	20
Petén Veracruz humid forests	2 523 000	53
Sierra Madre Chiapas humid forests	7100	1
Yucatan humid forests	11 300	93
Central American montane forests	251 000	42
Central American dry forests	21 400	3
Mangroves (Belizian coast)	28 500	80
Mangroves (Tehuantepec-El Manchon)	4600	5
Mangroves (northern region)	1800	94
Total	**3 301 500**	

* *Ecoregions without SIGAP areas are the Chiapas montane forests, the depression dry forests, and the Pacific coast dry mangrove forests.*

Source: CONAP (2008).

Table 7 Management of the protection PFE ('000 hectares)

Reporting year	Protection PFE	Attributed to IUCN categories I–IV	Allocated for soil and water	With management plans	Sustainably managed
2005*	1240	836	184	-	-
2010	**1240**	**836**	**235**	**-**	**265**

* *As reported in ITTO (2006).*

Indigenous communities and colonists use forest products in their households; products include the fibres of bayal (*Desmoncus* spp) and sabal (palm leaves) for housing. In the highlands, fuelwood harvested in forests is the most important source of energy (ITTO 2006).

Social relations. Guatemala has 24 ethnic groups. More than two-thirds of the population is of Indigenous descent and 61% lives in rural areas (Tolisano & López-Selva 2010). There is a long tradition of forest conservation, particularly in the highlands. For many years Guatemala has been implementing a decentralization policy aimed at engaging municipal governments and traditional and Indigenous communities in the issuing of permits, monitoring, and the enforcement of national policies.[a] Local institutions are in charge of forest administration, and a village council generally deals with forest-related issues. However, such local institutions, communities and local NGOs have long been excluded from forest management, except in a few cases in the Petén. Since the end of the civil war there has been participation in the classification and management of protected areas through national and regional roundtables (*mesas de diálogo*) and in forest development through consultation roundtables convened by INAB.

Summary

Forests play an important role in Guatemala. In the uplands, large areas are owned by communities, who manage natural pine and mixed forests for multiple uses. In the rainforests of the Petén, large community-run timber concessions allow local people to improve their livelihoods on the basis of forest resources. However, SFM is hindered by high rates of deforestation and forest degradation driven by agricultural expansion, mining, illegal logging, drug-trafficking and other threats. Great efforts are being made in the country to maintain an active dialogue on forest-based development and various incentive programs are in place to protect existing forests and support the development of planted forests and agroforestry. A relatively high percentage of the production PFE is certified and more than half of it is considered to be under SFM.

Key points

- Guatemala has an estimated PFE of 2.46 million hectares (compared with 2.45 million hectares in 2005), comprising 1.14 million hectares of natural production forest (as estimated for 2005), 1.24 million hectares of protection forest (as estimated for 2005) and 85 000 hectares of planted forest (compared with 71 000 hectares in 2005).
- An estimated 630 000 hectares of the production PFE are under SFM, including 481 000 hectares of certified forest. An estimated 265 000 hectares of the protection PFE are considered to be under SFM.
- The system of protected areas and the monitoring of biodiversity are both long established. Information on the status of protected-area management is limited, however.
- Considerable efforts have been made in the last decade or so to reorganize the control and management of forest resources; this has included the decentralization of management and law enforcement. There have also been significant efforts to develop an ongoing multi-stakeholder dialogue on forest conservation and development
- There is long-standing experience in the management of conifer forests. The concession management policy introduced in lowland rainforests 6–8 years ago continues to play an important economic and ecological role in the region and is helping to improve livelihoods and support forest conservation. Nevertheless, there are considerable threats, including illegal logging and drug-trafficking.
- A large area (more than one-third) of the production PFE is certified, but there are concerns about the long-term viability of

certifying forests given the considerable transaction costs incurred by local communities to maintain certification status and the lack of adequate price premiums for certified timber and timber products.

Endnotes

a Government of Guatemala (2010).

b ITTO estimate.

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GUYANA

Forest resources

In 2010 the estimated population of Guyana was 761 000 people (United Nations Population Division 2010) and the country is ranked 114th out of 182 countries in UNDP's Human Development Index (UNDP 2009). It has a very humid climate and can be divided into four biogeographical zones: the narrow coastal plain; the 'rolling hills' – an extensive, forested area with sandy acid infertile soils reaching 90 m above sea level; a Precambrian lowland region of tropical rainforest; and, bordering Venezuela and Brazil, the Pakaraima mountains, a forested sandstone plateau 1000 m or more above sea level. FAO (2010) estimated that Guyana had 15.2 million hectares of natural forest in 2010, which is 71% of the total land area (21.5 million hectares). Guyana has an estimated 39 600 hectares of mangroves, the largest tracts of which are in the northern half of the country (Spalding et al. 2010).

Forest types. The Government of Guyana recognizes the following forest types: dry evergreen forest, marsh forest; montane forest; swamp forest mangrove forest; and mixed forest.[a] The composition of the forest changes considerably from north to south and reflects varied topographic and geological conditions. Mixed forest is the most common type and the most important source of timber; common species include *Mora gonggrijpii* (morabukea), *Chlorocardium rodiei* (greenheart), *Vouacapoua macropetala* (sarabebeballi) and *Clathrotropis brachypetala* (aromata). Seasonal forests have a lower canopy and include deciduous trees; they are found in the North Rupununi and upper Berbice areas. Dry evergreen forests occupy belts of leached white sands and are also found throughout the Pakaraima mountains (ITTO 2006).

Permanent forest estate. About 13.6 million hectares have been classified as state forest[a], although FAO (2010) estimated that the actual area of this estate is 12.2 million hectares. About 6.85 million hectares of state forest is allocated to commercial use and 1.11 million hectares to research and protection.[b] The remaining state forest land, mainly in the south of the country, is unallocated; a lack of ready access and long distances to market make the commercial harvesting of these forests economically infeasible at present. Gazetted state forest is strictly allocated for production, harvesting, biodiversity and research and will not or is not converted in anyway to non-forested uses.[a] Therefore, all state forest may be regarded as part of the PFE (Table 1).

Agricultural leases may be issued by the Guyana Lands and Surveys Commission for areas outside state forest. If an agricultural lease overlaps with areas within state forest the lessee must apply to the Guyana Forestry Commission (GFC) prior to any removal of timber.[b]

Forest ecosystem health

Deforestation and forest degradation. Most of Guyana's forests are still intact, unexploited and not threatened by the expansion of agriculture, although more than half of the forest estate has been categorized as 'naturally regenerating' (Table 2). In its submission for this report the Government of Guyana did not report the area of forest affected by mining, slash-and-burn agriculture or fire.[a] The total area of forest formally converted to agriculture to 2009 was 25 121 hectares. FAO (2010) estimated the deforestation rate in Guyana in the period 2005–10 at 0%. According to a recent study (GFC & Pöyry Forest Industry 2010), the deforestation rate for the period 1990–2009 was 0.02% per year, increasing to 0.06% in 2010.

Table 1 Permanent forest estate

Reporting year	Estimated total forest area, range (million ha)	Total closed natural forest ('000 ha)	PFE ('000 hectares)			
			Production		Protection	Total
			Natural	Planted		
2005*	16.9	16 916	5450	12	980	6442
2010	**15.2–20.5**	**13 600****	**11 090‡**	**12[a]**	**1110**	**12 212†**

* *As reported in ITTO (2006).*

** *Calculated using the ratio of forest with greater than 60% forest cover estimated by UNEP-WCMC (2010) (89.2%) and the total natural forest area estimated by FAO (2010).*

‡ *Includes that part of the Iwokrama forest allocated for production. Also includes 4.24 million hectares of state forest currently unallocated to either production or protection.*

† *Includes forest on Amerindian lands within the state forest estate but excludes forest on private property.*

Table 2 Forest condition

	PFE	Non-PFE	Total
	'000 ha		
Area of primary forest	-	-	6790
Area of degraded primary forest	-	-	0
Area of secondary forest	-	-	8415*
Area of degraded forest land	-	-	0

* *'Other naturally regenerating forest'.*

Source: FAO (2010).

Vulnerability of forests to climate change. The mean annual temperature is projected to increase by 0.9–3.3 °C by the 2060s (McSweeney et al. undated). All climate-change projections indicate substantial increases in the frequency of days and nights that are considered hot in the current climate. This will affect forest growth and increase the vulnerability of forest ecosystems. Guyana's low-lying coastal plains are vulnerable to sea-level rises that may occur due to the effects of global warming (ibid.). In its submission to the UNFCCC, Guyana completed a vulnerability and adaptation assessment, the first step towards the formulation of a climate-change adaptation strategy for Guyana. The first draft of the Low Carbon Development Strategy was published in June 2009 and the third draft in May 2010, outlining a comprehensive approach to fostering Guyana's development while combating climate change (Office of the President 2010).

SFM policy framework

Forest tenure. The bulk of Guyana's forests is owned by the state (Table 3). Under the Forest Law and national forest policy, the ownership of all forest resources, except those on private property and Amerindian (Indigenous) Lands, are vested in the state. About 1.31 million hectares of forest has been formally gazetted as Amerindian lands. State Lands, formerly called Crown Lands, are controlled by the Commissioner of Lands and Surveys. The GFC, the Guyana Geology and Mines Commission (GGMC) and the Lands and Surveys Department administer, respectively, land that is used for forestry, mining and agriculture. Each of these three government agencies may issue titles for different purposes over the same land (National Development Strategy Secretariat 2000).

Criteria and indicators. Guyana was a participant in the development of the Tarapoto C&I, which was coordinated by the Amazon Cooperation Treaty Organization. In 2001 the GFC reviewed both the Tarapoto and ITTO C&I in the development of a new national forest plan. The submission of the Government of Guyana to ITTO for this report was in the ITTO C&I reporting format.[a]

Forest policy and legislation. The overall objective of Guyana's national forest policy, as set out in its 1997 National Forest Policy Statement, is "the conservation, protection, management and utilisation of the nation's forest resources, while ensuring that the productive capacity of the forests for both goods and services is maintained or enhanced".[a]

Table 3 Forest area, by tenure

Ownership category	Total area	Of which PFE	Notes
	'000 ha		
State ownership (national, state or provincial government)	12 200	12 200	Managed by the GFC.
Other public entities (e.g. municipalities, villages)	0	-	
Total public	**12 200**	**-**	
Owned by local communities and/or Indigenous groups	1307	-	Gazetted Amerindian lands.
Privately owned by individuals, firms, other corporate	1676	-	Amerindian areas that have not been gazetted; agricultural leases; transported properties*; etc.
Total	2983	-	

* *Privately owned. The owner of a transported property theoretically owns the land from the centre of the earth to the sky above subject to government interests (e.g. airplanes flying overhead, minerals, etc).*

Source: ITTO estimate based on data in Government of Guyana (2009) and FAO (2010).

The specific objectives are to:

- Promote sustainable and efficient forest activities which utilize the broad range of forest resources and contribute to national development while allowing fair returns to local and foreign entrepreneurs and investors.
- Achieve improved sustainable forest resource yields while ensuring the conservation of ecosystems, biodiversity and the environment.
- Ensure watershed protection and rehabilitation by preventing and arresting the erosion of soils and the degradation of forests, grazing lands, soil and water; promoting natural regeneration, afforestation and reforestation; and protecting the forest against fire, pests and other hazards.

The policy was prepared over two years through a process of broad consultation with sector interest groups and was formally approved by Cabinet in October 1997. It recognizes that there have been changes in Guyana's economic, social and political environment over the nearly 50 years since the previous forest policy was published. It marks a significant shift in emphasis from the development of the timber resources to a broader approach to management for multiple goods and services for the national benefit.

The Forest Act – Chapter 67.01 of the Laws of Guyana – governed the administration of Guyana's forests from 1953 to January 2009, when the Parliament passed the Forest Bill (2009). As of October 2009, however, this Bill was still awaiting assent by the President of Guyana. When it comes into effect it will repeal Law 67.01 (and others) and is designed to "consolidate and amend the law relating to forests". Specifically, it sets out to provide for:

- The sustainable forest management of state forests.
- The protection and conservation of forests (excluding the Iwokrama forest, Kaieteur National Park, and any other area designated as a conservation area, all of which are dealt with under other laws).
- The regulation of forest operations and activities relating to forest produce and quality control for value-added forest produce, having regard to Guyana's international legal obligations.

Features of the Forest Bill (2009) include the following:

- Before granting or renewing any concession over an area of state forest 8097 hectares or smaller, the GFC shall
  - by public notice invite applications for a concession over the area and notify the locations where the relevant documents may be inspected or bought
  - provide any other publicity that the GFC considers necessary to bring the invitation to the attention of persons likely to be interested in obtaining a concession over the area.
- The GFC shall make available for inspection at its offices and for sale at a reasonable price copies of all documents in its possession concerning the forest produce and other features of the area that the GFC considers relevant to the preparation of applications.

- A consolidated effort towards maintaining environmental integrity and social development in communities by using relevant sections of both the Amerindian Act (2006) and the Environmental Protection Act (1996). Specific provisions are made for community forest management and extractive and primary processing forest operations.
- Recognition of the importance of ensuring sustainability in forest resource use. Part 2 of the Bill deals with SFM, recognizing that the minister has overall directive input on all activities.
- Forest concession agreements are streamlined with specific size classes. More importantly, the system for granting and renewing these agreements is systematic and transparent in keeping with international best practices.
- A proposal to make mandatory the submission of annual and management plans by larger concessions, and a further stipulation that all harvesting activities are to be carried out in compliance with approved plans.
- Allowance for competitive bidding in forest area allocation in the event of multiple applications, thereby improving transparency in the process.
- It provides communities with a clear means of acquiring and securing rights to manage forest areas and of benefiting from their local forest while ensuring sustainability, stimulating income generation and fostering environmental stability.
- It addresses areas such as afforestation, occupational health and safety, forest conservation, the maintenance of soil and water quality, and the preservation of biological diversity.
- It guards against pricing below the true market value. The GFC and the Forest Products and Marketing Council of Guyana (FPDMC) advise stakeholders on prevailing market prices.
- The clauses on forest offences and the appeals which may be made are also strengthened to reflect more severe penalties for abuse of power, negligence and misconduct.
- It allows for the more efficient and optimal use of Guyana's state forest resources by strengthening the revenue system. This is done by creating a more efficient revenue structure which seeks to capture area management fees, fees for the standing stock of timber, an incentive to encourage SFM, and other related charges. The Bill provides for these monies to be paid over to the Consolidated and Contingencies Fund.
- It provides a robust mechanism for the authorization of state forest leases in cases of a change in ownership and effective control.

Institutions involved in forests. The GFC was created in 1979 under the GFC Act 67:02. In 2008 a new law, the GFC Act 2007, was passed by Parliament to "repeal and replace the Guyana Forestry Commission Act 1979, re-establish the Guyana Forestry Commission, and provide for incidental matters". The GFC is a semi-autonomous public agency with the aim of encouraging the development and growth of forestry in Guyana on a sustainable basis. Among other things it advises the Minister of Agriculture on and carries out forest policy, and administers the Forests Act, including by carrying out the Commission's functions under that Act and collecting and recovering all fees, charges, levies, premiums, fines, penalties, costs, expenses, and other monies payable under the Act.

The GFC is also mandated to:

- Prepare plans, codes of practice and guidelines for the conservation and management of forests.
- Research, collate, analyse, prepare and disseminate data, statistics and other information about forests and all aspects of forestry, including forest ecology and the use of forest produce.
- Make forest inventories.
- Provide or facilitate education and training in forestry and forestry-related jobs.
- Provide forestry extension services and give advice to persons and communities interested or involved in forestry.
- Provide an inspection, certification and accreditation service for quality control of forest produce.
- Represent the Government in regional and international forestry meetings and negotiations, and in relation to Guyana's international obligations concerning forestry.

The GFC is a member of the Cabinet Sub-Committee on Natural Resources and Environment. This body, comprising policy and technical representatives, provides guidance and technical support to Cabinet. Its work is supported by the Natural Resources and Environment Advisory Committee, which is chaired by the Prime Minister and coordinated by the Adviser to the President on Sustainable Development. In 2010, 260 people were employed in public forest institutions, including 60 with university degrees or an equivalent qualification. Total public expenditure in the forest sector in 2010 was 500 million Guyanese dollars.[b]

At the operational level, the GFC works in close collaboration with the FPDMC and the Forestry Training Centre. The Minister of Agriculture has established a Technical Committee comprising the GFC and the Forest Producers Association (FPA) and a Ministerial Committee comprising the GFC, the FPA and the Guyana Manufacturing and Services Association as part of efforts to foster a closer working relationship with the private sector and industry stakeholders. These fora allow open dialogue and act as problem-solving mechanisms for issues related to natural resource management, including in areas of harvesting, forest industry and export regulations.

One forest producers' association and a number of smaller, community-based loggers' associations represent loggers and sawmillers in the forest sector and endeavour to ensure collaboration in activities such as training, information, public awareness and institutional development. National environmental NGOs are weak, but international environmental organizations are assuming independent roles in forest control and information-sharing, partly in collaboration with the forest administration.

Status of forest management

Forest for production

The Forest Bill (2009) makes significant changes to the allocation of state forest for harvesting. Under the Bill, the GFC may grant forest concessions up to 8097 hectares in size for the harvesting of forest produce, including timber. Concessions may be larger on application by holders of exploratory permits (see below) or if they are for 'forest conservation operations', which are defined by the Bill as the preservation of forests for the purpose of carbon sequestration or any other form of environmental service[1]; the conservation of biological diversity; or ecotourism. Forest operations under these larger concessions can only be carried out after the GFC has approved a forest management plan of at least five years' duration and an annual operations plan for the concession area.

Exploratory permits may be granted under the Bill for exploratory operations within a specified area of state forest with a view to later applying for a concession in the area. The Bill does not state a limit on the size of the forest area that may be allocated under such permits. The Bill also specifies the parameters of community forest management agreements.

In its submission to ITTO, the Government of Guyana reported forest use on the basis of the Forest Act (1953), since the Forest Bill (2009) was yet to come into effect.[a] Under the Forest Act, forest harvesting permits are allocated according to the following three categories:

- *Timber sales agreements* (TSAs): concessions are granted on a lease of 20 years or more over an area of 24 000 hectares or more. As of June 2010, 25 TSAs had been allocated to local and international companies covering an area of 4.53 million hectares (47.7% of all state forest).[a] The average size of a TSA is 75 000 hectares (ranging from 50 000 to 100 000 hectares), and companies may hold more than one TSA at a time.
- *Wood cutting leases* (WCLs): licences are granted on 3–10-year leases for areas of 8000–24 281 hectares. As of June 2010, there were two licences covering a total area of about 30 500 hectares.[a]
- *State forest permits* (SFPs): cutting permits are granted on an annual basis for areas of state forest up to 8094 hectares in size. SFPs are generally issued to small-scale operators; 386 permits covering a total area of 1.35 million hectares were allocated as of June 2010 (14.2%

1 This provision is designed to allow conservation organizations to pay an amount equivalent to that which would have been paid for commercial harvesting rights for the exclusion of timber harvesting from particular forest areas.

of all commercial allocations).[a,b] There are also permits called 'SFPs in conversion'.[2]

- *State forest exploratory permits*: before a WCL or a TSA is issued, a three-year exploratory permit may be granted to allow the collection of information for the preparation of an investment proposal, an environmental and social impact assessment, and a forest management plan. In June 2010, six exploratory permits covering an area of 797 000 hectares were in effect.[a]

In 1998 the GFC introduced the Code of Practice for Timber Harvesting based on FAO's Model Code of Forest Practice. The Code, which was revised in 2002 (GFC 2002), prescribes internationally accepted standards for exclusion areas and buffer zones, 100% pre-harvest inventory, road construction, felling, skidding, trucking, operational and camp hygiene, and occupational health and safety. Besides exclusion areas and buffer zones, the Code restricts logging on slopes greater than 40% and sets a minimum distance of 10 m between harvest trees to minimize the size of canopy openings.

The Code of Practice for Timber Harvesting is not prescribed under the Forest Bill (2009). Instead, the Bill specifies that the GFC "may at any time submit to the Minister a proposed code of practice to regulate any class or description of forest operations". Such a code, if adopted by the minister, must then be adhered to during forest operations.

Guyana's forests are characterized by a predominance of relatively slow-growing, high-density timber species and smaller trees compared with most other tropical regions due to the inherently low fertility of soils derived from the ancient Guiana Shield. Commercial timber occurs in spatially segregated 'reefs' or stands in which one or two commercial species dominate. Nevertheless, a large proportion of the commercial stock in these stands is defective (hollow or crooked), possibly due to the poor nutrient status of the soils and a very low rate of natural disturbance (which seems to have resulted in overmature stands), and commercially viable stands are usually separated by stands that are nearly devoid of commercial species. Forest harvesting is, therefore, highly selective; on average, 2–3 trees are felled per hectare, with an average yield of about 7 m^3. The national forest plan guidelines prescribe a cut of up to 20 m^3 per hectare on a 60-year cycle. Owing to the limited range of commonly used species, however, the extraction rate is only about half this maximum allowable cut.

Guyana has developed principles, policies and guidelines for improved forest management and timber harvesting practices. This is reflected in the 1997 national forest policy as well as in forest legislation, forest management guidelines and codes of practice. Among these guidelines are:

- Code of Practice for Timber Harvesting
- Guidelines for Conducting Management-level Inventory and 100%-level Inventory
- Guidelines for the Preparation of Forest Management Plans and Annual Operational Plans.

Prior to the approval of operations, large concessions (TSAs) are required to submit to the GFC a detailed management plan and annual operations plan. The latter specifies, among other things, the forest blocks to be harvested that year and the volume to be extracted. Volume is calculated based on area and felling cycle and tags are issued accordingly. Prior to the renewal of operations for the following year, harvested blocks are inspected by GFC field staff to ensure adherence to the annual operations plan.

Also stipulated in the management guidelines is the requirement that all large concessions allocate 4.5% of the total area to biodiversity conservation for the life of the concession. A number of criteria are set out for the selection and identification of this area:

- The area identified must be representative of the various vegetation types found in that concession and the area identified must represent all flora and fauna found in the concession.
- No harvesting may take place within this area once approved for biodiversity conservation.
- The GFC must conduct a reconnaissance survey to verify that the area selected is indeed

2 These are areas exceeding 24 000 hectares that were previously issued as SFPs. These concessions are being regularized and some are being converted to the larger-sized category (TSAs) while others are being reduced to the smaller category (SFPs). The use of these areas is for sustainable production. The word 'conversion' therefore does not refer to land use but to a process of recategorization. These areas were not included in the figures provided for TSAs or SFPs.

representative of the vegetation type(s) found in the concession.

- The GFC must give official approval for this area to be allocated to biodiversity conservation.

A national log-tracking system was established in 1999 and is based on international best practice to ensure transparency.[a] It works on the ground through the GFC's 26 forest stations, enabling a forest officer to track timber from the stump. Harvesting can therefore be monitored to ensure that the requirements established in the approval of management plans and annual operation plans are met. The system, further developed in recent years with ITTO assistance, reduces the risk of over-harvesting within a concession and helps ensure that harvesting is carried out only in those areas identified and approved by the GFC for harvesting.

The log-tracking system functions via the use of log tags which are assigned (free of charge) to operators at the annual renewal of their licences. Each operator is given a unique set of tags, which are valid only for a period determined by the GFC (two years for SFPs and one year for large concessions). Half of the tag is affixed to the stump at the time of felling and the other half, which bears the same sequence of numbers, is affixed to the produce being conveyed. All timber is tagged, including logs, lumber, piles, poles and posts.

The system is currently applied to all forestry operations in state forests and on Amerindian reservations and private properties. All timber legally originating in Guyana can therefore be traced back to the stump. A bar-code system is under development. This system of log-tagging appears to have been accepted by the industry and has increased the capability of the GFC to monitor timber transactions.

Reduced impact logging techniques are promoted by the ITTO-funded Forestry Training Centre, Inc, a subsidiary of the GFC, through demonstration forests and hands-on training. To October 2009 the Forestry Training Centre had provided training for 1036 persons from academic institutions, forest administration, NGOs, logging enterprises and communities. This figure includes 345 persons from community-level operations, largely in Indigenous communities, who received training in 2010.[b]

The Iwokrama International Centre for Rainforest Conservation and Development (known as the Iwokrama forest) is responsible for the management, conservation and sustainable development of almost 372 000 hectares of tropical rainforest, which the government of Guyana allocated as a way of demonstrating that tropical forests can provide economic benefits while also conserving biodiversity. Its operation has been supported by a range of donors, including ITTO.

The GFC is coordinating a program of work on forest law enforcement and legality with the support of the Forest Products Development and Marketing Council, the Forestry Training Centre Inc., and private-sector counterparts. One of the outputs of this process has been the development of the Guyana Legality Assurance System (LAS) through a process of stakeholder consultation and participation. In June 2006, Proforest (an international firm specializing in forest legality systems) was contracted to assist in the development and field-testing of an independent, transparent and suitable timber legality verification system for Guyana's forest sector. The LAS complements other efforts towards ensuring legality, such as ongoing concession-level monitoring, the national log-tagging and tracking system, and the implementation of the Code of Practice for Timber Harvesting.

A memorandum of understanding between the Government of Guyana and the Government of Norway outlines a number of activities to be undertaken in 2009–10, including the establishment of a system for independent forest monitoring (IFM). This will build on work already under way in Guyana and will allow for the development of a mechanism for assessing illegality in the forest sector. It will cover all significant drivers of deforestation and forest degradation in Guyana and thus has direct links to a REDD+ monitoring program. The IFM is not intended to replace the LAS, ongoing dialogue with the European Union's Forest Law Enforcement, Governance and Trade initiative, or existing legality procedures/systems. Instead, it will serve as a national system of legality assessment at the broader country level, addressing relevant drivers of forest change that are linked to forest legality/illegality and providing a system that can be recognized globally. The IFM will be implemented in state forests and Amerindian villages that opt into the

country's Low Carbon Development Strategy. It will be applied to logs (roundwood, piles, poles and posts) and lumber. It will cover all stages of the chain of custody – harvesting, transportation, processing and export. The initial activity in late 2010 was to be a scoping mission. The GFC will implement recommendations over a one-year period. Thereafter, monitoring assessments will be conducted at two-year intervals (or less).

Silviculture and species selection. The default silvicultural system in use in Guyana is natural regeneration with polycyclic cuts, without post-harvest silvicultural interventions. Under the Forest Act (1953), yield is regulated by a minimum diameter limit of 34 cm, while forest management plans for WCLs and TSAs must specify the cutting cycle and yield per cutting cycle; they must also indicate species for harvesting and harvesting rules. The Forest Bill (2009) does not specify a minimum diameter limit.

There are more than 1000 tree species in Guyanese forests, more than 30 of which are marketed and exported to destinations in Asia, Europe, North America and the Caribbean (Table 4 shows five of these). *Chlorocardium rodiei* (greenheart), *Peltogyne venosa* (purpleheart), *Eperua* spp (wallaba) and *Hymenaea courbaril* (locust) are some of the species most favoured by international markets. In the Iwokrama forest, the second most abundant species after greenheart is *Dicorynia guianensis* (wamaradan, also known as Angelique in French Guiana) (K. Rodney, pers. comm., 2011).

Greenheart is resistant to attack by marine borers and is highly valued, especially as piling for wharves and for other marine applications. The 'special' category of timber, which includes greenheart, purpleheart, bulletwood, red cedar, brown silverballi and letterwood, accounted for about 35% of total log production in 2009.[b] The production of piles and chainsaw lumber is not included in these figures. Other important species are *Goupia glabra* (kabukalli), *Trattinickia* spp (ulu), *Pouteria speciosa* (suya), *Aspidosperma* spp (shibadan), *Simarouba amara* (marupa), *Carapa guianensis* (crabwood) and *Catostemma commune* (baromalli).

Planted forest and trees outside the forest. About 12 000 hectares of planted forest, mainly *Pinus caribaea,* were established in the 1960s. They were originally intended to supply a pulp industry but are now maintained as permanent sample plots under the management of the GFC.[b] No new planted forests are being established.[b] FAO (2010) reported that there were no planted forests in Guyana.

Forest certification. ITTO (2006) reported that two concessionaires were engaged in the process of obtaining forest-management and chain-of-custody certification under the FSC, while two more had shown an interest in pursuing certification. Currently, however, there is only one certified forest area – the Iwokrama forest (372 000 hectares, including 184 500 of production forests in the 'sustainable utilization area', FSC 2010).[3] The estimated sustainable yield in Iwokrama's sustainable utilization area is about 22 000 m^3 per year (Iwokrama International Centre for Rain Forest Research and Development 2009).

Estimate of the area of forest sustainably managed for production. Table 5 shows that the total size of the production PFE and the area allocated to concessions or otherwise under licence have both increased compared with 2005. Guyana is making good progress towards SFM and the log-tracking system has added transparency to the system. The Government of Guyana[b] reported that "all concession harvesting activities are managed in keeping with sustainable forest management principles … There is overall compliance with GFC principles and management practices across issued concessions. GFC has 26 field stations as well as mobile stations that monitor forest operations. Additionally, routine monitoring and environmental audits are conducted to test compliance with set principles and practices. These have overall indicated positive results and compliance." On the basis of an estimate provided by the Government of Guyana, FAO (2010) reported that the entire state forest estate (12.2 million hectares) was under sustainable management.

In 2005, two concessionaires were working towards the certification of their forests under the FSC scheme. Several companies have since had some experience with certification (K. Rodney, pers. comm., July 2010):

- Barama Co. Ltd., a wholly-owned subsidiary of Samling Global Limited with concessions

3 The Iwokrama forest was the second Guyanese forest to be certified. The Barama concession was the first, but lost its certificate following an FSC audit (K. Rodney, pers. comm., 2011).

Table 4 Commonly harvested species for industrial roundwood

Species	Notes
Peltogyne venosa (purpleheart)	Used mainly in high-end internal construction applications and for furniture and components.
Chlorocardium rodiei (greenheart)*	Used mainly for outdoor structural applications and marine works.
Swartzia leiocalycina (wamara)	Used mainly for furniture, and components.
Mora excelsa (mora)*	Used mainly for building construction, especially flooring.
Goupia glabra (kabukalli)	Used mainly for heavy construction, house framing, flooring and decking.

* *Also listed in ITTO (2006).*
Source: Government of Guyana (2009).

Table 5 Management of the production PFE ('000 hectares)

Reporting year	Natural						Planted	
	Total	Available for harvesting	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
2005*	5450	3800	3730	0	520	12	0	0
2010	**11 090**	**6710**[**,a]	**4053**[a]	**184.5**	**520**	**12**	**0**	**0**

* *As reported in ITTO (2006).*
** *Existing TSAs, WCLs and SFPs.*

covering about 1.6 million hectares of forest (Barama 2010), had certification, but this has lapsed.

- Demerara Timbers Ltd (DTL) has a chain-of-custody certificate in compliance with a UK government standard.
- Variety Woods & Greenheart Limited has sought FSC certification but it is unclear how far it has progressed.
- Toolsie Persaud Ltd underwent a pre-assessment audit with The Forest Trust.
- Iwokrama's joint venture partner (Tigerwood Guyana Inc) has an FSC chain-of-custody certificate.

Although Iwokrama is the only operation in Guyana with an FSC forest-management certificate, the strong field presence of the GFC, moves by several companies towards certification, and the development of a trained cadre of forest operators suggests that a significant area of the Guyana's forest is being managed in a way that is consistent with sustainability. At the very least it seems unlikely that the area under such management has declined since the previous report.

Timber production and trade. Total industrial log production was 299 000 m^3 in 2009, down from 474 000 m^3 in 2006 and 366 000 in 2004 (ITTO 2011). About 64 000 m^3 of sawnwood were produced in 2009, an increase over the 56 000 m^3 produced in 2004 and the 50 000 m^3 produced in 1999. Plywood production, on the other hand, declined from 87 000 m^3 in 1999 to 54 000 m^3 in 2004 and to 21 000 m^3 in 2009 (ibid.).

The total export value of logs, sawnwood and plywood in 2009 was US$48.1 million, compared with US$38.3 million in 2004 and US$31.3 million in 1999 (ibid.). In 2009, Guyana exported 91 000 m^3 of logs, 49 000 m^3 of sawnwood and 17 000 m^3 of plywood (ibid.).

In January 2009 the Government of Guyana introduced a national log export policy that increased the export commission rate on key species used locally in value-added production. The policy was in response to the perceived need among various stakeholders to stimulate more value-added activities in Guyana, to increase the use of lesser-used species, and to ensure that domestic downstream processors of logs receive adequate supplies of materials. The policy has three elements:

- Raise the export commission rate from 2% to 7% from January 2009, to 10% from January 2010, and to 12% in the period January–December 2011, for logs of the following species: purpleheart, *Cedrela fissilis, C. odorata* (red cedar), *Piratinera guianensis* (letterwood), *Manilkara bidentata* (bulletwood), *Bagassa guianensis* (cow wood), *Diplotropis purpurea*

(tatabu), kabukalli, shibadan, *Humiria balsamifera* (tauroniro), *Tabebuia serratifolia* (washiba), *Loxopterygium sagotii* (hububalli), *Dipteryx odorata* (tonka bean), *Hymenolobium flavum* (darina), greenheart and *Licaria canella* (brown silverballi).

- Raise the export commission rate from 2% to 7% in January 2009 and to 10% in the period January 2010 to December 2011 for logs of the following species: *Swartzia benthamiana* (itikiboroballi), *Ocotea rubra* (determa), wamara, *Tabebuia capitata* or *insignis* (hakia), mora, *Parahancornia fasciculata* (dukali), *Ocotea puberula* (keriti silverballi), wallaba, *Terminalia amazonica* (fukadi) and *Jacaranda copaia* (futui).
- Impose the same export commission rates as specified in the first part of the policy to the export of squares with dimensions of 20.3 cm x 20.3 cm and greater (or 8" x 8" and greater) to the following species: purpleheart, red cedar, letterwood, kabukalli, shibadan, washiba, hububalli and tonka bean.[a]

Only companies holding forest concessions are permitted to export logs. The log export policy is expected to induce a reduction in the volume of wood exported in log form and as squares.

Non-timber forest products. Many NTFPs are harvested from natural forests but only a few are extracted commercially. Significant volumes of *Euterpe oleracea* (palm heart, manicole) are exported in canned form; in 2008 about 2.7 million palm hearts were harvested in Guyanan forests, up from 2.48 million in 2007.[b] Nibi and kufa (rattan-like *Heteropsis flexuosa* and *Clusia* spp) are used for furniture-making and exported to the Caribbean islands, the United Kingdom and North America. Fibres of *Mauritia flexuosa* (ité palm) are used to make baskets, mats and other items for export. Other products include latex from *Manilkara bidentata* (balata), *Bixa orellana* (annatto dye) and *Carapa guianensis* (crabwood oil). Mangrove bark is exported for tanning leather. There is a legal trade in wildlife, especially birds, reptiles and amphibians.

Forest carbon. Gibbs et al. (2007) estimated Guyana's forest carbon at 2490–3740 MtC and FAO (2010) estimated it at 1629 MtC. Since 2000, GHG emissions from deforestation are estimated to have averaged about 22.6 million tonnes of CO_2e per year (Government of Guyana 2008). In preparing its REDD+ strategy the Government of Guyana engaged with the Forest Carbon Partnership Facility and UN-REDD, and it is an active member of the REDD+ Partnership. On 9 November 2009 the governments of Guyana and Norway signed a memorandum of understanding that sets out how the two countries will "work together to provide the world with a relevant, replicable model for how REDD+ can align the development objectives of forest countries with the world's need to combat climate change". Norway committed to providing financial support of up to US$250 million by 2015 for results achieved by Guyana in limiting emissions from deforestation and forest degradation under its Low Carbon Development Strategy (Office of the President 2010). This strategy sets out Guyana's approach to transition to a green economy, with the stated aim of combating climate change while simultaneously promoting economic growth and development. It sets out how Guyana's economy can be realigned along a low-carbon development path by investing payments received for avoided deforestation into strategic low-carbon sectors (Government of Guyana 2011). The increase in deforestation reported in 2010 may be due partly to an expectation of tighter controls under this strategy.

Guyana has also established a National Climate Committee comprising representatives of a number of government agencies, NGOs and the private sector. This committee has a reporting responsibility to the Government and the Parliament of Guyana. The National Climate Unit within the Ministry of Agriculture is the implementing entity for the

Table 6 Forest carbon potential

Biomass forest carbon (MtC)	% forest with canopy cover >60%	Deforestation/ degradation potential to 2030	Enhancement of carbon sink capacity to 2030	Forest area change monitoring capacity	Forest/ GHG inventory capacity	Importance of forest fire/ biomass burning	Engagement in international REDD+ processes
2490–3740	89.2	+	+++	+++	++	+	+++

+++ high; ++ medium; + low; estimate of national forest carbon based on Gibbs et al. (2007); estimate of % total forest with canopy cover >60% based on UNEP-WCMC (2010).

Table 7 Management of the protection PFE ('000 hectares)

Reporting year	Protection PFE	Attributed to IUCN categories I–IV	Allocated for soil and water	With management plans	Sustainably managed
2005*	980	980	-	243	243
2010	**1110**	**1040**	**-**	**332****	**332****

* *As reported in ITTO (2006).*

** *Comprises Conservation International's conservation concession (which, strictly speaking, is part of the production PFE but is not counted there), the protected portion of the Iwokrama forest, and Kaieteur National Park.*

committee and manages and coordinates day-to-day climate-change procedures. Guyana has also established an Office for Climate Change and a REDD+ Secretariat to execute aspects of climate-related activities and REDD+. Table 6 summarizes Guyana's carbon potential.

Forest for protection

Soil and water. Forests are still intact over large areas. There are, however, threats to biodiversity and to soil and water, of which mining – particularly for gold – may be the greatest. Small-scale gold-mining takes place over a wide area; impacts include localized deforestation, the removal of topsoil and the pollution of watercourses with sediment and mercury. Trees felled by gold-miners cause blockages to rivers, sometimes resulting in downstream flooding. Guyanese soils are essentially alluvial; they are acidic, with a pH as low as 3.6, and quickly degenerate once trees are removed (Clarke 2006).

Biological diversity. Guyana's large areas of intact forest ecosystems have a very high conservation and ecological value. More than 1200 vertebrate species were counted in a 1997 inventory, including 198 mammals, 728 birds, 137 reptiles and 105 amphibians, and more than 6000 flowering plant species, of which about one hundred are forest trees of commercial interest. It is almost certain that many more species remain to be discovered. No species found in Guyana's forests are listed on the IUCN red list of threatened species (IUCN 2011). Guyana has two plant species listed in CITES Appendix I, 42 in Appendix II and one in Appendix III (UNEP-WCMC 2011). Bulletwood is protected under the Forest Act for its value to Indigenous communities and because of the limited occurrence of this species in Guyanan forests.

Protective measures in production forests. The Code of Practice for Timber Harvesting includes provisions for protecting watercourses, reducing the impact of logging on residual stands and conserving protected wildlife. Forest management plans must identify representative biodiversity reserves covering at least 4.5% of the productive forest area that are then excluded from harvesting. The GFC's monitoring division monitors TSAs against the standards prescribed by the Code.

Extent of protected areas. Guyana has two formally established protected areas in forests (both of which are established under separate laws): the Kaieteur National Park, which is 63 000 hectares in size, and the Iwokrama forest, of which 187 500 hectares are set aside for forest conservation purposes. Under the proposed National Protected Areas System, more areas could be allocated for protection, including Shell Beach (which includes mangrove forests), Kanuku Mountains, Mount Roraima, and Orinduik Falls.[4] In 2002 Conservation International was awarded a 30-year conservation concession of 81 000 hectares to the south of Iwokrama called the Upper Essequibo Conservation Concession.[5] There are also eleven 'GFC reserves' covering a total area of 17 800 hectares. UNEP-WCMC (2010) estimated that there were 1.04 million hectares of forest in IUCN protected-area categories I–IV.

Estimate of the area of forest sustainably managed for protection. The estimated area of protection PFE under sustainable management is at least 331 500 hectares (Table 7). This area comprises the Kaieteur National Park, Conservation International's conservation concession, and the conservation area set aside in the Iwokrama forest. The area under sustainable management has increased since 2005, due mainly to the addition of CI's conservation concession but also to a slight amendment in the size of Iwokrama's conservation area.

4 www.guianashield.org/joomla/index.php?option=com_content&view=article&id=173:wwf-grant-agreements&catid=1:latest-news&Itemid=50 =en, accessed 9/9/09.

5 www.conservation.org/FMG/Articles/Pages/guyana_conservation_concession.aspx, accessed 9/9/09; the Upper Essequibo Conservation Concession Guyana fact sheet; seen at http://www.conservation.org/Documents/guyanaconcession_factsheet.pdf.

Socioeconomic aspects

Economic aspects. An estimated 24 100 people are employed in forest operations in Guyana and 19 800 people in the forest products industry.[b] There is also considerable – but un-estimated – informal and unrecorded employment and economic activity. The total value of wood exports in 2008 was US$56.7 million[b]; the country also exported fuelwood valued at about US$151 000 and NTFPs (not including canned palm hearts) valued at about US$96 000.[a]

Livelihood values. Forests are an integral part of Amerindian culture and are important for the supply of building materials, fibres for textiles and weaving, and tannins and dyes, as well as for wildlife, fruit, seeds and nuts that are hunted or gathered for food. Medicines are obtained from more than 130 plant species (van Andel et al. 2003). Some communities have undertaken the commercial harvesting of these resources.

Social relations. Amerindians comprise 9.1% of the Guyanese population and own 13.9% of the land. Amerindian communities are generally located in areas remote from urban centres and rely on subsistence fishing, shifting cultivation and hunting. The creation of a Ministry of Amerindian Affairs in 1992 has facilitated a more participatory role for these communities in national development. The Amerindian Act (2006), too, gives Amerindian communities legal powers to manage and conserve their lands. Ninety-six communities have titles, but another ten communities do not have formal legal title to the lands they occupy. Guyana's Low Carbon Development Strategy identified, as a priority activity, the titling of these areas.[b] The Amerindian Act empowers Amerindian communities to create and enforce protected areas on their lands. A community can, for example, prohibit or control entry and access to its territory and traditional knowledge, prohibit or control mining, zone its lands, protect sacred sites, and regulate hunting, fishing, tourism and research. All Amerindian lands are owned collectively by communities (called 'villages') and administered through village councils (Anon. 2008).

Amerindian communities are afflicted by severe social and health problems, particularly in communities adjacent to gold-mining and timber concessions. The Ministry of Amerindian Affairs and the GGMC have collaborated to train a number of rural residents as rangers to complement GGMC's monitoring efforts in mining districts. The Iwokrama forest initiative has had significant success in involving local Amerindian communities in forest management (Bakken Jensen 2005).

A greenheart tree in a logging concession, Guyana.

The GFC has managed a number of outreach, communications and extension programs with communities and Amerindian groups. It has established a community forestry program which entails the formation of community forestry organizations, which are provided with access to state forest lands and, in some cases, with equipment. Several Amerindian communities have also been provided with extension services and training in reduced impact logging. In the North Rupununi area, a community forestry project has been implemented, reduced impact logging skills transferred and other forest management services extended (Government of Guyana (2008).

When it comes into force the Forest Bill (2009) will provide communities (including but not restricted to Amerindian communities) with a means of acquiring clear and secure rights to manage and benefit from their local forests on a sustainable basis in order to help meet local needs, stimulate

income generation and economic development, and enhance environmental stability. Under the Bill, properly established community groups can apply to the GFC for community forest use agreements that would authorize the group to occupy a specified area of state forest and to manage it in accordance with the agreement.

The GFC's Community Development Unit, which sits within its Planning and Development Division, has a mandate to build capacity in forest-based communities. Community forestry is being formally undertaken on an area of about 114 000 hectares under SFPs.[a]

Summary

Most of Guyana's forests are still intact, unexploited and not threatened by the expansion of agriculture. Guyana is pursuing a well-designed forest management and control system in its timber production forests. A new law, the Forest Bill, is awaiting assent by the President of Guyana. This law will provide for the sustainable management, protection and conservation of state forests and the regulation of forest operations, and it will also make considerable changes to the allocation of state forest for harvesting. The Guyana Forestry Commission appears to be well-organized and responsive and has a substantial field presence. Guyana has made progress in a number of areas, including the development of a legality assurance system and independent forest monitoring, which will not only provide a basis for international scrutiny and access to REDD+ initiatives but also enable the validation and improvement of existing forest management systems. At the forest industry level, however, significant progress is required to fully realize the SFM goal.

Key points

- Guyana has an estimated PFE of 12.2 million hectares (compared with 6.44 million hectares in 2005), comprising 11.1 million hectares of natural production forest (compared with 5.45 million hectares 2005), 1.11 million hectares of protection forest (compared with 980 000 hectares in 2005) and 12 000 hectares of planted forest (the same as reported in 2005).
- A new forest law is due to come into effect.
- Gold-mining is a significant cause of forest degradation and environmental pollution.
- At least 520 000 hectares of production PFE is being managed sustainably. Given the general lack of threats to the forest, the high-quality training available to forest operators, and positive moves by the Guyana Forestry Commission to institute improved tracking and monitoring systems, this is likely an underestimate.
- At least 332 000 hectares of protection PFE is being managed sustainably. Given the general lack of threats to Guyana's forests, this is also likely to be an underestimate.
- Wood exports make a significant contribution to Guyana's foreign-exchange earnings. A new national log export policy has been introduced with the aim of encouraging local wood-processing.
- Guyana has considerable potential for participation in a global REDD+ scheme for avoided deforestation and forest degradation.

Endnotes

a Government of Guyana (2009).

b Personal communications with officials of the Government of Guyana, 2009, 2010.

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HONDURAS

Forest resources

Honduras, the second-largest country in Central America, has a land area of 11.2 million hectares and an estimated population in 2010 of 7.6 million people (United Nations Population Division 2010). Honduras is ranked 112th out of 182 countries in UNDP's Human Development Index (UNDP 2009). It comprises three distinct biogeographic regions. The central highlands cover about 60% of the country, with fertile valleys and steep slopes between 700 m and 1900 m above sea level, the highest peak reaching more than 2800 m. A second region is the vast northern coastal plain abutting the Caribbean Sea, which can be divided into two subregions: the central plain covered mainly by grassland, swamps, secondary palm forests and pine forests; and the northeastern plain – the Mosquito Coast (*La Mosquitia*) – which is sparsely populated and covered by pine forests, humid forests and some mangrove forests. The third biogeographic region is a narrow strip of land along the Gulf of Fonseca on the southern Pacific coast, which mainly comprises agricultural land and some remnant mangroves.

According to the most recent national forest inventory (ENF 2006), forests cover an area of 5.79 million hectares (52% of the land area), including 4.83 million hectares of assessed forests and another 960 000 hectares of unclassified forests. The Government of Honduras (2010a) estimated the total forest area at 6.66 million hectares on the basis of a 2009 analysis. FAO (2010a) estimated the total forest area at 5.19 million hectares, which is more than the estimate reported in FAO (2006) of 4.65 million hectares.

Forest types. The central highlands and the Mosquito Coast savannas are covered by nearly two million hectares of pine and mixed forests, while about 3.5 million hectares of broadleaved forests cover much of the Caribbean coast, the Agalta mountains and the eastern lowlands (ENF 2006); these constitute the country's major closed forests. Honduras is one of the few tropical countries with large areas of natural conifer forests, which are composed of one or several of seven *Pinus* species, as well as species of the genus *Abies*. At lower altitudes (up to 700 m above sea level), *P. caribaea* (pino costanero) dominates; between 700 and 1400 m, *Pinus oocarpa* (pino ocote) occurs often in pure stands; and between 1500 m and 1900 m above sea level a mixture of pino ocote, *P. maximinoi* (pino llorón) and *P. tecumumanii* (pino rojo) constitutes the major forest layer. Above 2000 m, *P. ayacahuite*, *P. pseudostrobus* (pinabete), *P. hartwegii* (pino de montaña) and species of the genus *Abies* occur. Natural pine forests are used intensively by local communities and by industry.

Tropical broadleaved forests are found mostly in the north. The most common species are *Vochysia hondurensis, Virola koschnyi, V. sebifera, Luehea seemanii, Terminalia amazonia, Cordia alliodora, Cedrela mexicana, Ceiba pentandra, Carapa guianensis* and *Tabebuia guayacan*. The *Acrocomia* palm is common in all these forests. Mangroves are found on the Caribbean coast, notably in protected lagoon and estuarine formations; they extent over about 62 000 hectares (Spalding et al. 2010).

Permanent forest estate. Honduras defines its PFE as those forests that are included in protected areas and declared micro-watershed areas, and those areas of production forests that are covered by forest management plans.[a] In all those areas, it is prohibited to change the land use from forests to other uses. As of 2009 the entire area of the production PFE and 57% of the protection PFE had been delimited on the ground.[a] The PFE extends over an estimated area of 3.62 million hectares, including about 2.5 million hectares of

tropical broadleaved forests, 1.1 million hectares of conifer forests (some of them mixed with broadleaved species) and 70 000 hectares of mangrove forests (Table 1).[a] The potential PFE (i.e. including forests that could be included in the PFE in the future) has been estimated at 4.68 million hectares (ENF 2006).

Forest ecosystem health

Deforestation and forest degradation. Deforestation averaged an estimated 120 000 hectares per year between 2005 and 2010, an annual rate of 2.16% (FAO 2010b), the highest rate in the Americas. Deforestation is most prevalent in the eastern tropical broadleaved forest. In the past, deforestation was due to agro-industrial development, mainly for banana plantations. Today, demand for land by small-scale farmers is thought to be the major cause (ITTO 2006); often, such small-scale farmers ultimately sell the deforested land to larger farmers and agro-industrial owners. In recent years, people involved in illegal activities (i.e. drug-trafficking) have also acquired this sort of land.

Forest degradation is also widespread in the humid broadleaved forests, due mainly to small-scale illegal logging (Paaby Hansen & Florez 2008).

The existence of pine forests in Honduras is closely linked to repeated fire, which aids their regeneration, but frequent human-induced fires have led to their widespread degradation. The productivity and genetic quality of the pine forests have declined, mainly as a result of fire, disease and selective felling. Table 2 shows that the majority of remaining natural forest in Honduras is considered to be degraded primary forest.

Vulnerability of forests to climate change. While Honduras is largely unaffected by the earthquakes that afflict other Central American nations, it is vulnerable to hurricanes and frequent flooding along the north coast and in other regions. Climate models project an increased frequency and severity of such storms, constituting a risk to forest ecosystems and the people who depend on them. In terms of the relative number of deaths and economic losses (Harmeling 2010), Honduras was one of three countries (the other two being Bangladesh and Myanmar) most affected by extreme weather events between 1990 and 2009.

SFM policy framework

Forest tenure. With the passing of a law on the modernization of agriculture (*Ley de Modernización Agrícola, Decreto* 31-92) in 1992, some state-owned

Table 1 Permanent forest estate

Reporting year	Estimated total forest area, range (million ha)	Total closed natural forest ('000 ha)	PFE ('000 hectares)			
			Production		Protection	Total
			Natural	Planted		
2005*	5.38	3811	1590	48	1600	3238
2010	**5.19–6.66**	**2630****	**1096**‡**	**48**	**2521**†**	**3617**

* *As reported in ITTO (2006).*

** *Calculated using the ratio of forest with greater than 60% forest cover estimated by UNEP-WCMC (2010) (50.6%) and the total natural forest area as estimated by FAO (2010a).*

‡ *According to Government of Honduras (2010b).*

† *Includes the declared protected areas and proposed protected areas according to ENF (2006).*

Table 2 Forest condition

	PFE	Non-PFE	Total*
	'000 ha		
Area of primary forest	-	-	457**
Area of degraded primary forest	-	-	3823
Area of secondary forest	-	-	550
Area of degraded forest land	-	-	-

* *Based on a total forest area of 4.8 million hectares, as per ENF (2006).*

** *Primary tropical broadleaved forests only. The figure for secondary forests includes young pine and broadleaved forest.*

Source: ENF (2006).

forests were transferred to municipal and private ownership (ITTO 2006). Today, forest ownership may be public (*tierras nacionales*), which is under the direct administration of the forest service, municipal, community or private (Table 3). There are still many claims for the use of forests, particularly over public lands, and large tracts of humid forest have no clear ownership status. Thus, there is still considerable uncertainty about forest tenure. An estimated 60% of forest administrators do not know exactly the areas and borders of their FMUs (ENF 2006).

The 2007 Forest Law (*Decreto* 98-2007) provides for the participation of communities in forest consultative councils and the regularization of forested lands through the demarcation of areas for protection, conservation and community management. According to a recent decree, the ownership of public lands that have been appropriated informally by communities and private landowners will be defined and given legal status, and the administration of public forest lands will be strengthened. The law's implementing regulations were finalized in early 2009. Since the law was passed, five new titles of 40 000 hectares have been granted to five communities, and four consultative councils have been established, increasing community participation in the process of drafting regulations (ITTO & RRI 2009). Indigenous property rights have not been resolved, however.

Criteria and indicators. Honduras has adopted the ITTO C&I to monitor progress towards SFM. The Forestry Action Plan (*Plan de Acción Forestal* – PLANFOR) 1996–2015 is aligned to the principles of sustainable forest development, the conservation of ecosystems, integrated watershed management, forest utilization and industrialization, and forestry extension and research. The Government of Honduras used the ITTO C&I in its submission to ITTO for this report.[a]

Forest policy and legislation. Forest Law 98 (*Ley Forestal, Areas Protegidas y Vida Silvestre*), enacted in 2007, replaced Forest Law 85 (1972). The new law addresses the conservation of national forests and introduces provisions to support the management of forests by communities, such as technical support and subsidies for tree-planting. Nevertheless, in general the legal provisions pertaining to forests remain weak and illegal activities by some actors persist as a serious hindrance to the widespread adoption of SFM.

The vision for the period 2002–2025, articulated in the national forestry policy, views the sector's contribution to economic development as follows: "Forest resources and their biodiversity are conserved and managed efficiently, increasing production and productivity of goods and services, increasing forest cover, recuperating deforested areas and generating benefits through the three main basic functions of forest – economic, social and environmental/ecological – significantly contributing to the socioeconomic development of all Honduran people and specifically supporting poverty reduction".

Local governments have increased responsibilities for forests and protected-area management under the 2007 Forest Law and the 1990 Municipalities Law (*Ley de Municipalidades* 134-90, revised

Table 3 Forest area, by tenure

Ownership category	Total area*	Of which PFE	Notes
	'000 ha		
State ownership (national, state or provincial government)*	2230	-	Including 1.2 million hectares of forest protected areas.
Other public entities (e.g. municipalities, villages)	570	-	*Ejidal***/municipal (335 000 hectares) and communities (235 000 hectares).
Total public	**2800**	**-**	
Owned by local communities and/or Indigenous groups	160	-	Tribal and forest consultative councils.
Private owned by individuals, firms, other corporate	1840	-	Private individuals (1.83 million hectares) and enterprises (30 000 hectares).

* *Based on a total forest area of 4.8 million hectares, as per ENF (2006).*

** *Community land.*

Source: Derived from ENF (2006).

in 2010). In state forests and private forests this responsibility is limited to information and control but, in the case of *ejidales* (areas of community land), management has been entirely decentralized to municipalities, as long as the activities undertaken are embedded in a sustainable development approach (for details see Vallejo & Coronado 2006). Box 1 shows the responsibilities of municipal governments in the management of forests in the *ejidales*.

Institutions involved in forests. Three institutions have responsibilities for forests and biodiversity at the national level: the National Institute of Conservation of Forests, Protected Areas and Wildlife Development (*Instituto Nacional de Conservación y Desarrollo Forestal, Areas Protegidas y Vida Silvestre* – ICF), which replaced many of the functions of the former State Forestry Administration (*Administración Forestal del Estado–Corporación Hondureña de Desarrollo Forestal* – AFE-COHDEFOR), the Secretariat for Natural Resources and Environment (*Secretaría de Recursos Naturales y Ambiente* – SERNA); and the Secretariat for Agriculture and Cattle Ranching (*Secretaría de Agricultura y Ganadería* – SAG).

Perhaps the most significant change in recent years is that the forest administration (i.e. the ICF) is now administratively and financially independent of the SAG. The ICF was established in 2008 by Decree No 98-2007 as a dependency of the President's Office and has a mandate to implement the National Policy on Conservation, Forestry, Protected Areas and Wildlife (*la Política Nacional de Conservación y Desarrollo Forestal, Áreas Protegidas y Vida Silvestre*; Article 14). It brings many previously disparate activities, roles and responsibilities into one organization, including:

- Supporting the creation and operation of community consultative boards to improve participation and transparency in the management of forest resources.
- Supporting forest management and reforestation programs through government-funded incentive programs.
- Implementing the national forest program 2010–2030, which is now a legal obligation.

The Research System for National Forests, Protected Areas and Wildlife (*Sistema de Investigación Nacional Forestal, Áreas Protegidas y Vida Silvestre*) has been created to promote applied and scientific forestry research, involving municipalities and other organizations capable of sustaining forest research. In addition, the state, through the ICF, will promote and support forest certification as an incentive for SFM and to guarantee the quality of forest products.[a]

The National Forestry School (*Escuela Nacional de Ciencias Forestales*) provides technical support for the implementation of forest policy along

Box 1 Municipal government responsibilities for forest management in ejidales

Area	Responsibilities
Exploitation	• Rationalize the use and exploitation of municipal resources.
Protected areas	• Create municipal areas. • Provide a hearing for the procedure of including *ejiadal* forest in the public forest register.
Economic resources	• Obtain resources and invest them in environmental protection. • Charge taxes for extracting or otherwise exploiting forest resources.
Protection	• Protect municipal ecosystems and the environment. • Preserve forests for water protection and preserve watersheds. • Participate in the prevention of forest fires, pests and diseases.
Administration and norms	• Grant permits or contracts for the establishment of forest industries. • Assist in administering forest law enforcement and governance. • Grant permits or contracts together with the forest authority, when they concur on forest exploitation.
Reforestation	• Promote reforestation projects. • Implement reforestation works at the sources of water supply.
Control and monitoring	• Supervise compliance with the norms related to waste industries. • Monitor protected areas and sources of water supply.

Source: Modified from Vallejo & Coronado (2006).

with the *Agenda Forestal Hondureña*, an organized stakeholder platform promoting SFM. About 690 people dealing with forests are employed in governmental institutions.

Status of forest management

Forest for production

Forest management plans have been mandatory in production forests for more than 15 years, based on management and silvicultural norms established in 1995–96. Before a forest management plan is prepared, the forest owner must clearly establish legal tenure (ITTO 2006). Besides directions for silviculture and harvesting, management plans should contain prescriptions covering the protection of soil, water and biodiversity and measures for the management of fire, pests and diseases.

Forest harvesting is based on a contract between the ICF and the forest owner, which also specifies the silvicultural and conservation measures of the forest management plan. Before harvesting, the owner must give a bank guarantee in favour of the ICF, which is cancelled once all silvicultural and conservation measures are complete. Incentives to promote SFM include exemption from taxes up to a certain amount if a forest owner invests in reforestation; technical assistance to prepare reforestation plans; and the provision of seeds and nursery stock.

The sustainable management of pine forests should be relatively straightforward. Honduran pine forests have a great capacity for regeneration if fire can be controlled and used effectively to accelerate re-growth and if regenerating seedlings are protected from animals. Pines are fast-growing and, if management guidelines are followed, continuous production is assured (ITTO 2006). However, in many cases the harvesting plan is the only component of the forest management plan applied. Illegal practices are still common in FMUs and there is a general problem of non-compliance with management prescriptions.[a] As a result, average production has dropped to 1–2 m^3 per hectare per year, much less than the 4–5 m^3 per hectare per year considered feasible if sustainable silvicultural practices were to be applied.[a]

There is little experience in the management of broadleaved forests in Honduras and there are few management prescriptions for SFM. A former

Pine forest area in central Honduras.

ITTO project examined the impact of intensive harvesting on lesser-used species in the broadleaved forests of northeastern Honduras and resulted in the development of new management prescriptions. Honduran broadleaved forests carry a total commercial timber volume of about 33.5 million m^3, with an average stocking of 22 commercial trees per hectare (ENF 2006). The commercial stock of conifer forests is estimated at 72 million m^3.

As of early 2010, management plans covered a total of 1 095 622 hectares of pine forests, most of them privately owned, and 96 000 hectares of tropical moist forests.[a] In total, 903 FMUs had management plans, 97 of which were in public forests, 78 in forests under the responsibility of municipal governments and 728 in private forests.[a] The total AAC in the pine forests was 1.97 million m^3.[a]

The extent to which management plans are being applied is unclear, however. In 2005, the Environmental Investigation Agency (EIA), an NGO, described what it believed was an "illegal logging crisis in Honduras", in which an estimated 80% of mahogany and up to 50% of pine was being produced in violation of government regulations (EIA 2005).

Silviculture and species selection. Of 332 forest tree species inventoried in the country (ENF 2006), about 25 are used commercially in significant quantities. The two most important species by far are pino costanero and pino ocote (Table 4). Important hardwood species in the broadleaved forests, in addition to those listed in Table 4, are *Dialium guianesis* (andiroba), *Vochysia guatemalensis* (san juán), *Brosimum alicastrum* (ramón, breadnut), *Virola koschnyi* (palo de sangre), *Terminalia*

Table 4 Commonly harvested species for industrial roundwood

Species	Notes
Pinus caribaea (pino costanero)*	From natural pine forests and plantations.
Pinus oocarpa (pino ocote)*	From natural pine forests.
Calophyllum brasiliense (santa maria)*	Mainly for domestic use.
Cordia alliodora (laurel)*	From off-forest areas, village plantations and natural forests.
Ceiba pentandra (ceiba)*	Mainly off-forest trees are harvested.

* *Also listed in ITTO (2006).*
Source: Government of Honduras (2010b).

amazonica (cumbillo), *Swietenia macrophylla* (mahogany), *Carapa guianensis* (macho), *Cedrela odorata* (cedro) and *Tabebuia rosea* (apamate).

Planted forest and trees outside the forest. Because natural pine forests are so abundant, there has been relatively little development of planted forests. Based on data from 2000, the planted forest estate is estimated at about 48 000 hectares (no more recent data were available for the preparation of this report, although there are indications that new planted forests have been established, especially on the north coast). Nearly all planted forests are privately owned and the main plantation species are native pines (up to one-third of all plantations). Species such as *Gliricidia sepium, Leucaena* spp, *Gmelina arborea* and eucalypt species are an essential part of agroforestry; another important planted tree is *Tectona grandis* (teak, teca).

Forest certification. Certification is supported by the ICF and promoted by the Honduran Council for Voluntary Forest Certification (CH-CFV), which is a national initiative of the FSC. However, there is little market incentive for certification. In 2010 a total area of 34 300 hectares was certified in natural broadleaved and pine forests for wood production and 76 600 hectares were certified for NTFPs (*Elaeis oleifera and Carapa guianensis*) (FSC 2011). An additional 3370 hectares of planted forest was certified.

Estimate of the area of forest sustainably managed for production. About 700 000 hectares of the production PFE are subject to some kind of management, a figure which includes an estimated 265 000 hectares of pine and mixed forests outside the humid forest zone (ITTO 2006). It is estimated that an area of at least 276 000 hectares of natural PFE is sustainably managed (Table 5). This comprises about 180 000 hectares of natural pine forests managed effectively by communities (of which a portion is certified)[a] and the certified forest area for the production of timber and NTFPs (see above). It also includes an area of about 45 000 hectares of tropical broadleaved forests in the upper Cangrejal River Basin, where local communities have benefited from considerable support from the international community in managing their forests.

Timber production and trade. Total annual roundwood production in 2006 was estimated at 10.8 million m^3, of which about 9.9 million m^3 was fuelwood (FAO 2010a). In 2009, the estimated production of industrial pine logs was 750 000 m^3 (compared with 920 000 m^3 in 2005 and 744 000 m^3 in 2000), while the production of tropical hardwoods was 20 000 m^3, compared with 15 200 m^3 in 2005 and 12 000 m^3 in 2000 (ITTO 2011). Total sawnwood production in 2009 was 349 000 m^3 (342 000 m^3 of which was coniferous), compared with 406 000 m^3 in 2005 and 437 000 m^3 in 2000 (ibid.).

Nearly all Honduran wood production serves the domestic market, although a small amount of pine sawnwood is exported to other countries in the region. Official production figures do not take into account timber harvested illegally. Based on data in EIA (2005), illegal production might have exceeded official production by a factor of 3–4 as recently as 2004, but few data are available on whether such illegal production has since been curbed. In 2008, a timber-tracking manual (*Manual de la Cadena de Custodia para Madera Aserrada de Bosque Latifoliado*) was introduced but, to date, it has only been applied in the Río Plátano Biosphere Reserve.[a]

Non-timber forest products. Fuelwood in the form of firewood and charcoal (70% of which comes from hardwood forest species such as *Quercus* spp – roble) is the most economically important NTFP in Honduras. It is an essential energy source for many people, especially rural people. Internationally tradable NTFPs include pine resin,

Table 5 Management of the production PFE ('000 hectares)

Reporting year	Natural					Planted		
	Total	Available for harvesting	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
2005*	1590	1070	671	37	187	48	28	0
2010	**1096**	**1096**	**1096**	**111**	**276**	**48**	**31**	**3.4**

* *As reported in ITTO (2006).*

with an estimated production in 2008 of 14 800 barrels[a], liquidambar resin (76 barrels in 2008[a] (compared with 251 barrels reported in ITTO 2006), and pine seeds for export. Also, Indigenous communities in the forests of the Mosquito Coast have been producing about of 80 000 litres of batana oil (derived from the American oil palm – *Elaeis oleifera*) for export per year for the last seven years (C. Sandoval, pers. comm., 2010), and their operations were certified recently by the FSC (FSC 2011). Besides its use as timber, *Brosimum alicastrum* also produces what is known as Mayan nut, which has been a staple food for the Maya for more than 2000 years.

Forest carbon. ENF (2006) estimated the total forest carbon stock in the living biomass at 294–402 MtC, Gibbs et al. (2007) estimated it at 852–1268 MtC, and FAO (2010a) estimated it at 330 MtC. The potential for carbon capture and storage by reducing deforestation and by restoring forests and expanding planted forests is relatively high (Table 6). Forest fires are frequent: it is estimated that more than 55 000 hectares of forests burn each year.[a] Honduras has submitted a readiness idea note to the Forest Carbon Partnership Facility and is a member of the REDD+ Partnership.

Forest for protection

Soil and water. Many municipalities manage micro-watersheds declared for the protection of freshwater sources (ITTO 2006). Such micro-watersheds are delimited in the field (generally fenced) and no activities are permitted other than for the protection of water resources. A total forest area of 544 000 hectares has been classified for the primary purpose of protecting water and water resources, of which 319 000 hectares are in the PFE.[a] In addition, about 494 000 hectares have a specific role in soil protection as well as other functions (ENF 2006).

Biological diversity. The forests of Honduras are characterized by flora and fauna that are representative of both temperate and tropical America. Detailed biological inventories are not unavailable, although it is known that there are more than 700 breeding bird species and an additional 225 that are migratory (ITTO 2006). Five mammals, seven birds, six reptiles, 60 amphibians and four plants found in forests are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species (IUCN 2011). Two plant species are listed in CITES Appendix I, 171 in Appendix II and two in Appendix III (UNEP-WCMC 2011).

Protective measures in production forests. Forest management plans contain detailed prescriptions for protective purposes, such as the maintenance of unlogged strips along watercourses, reduced impact logging, logging restrictions on slopes and vulnerable areas, and specific provisions for biodiversity conservation in both pine and broadleaved forests.[a]

Table 6 Forest carbon potential

Biomass forest carbon (MtC)	% forest with canopy cover >60%	Deforestation/ degradation potential to 2030	Enhancement of carbon sink capacity to 2030	Forest area change monitoring capacity	Forest/ GHG inventory capacity	Importance of forest fire/ biomass burning	Engagement in international REDD+ processes
852–1268	51	++	++	+	+	+++	+

+++ high; ++ medium; + low; estimate of national forest carbon based on Gibbs et al. (2007); estimate of % total forest with canopy cover >60% based on UNEP-WCMC (2010).

Extent of protected areas. SERNA, in partnership with The Nature Conservancy and WWF, undertook a conservation gap analysis to 2008 to better define conservation priorities. As a result, Honduras established a 12% conservation goal for the country's 59 terrestrial ecosystems. In 2009 there were 51 declared terrestrial protected areas, covering nearly all ecosystems over a total area of 1.37 million hectares. Another 21 areas covering 509 000 hectares were proposed to be added to the protected-area network in order to address deficiencies identified in the gap analysis (Paaby Hansen & Florez 2008). UNEP-WCMC (2010) estimated the forest area in IUCN categories I–IV at 976 000 hectares. The Río Plátano Biosphere Reserve in northeastern Honduras is designed to protect the largest intact lowland tropical and pine forests within Honduras and includes community-based production forest (some of which is certified). All cloud forests (*bosques nublados*) are protected in ten national parks, eight wildlife reserves and 18 biological reserves; even so, most are degraded (ITTO 2006). Honduras is part of the Mesoamerican Biological Corridor.

Estimate of the area of forest sustainably managed for protection. In 2010, management plans had been prepared for 19 protected forest areas covering a total area of about 608 000 hectares.[a] Areas that are co-managed by NGOs or that receive support from the international donor community (e.g. USAID, UNDP, the Global Environment Facility and the World Bank) have approved protected-area management plans in place, including the Río Plátano Biosphere Reserve, The Tawahka Biosphere Reserve, the Patuca National Park, the El Chile Biological Reserve, the Güisayote Biological Reserve, the Cuero y Salado Wildlife Refuge, the Jeannette Kawas Park, the Wildlife Refuge and Islas de la Bahía. The Río Plátano Biosphere Reserve, which covers 439 000 hectares, is part of the largest extant area of relatively undisturbed tropical rainforest in Honduras and one of the few remaining in Central America. Management plans are being implemented in its totally protected portion and considerable efforts are being made in forest law enforcement. This area is counted here as sustainably managed (Table 7), although until recently a threat was posed by illegal loggers seeking mahogany and other valuable hardwoods (EIA 2005).

Socioeconomic aspects

Economic aspects. Forestry contributes significantly to Honduran national income, peaking at more than 10% of GDP late in the 1990s. In 2006, the sector's economic contribution was 9.9% of GDP, making forestry the fourth most important economic activity (AFE-COHDEFOR 2008). The forest sector generates nearly 68 000 direct jobs and a similar quantity of indirect jobs (ibid.).

Livelihood values. Honduras has high levels of poverty in both rural and urban areas. Forests constitute an important supplement to livelihoods – both in the provision of goods and services and for land. Informal harvesting and trade in a variety of forest products are important in forested areas to sustain livelihoods. Nevertheless, these issues need to be tackled to make informal forest use compatible with the objectives of SFM (ITTO 2006).

The concept of payments for ecosystem services has gained momentum in recent years, but experiences are nascent. Most focus on water resources as the principal service emanating from forests, and other services such as carbon sequestration and ecotourism warrant further exploration.

Social relations. Even though the law has made provisions for local communities to own forests, there are great difficulties in practice in protecting these forests from encroachment, timber theft and illegal hunting. For example, the La Mosquitia Biosphere Reserve and the Indigenous communities of Miskito, Pech and Garifuna are greatly threatened by unregulated colonization (ITTO 2006).

Summary

It is estimated that 80 000–100 000 hectares of mainly broadleaved forests are lost annually to the expansion of agriculture as well as to forest fire and illegal felling. Pine forests sustain the livelihoods of many communities in the highlands of Honduras. These forests, although stable in area, have declined in productivity and genetic quality. This is of concern because the forest sector, which is largely reliant on this resource, generates an estimated 68 000 direct jobs.

Management of the broadleaved natural forests in Honduras is sometimes more a matter of extracting the most valuable species than of silvicultural

Table 7 Management of the protection PFE ('000 hectares)

Reporting year	Protection PFE	Attributed to IUCN categories I–IV	Allocated for soil and water	With management plans	Sustainably managed
2005*	1600	434	352	-	-
2010	**2521**	**434**	**319**	**608**	**439**

* *As reported in ITTO (2006).*

management. Silvicultural and conservation measures described in forest management plans are often not respected and there is a risk that logged-over areas will become degraded. Illegal logging is probably widespread. More attention has been paid to protected areas in recent years but in many areas they remain vulnerable to degradation and clearing.

Key points

- Honduras has an estimated PFE of 3.62 million hectares (compared with 3.24 million hectares in 2005), comprising 1.1 million hectares of natural production forest (compared with 1.59 million hectares in 2005), 2.52 million hectares of protection forest (compared with 1.6 million hectares in 2005) and 48 000 hectares of planted forest (as in 2005).
- An estimated 276 000 hectares of the natural production PFE is under SFM, including 111 000 hectares of certified forest. An estimated 439 000 hectares of the protection PFE is under SFM.
- The broadleaved moist forest could make a larger contribution to sustainable development in Honduras if all goods and services were taken into account and illegal activities controlled.
- A new forest law has been in place since 2007. A new forestry administration assumed oversight of forest production in 2008, under the direction of the President's Office.
- Management norms for the pine forests have been formulated and are being implemented in some of these forests. Silvicultural prescriptions for the sustainable management of moist broadleaved forests also exist but the extent to which they are being applied is unclear.
- Forest tenure, particularly on public land, remains subject to dispute, and large tracts of broadleaved forests have no clear ownership status.

Endnote

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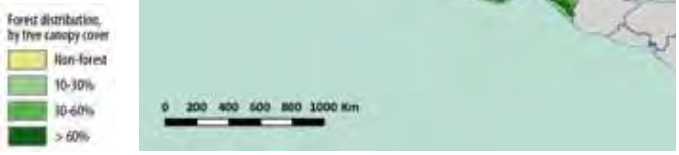
MEXICO



Forest resources

With a land area of 194.2 million hectares, Mexico is the third-largest country in Latin America after Brazil and Argentina. It had an estimated population in 2010 of 110 million people (United Nations Population Division 2010). Mexico is ranked 53rd out of 182 countries in UNDP's Human Development Index (UNDP 2009). The country is mainly mountainous, with more than half of its land area above 1000 m. The northwest of the country supports dry, open forest but tropical moist forests are found further south, where rainfall is higher. The Southern highlands are composed of a number of steep mountain ranges, deep valleys and dry plateaux, including the Chiapas highlands bordering Guatemala, which constitute an important forest zone. CONAFOR (2010) and FAO (2010a) estimated the total forest area at 64.8 million hectares, of which 31.4 million hectares are in the tropics. According to the definition of forest (adopted at a workshop held in March 2009) used in the context of climate change, there were about 85.5 million hectares of forests in Mexico in 2007, including shrub forests (*matorales*) and 'vegetation' cover in arid zones (Government of Mexico 2010a).

Forest types. Mexico's eco-climatic zones can be divided into three approximately equal areas: tropical (in the south and southeast), subtropical/temperate, and semi-arid/arid. The tropical region includes rainforests, which originally covered about 6% of the country. The major forest type in the temperate/subtropical region is *Quercus* (oak) forest, which may be pure or mixed with other temperate-climate broadleaved species such as *Liquidambar styraciflua* (sweet gum) and *Fagus mexicana* (beech). The 'conifer and broadleaved forests' category of the national forest inventory is characterized by a few dominant species, such as *Pinus* and *Abies*, combined with various species of *Quercus*, *Cupressus* and *Juniperus*.

Tropical forests are found on slopes along the Gulf of Mexico and the Pacific Ocean, on the Isthmus of Tehuantepec and in southern Yucatán in the states of Campeche, Chiapas, Oaxaca, Quintana Roo, Tabasco and Veracruz. They can be divided into three major types: high forests (*selva alta*), with a canopy height of 30 m and above composed of a large variety of species such as *Brosimum* spp, *Bursera* spp, *Cedrela odorata*, *Dialium* spp, *Lonchocarpus* spp, *Manilkara zapota, Tabebuia* spp, *Terminalia* spp and *Swietenia macrophylla*; medium forests (*selva mediana*), with a canopy height of 15–30 m and species such as *Lysiloma* spp, *Bucida buceras, Manilkara zapota* and *Ceiba* spp; and low forests (*selva baja*) with a height of 4–15 m and species such as *Annona glabra, Calophyllum brasiliense* and *Eugenia* spp.

Mexico has 770 000 hectares of mangroves (Spalding et al. 2010). They occur in a considerable variety of settings and formations on both the Pacific and Atlantic coastlines and in conditions that range from arid to wet tropical.

Permanent forest estate. Mexico does not have a formally allocated PFE. The estimate of tropical production PFE shown in Table 1 for 2005 was based on data supplied by the Government of Mexico to ITTO in conjunction with a C&I workshop convened in April 2005 and the estimate of protection PFE was based on data reported by an ITTO diagnostic mission to Mexico. The estimates for 2010 are based on data supplied in Government of Mexico (2010a and 2010b).

Forest ecosystem health

Deforestation and forest degradation. Mexico suffered rapid deforestation and degradation in the period 1970–2000. For example, the estimated average annual deforestation rate in the

Table 1 Permanent forest estate

Reporting year	Estimated total forest area, range (million ha)	Total closed natural forest ('000 ha)	PFE, tropical forests only ('000 hectares)			
			Production		Protection	Total
			Natural	Planted		
2005*	64.0–65.2	33 120	7880	100	5600	13 580
2010	**64.8**	**22 600****	**8400**	**171‡**	**3649**	**12 220**

* *As reported in ITTO (2006).*

** *Calculated using the ratio of forest with greater than 60% forest cover estimated by UNEP-WCMC (2010) (35.1%) and the total natural forest area as estimated by FAO (2010a).*

‡ *Tropical, including plantations for production and for protective functions.*

period 1990–2000 was about 354 000 hectares (FAO 2010b). In the past decade, however, the annual rate of net forest loss has diminished, to about 155 000 hectares, although an estimated 250 000–300 000 hectares of forest were degraded between 2005 and 2010 (Government of Mexico 2010a). Uncontrolled logging (over-harvesting and/or illegal logging), forest fires, grazing in forests, forest diseases and pests, fuelwood harvesting, population pressure and shifting cultivation are the main direct causes of forest degradation.[a]

Various factors have helped to reduce forest loss in recent years. These include greater government support for forestry and conservation; low prices for agricultural commodities; a general shift of people from rural areas to urban centres; and the low suitability for agriculture of most remaining forest lands. In addition, efforts are being made to address deforestation and forest degradation through an emerging REDD agenda. According to the Government of Mexico (2010b), deforestation in areas where forest management plans are being executed is significantly lower than in areas where no management plans are established, indicating that forest management may reduce deforestation. The same is true for areas within and outside federally protected areas. Table 2 shows the best available estimates of forest condition.

Vulnerability of forests to climate change. The climate varies greatly from north to south. The varied topography results in further climatic differences between the various regions of the country. In the north, rainfall can be as low as 50 mm per year, while in the south and the central highlands there are distinct wet and dry seasons, with rainfall of up to 550 mm per month. The rainfall received in these regions is controlled largely by the North American monsoon and the position of the Intertropical Conversion Zone. Coastal areas are vulnerable to hurricanes from both the Atlantic and Pacific oceans.

Mean annual temperature has increased by 0.6 °C since 1960, a rate of around 0.13 °C per decade, with the rate of increase most rapid in the dry season (McSweeney et al. undated). Mean annual rainfall in Mexico has not shown any consistent increase or decrease since 1960. Climate models project an increase in average annual temperature in Mexico of 1.1–3 °C by 2060 and substantial increases in the frequency of days and nights that are considered 'hot' in the current climate (ibid.).

In the tropical part of Mexico, an increased frequency and intensity of tropical storms has been observed in the past 10–20 years.[a] Climate models suggest that tropical hurricanes are likely to become more intense under a warmer climate as a result of higher sea surface temperatures, but there is uncertainty over changes in frequency and

Table 2 Forest condition

	PFE	Non-PFE	Total*
	'000 ha		
Area of primary forest	-	-	34 300
Area of degraded primary forest	-	-	-
Area of secondary forest	-	-	30 500
Area of degraded forest land	-	-	-

* *All forests – no data available specifically for tropical forest.*

Source: CONAFOR (2010).

changes to storm tracks and their interactions with other features of climate variability, such as the El Niño–Southern Oscillation (ibid.). Fire is a serious problem, particularly in the semi-arid parts of the country, and is caused mainly by agricultural and grazing activities.

SFM policy framework

Forest tenure. Tenure rights are relatively secure in Mexico, although agrarian conflicts persist in some areas.[a] Article 5 of the 2003 Forest Law (see below) states that the forest resources belong to communes (*ejidos*), local communities, Indigenous peoples and Indigenous communities, private landowners or the government, depending on the location of the forest (ITTO 2006). Most of Mexico's forests (55–68%, depending on the source) are owned by 8500 communities and *ejidos* or by individuals (27–33%), with relatively few state-owned forests (Table 3).

The risk of deforestation and degradation is higher in areas with unresolved land-tenure conflicts, where illegal logging and forest fires are the most common problems (Government of Mexico 2010a, 2010b). Problems of access to some areas where conflict is high due to the presence of organized crime (sometimes drug-related) or political unrest hampers further the clarification of land rights. About 2 million hectares are disputed among Indigenous groups or between Indigenous and other communities.[b]

Criteria and indicators. Mexico has a comprehensive national forest program as well as the National Strategic Forestry Plan 2025 (*Programa Estratégico Forestal* – PEF 2025). Combined, these set the framework for SFM. Mexico has developed C&I frameworks for both its temperate forests (based on the Montreal Process framework) and its tropical forests (based on the ITTO C&I). Mexico's submission to ITTO for this report was not in the ITTO C&I reporting format.

Forest policy and legislation. As one of the main actions specified in PEF 2025, a new forest law (the General Law for Sustainable Forest Development, *Ley General de Desarrollo Forestal Sustentable* – LGDFS) was prepared in 2003 and its regulations enacted in 2005, when the incorporation of the forest sector in a broader environmental framework was formalized. The law emphasizes the importance of forest ecosystem services and their consideration in forest management.

The LGDFS establishes eight instruments: Forest Development Planning (*La Planeación del Desarrollo Forestal*); the National Forest Information System (*Sistema Nacional de Información Forestal*); the National Forest and Soil Inventory (*Inventario Nacional Forestal y de Suelos*); forest zoning; the National Forest Registry (*Registro Forestal Nacional*); official forest regulations (*Normas Oficiales Mexicanas en Materia Forestal*); the National System of Forest Management (*Sistema Nacional de Gestión Forestal*); and an annual satellite assessment of forest-cover change.

A number of special programs have been set up in the last 15 years to bring greater consistency to forest policy. Among the most important are the Forest Development Program (*Programa de Desarrollo Forestal* – PRODEFOR); the National Reforestation Program (*Programa Nacional de Reforestación*), which is designed to promote the reforestation of deforested and/or degraded areas; the Program for the Conservation and Sustainable Management of Forest Resources in Mexico

Table 3 Forest area, by tenure

Ownership category	Total*	Of which PFE	Notes
	'000 ha		
State ownership (national, state or provincial government)	2900	-	National forests and forests that have not been allocated to a non-state owner.
Other public entities (e.g. municipalities, villages)	0	-	
Total public	**2900**	**-**	
Owned by local communities and/or Indigenous groups	45 700	-	The total area is unclear and varies according to source.
Privately owned by individuals, firms, other corporate	17 000	-	The total area of privately owned forest is unclear. Plantation development also affects the area that is classified under privately owned forests.

* *Includes non-tropical forests. Note that the total differs to that shown in Table 1 due to differing sources.*

Source: Government of Mexico (2010b), CONAFOR (2010).

(*Programa de Conservación y Manejo Sustentable de Recursos Forestales en México*); the program for promoting and developing commercial plantations (PRODEPLAN) and, among various programs for ecosystem services, the Program for Payments for Environmental and Hydrological Services (*Programa de Pago por Servicios Ambientales e hidrológicos)* under the broader ProÁrbol program of the National Forestry Commission (*Programa de Desarrollo Forestal* – CONAFOR). These programs are geared mainly towards community development and the reduction of poverty through the restoration of natural capital.

Institutions involved in forests. Mexico is a representative, democratic and federal republic comprising 31 states and one federal district. Each state is autonomous in all internal affairs. Many of the states have considerable interest in environmental issues such as forest restoration and conservation, and several have their own secretariats for environmental and forestry issues (ITTO 2006). At the federal level, the Secretariat for Environment and Natural Resources (*Secretaría de Medio Ambiente y Recursos Naturales de México* – SEMARNAT) is the government agency responsible for natural resources, including forests. With the new forest law entering into force, SEMARNAT was assigned the task of "formulating and running the national policy for sustainable forest development, and assuring its coherence with environmental and national natural resources as well as those policies related to rural development". This function is carried out in coordination with CONAFOR through the eight instruments established in the LGDFS.

SEMARNAT is responsible for the sectoral plan and maintains control over the formulation of forest management plans. Through its recently created 32 state offices, CONAFOR is responsible for, among other things, the implementation of PEF 2025.[b] CONAFOR has the objective of developing, encouraging and driving activities associated with production, conservation and restoration in forests, as well as participating in the formulation of plans and programs and the application of SFM policy. The Federal Office for Environmental Protection (*Procuraduría Federal de Protección al Ambiente* – PROFEPA) is in charge of inspection, surveillance and sanctions within forest production areas and natural protected areas. There are also technical and capacity-building institutes such as the National Forest and Agriculture Research Institute (*Instituto Nacional de Investigaciones Forestales y Agropecuarias*).

Other institutions that play a supportive and/or complementary role in conserving and managing Mexico's forest estate are the National Commission for Natural Protected Areas (*Comisión Nacional de Áreas Naturales Protegidas*); the National Biodiversity Commission (*Comisión Nacional para el Conocimiento y Uso de la Biodiversidad*); and the National Institute of Ecology (*Instituto Nacional de Ecología*).

NGOs play a major advocacy role on behalf of communities and are also important in information-sharing and capacity-building for collaborative forest management. Community organizations have a strong influence on the use and management of forest areas. However, communities still need to be more strongly involved in the development of forest policy if they are to become active agents in the design of solutions rather than simply receivers of subsidies (Government of Mexico 2010a).

Status of forest management

Forest for production

SEMARNAT issues authorizations to owners for forest harvesting, based on technical studies and forest management plans (*programas de manejo forestal*) as required by forest law. Three kinds of harvesting permit are available: small-scale, for areas of up to 20 hectares; medium-scale, for areas of 20–250 hectares; and commercial scale, for areas larger than 250 hectares in size (ITTO 2006). PROFEPA is responsible for the enforcement of harvesting authorization. Even though capacity for law enforcement is growing and forest law clearly establishes measures to punish unauthorized land-use change and illegal logging, insufficient human and financial resources are available to enforce laws effectively. Moreover, there are areas within the country where government personnel have limited access due to the presence of organized groups of illegal loggers and drug-traffickers (Government of Mexico 2010a).

Tropical production forests in Mexico are located in the states of Campeche and Quintana Roo, where forest management is conducted largely by *ejido*s. *Ejidos* not only harvest natural forests, they also

conduct enrichment planting and forest restoration activities on the basis of forest management plans. The total area of potentially managed tropical forests is estimated at 8.4 million hectares.[a] Logging in tropical forests is carried out by forest owners and communities as well as by contractors working for timber traders or the forest industry. Forest owners must employ at least one forestry professional who is in charge of forest management, and they must also present a forest management plan and a yearly harvesting plan. Minimum cutting diameters vary by state. In Quintana Roo, for example, the minimum diameter is 55 cm for high-value species and 35 cm for other species (ITTO 2006).

The majority of forest production is carried out by *ejidos*. The extent of forest within *ejidos* varies, from around 300 hectares to nearly 450 000 hectares. An estimated 9 million hectares of closed forests (both temperate and tropical) are covered by management plans[c] for the production of timber and/or NTFPs. The estimated total tropical forest area harvested annually is 750 000 hectares, distributed in 584 forest management units.

Timber harvesting in moist tropical forest involves the selective cutting of high-value tree species, in particular *Cedrela odorata* (cedro rojo) and *Swietenia macrophylla* (caoba) and 20–30 common hardwood species. Well-established silvicultural systems known as the Silvicultural Development Method (*Método de Desarrollo Silvícola*) and the Mexican Method of Forest Management (*Método Mexicano de Ordenación de Montes*) are applied in temperate and pine forests. In the Mayan zone in the state of Quintana Roo, several well-functioning FMUs are applying polycyclic forest management and some are certified (ITTO 2006). In general, however, *ejidos* find themselves in a vicious circle: income derived from forest activities is often insufficient to justify the long-term investments required to improve their operations.[b]

A national forest and soils inventory involving 26 220 geo-referenced permanent plots was carried out between 2004 and 2007. About 20% of the plots were re-measured in 2008–09.

Silviculture and species selection. According to Government of Mexico (2010b), approximately 1.4% of total national timber production comes from tropical species (common and precious). Caoba and cedro rojo are the most economically important species harvested in natural forests. In some *ejidos* these two species are also used in plantations and for enrichment planting. Besides the species listed in Table 4, the following species are harvested in significant volumes: *Brosimum alicastum* (ramón), *Bucida buceras* (pucte), *Ceiba pentandra* (seiba), *Bursera simarouba* (chaka), *Dalbergia* spp (guanciban, granadillo), *Dendropanax arboreus* (sac-chaca), *Dialium guineense* (tamarindo), *Enterolobium cyclocarpum* (guanacaste), *Pseudobombax ellipticum* (amapola), *Simarouba glauca* (pasak), *Tabebuia donnell-smithii* (guayacán) and *Terminalia amazonica* (roble).[a]

Planted forest and trees outside the forest. In 2006 Mexico had an estimated 170 000 hectares of planted forests in the tropics, including 88 000 hectares for timber production.[a] FAO (2010a) reported a total planted forest area (tropical and temperate) of 3.20 million hectares and estimated the annual increase in the total area of planted forests country-wide in the period 2005–10 at 162 000 hectares.

The main planted species in tropical Mexico are eucalypts *(Eucalyptus urophylla, E. grandis* and *E. urograndis)*, *Gmelina arborea* (melina), *Hevea brasiliensis* (hule, for timber production) and *Tectona grandis* (teca). The latter is becoming increasingly important, with plantations now covering about 19 000 hectares.[a] Increasingly, native species are being used in new plantations.

Table 4 Commonly harvested species for industrial roundwood

Species	Notes
Swietenia macrophylla (caoba, kobchi)*	The most important harvested species by value; together with cedro rojo accounts for about 15% of the annual production.
Cedrela odorata (cedro rojo)*	Both caoba and cedro rojo are being planted due to shortage of supply.
Lysiloma latisiliquu; L. bahamensis (tzalam)*	Known also as sabicu or wild tamarind. Wood is highly valued, especially for shipbuilding.
Lonchocarpus lanceolatus (machiche)*	Common wood for construction and furniture.
Metopium brownei (chechen, palo roso)*	Decorative species for interior use.

* *Also listed in ITTO (2006).*
Source: Government of Mexico (2010b).

The estimated area of cedro rojo and caoba plantations in 2010 was 25 000 hectares.[a] There are about 4000 hectares of plantations of other native species, in particular *Terminalia amazonica, Tabebuia* spp and *Ceiba pentandra*; outside the tropics, most plantations are of pines.[a] *Chamaedorea elegants* (palma camedor) is the main tree species planted for NTFPs. A national forest inventory in 1994 estimated that 10.7 million hectares of land were available in Mexico for the establishment of planted forests, although only 4–5 million hectares are suitable for that purpose (ITTO 2006).

Forest certification. As of February 2011, about 614 000 hectares of forest were certified (mostly outside the tropics, down from 750 000 in mid 2010) (FSC 2011). In December 2010 an estimated area of 98 960 hectares of forests (in both tropical and temperate areas) were in the process of certification.[b] A total of 31 FMUs of natural and planted forests are FSC-certified, the great majority of them in *ejidos*. In 2006 there were six FSC-certified FMUs covering about 163 000 hectares of tropical forests in Quintana Roo, but as of December 2010 none of those certificates remained valid. The main reason for the non-renewal of certificates appears to have been financial rather than technical, particularly the high transaction costs for maintaining certification status and the lack of a sufficient price premium for certified timber and timber products. The only valid certified forests in tropical Mexico were two planted forests covering an area of about 20 600 hectares and a small area of 12 000 hectares of natural forests (FSC 2011).

Estimate of the area of forest sustainably managed for production. As most forests are either community or privately owned, the implementation of SFM requires extensive and continuous consultation with landowners. SEMARNAT estimates the total area managed sustainably in the country at 9 million hectares, while 12 million hectares of production forests are not yet sustainably managed (Government of Mexico 2010b). Of the 8500 *ejidos*, about 2500 were conducting commercial harvesting in 2008 (ibid.). Staff at CONAFOR estimate that about 750 000 hectares of the tropical production PFE is under sustainable management.[b] This is the figure used in Table 5; it includes the six formerly certified natural forests (where management has not changed significantly since certification lapsed) and semi-natural planted forests in three other *ejidos* now in the process of certification.

Timber production and trade. Total roundwood production in Mexico was estimated at more than 40 million m^3 in 2008.[a] There are differing estimates of tropical hardwood production. About 495 000 m^3 of tropical industrial roundwood was produced in 2008 (7.3% of total industrial roundwood production), of which 37 683 m^3 were of the 'noble' species cedro rojo and caoba and the remainder were of common hardwood species.[c] ITTO (2011) reported a total non-coniferous tropical industrial roundwood production of 942 000 m^3 in 2008.

Nearly the entire volume of industrial roundwood production is for internal consumption. The area of cedro, caoba and teak plantations is increasing to help satisfy demand for high-quality hardwoods.[a]

Non-timber forest products. NTFPs play an important role in the economies of many *ejidos* in the tropical part of Mexico.[a] More than 1000 species are used as NTFPs throughout Mexico, of which 70 are subject to some form of control (ITTO 2006). NTFPs include ornamental plants, resin, bamboo fibres, wax, tannin and gums, medicine, fruits, nuts, spices and honey. Natural gum (chicle natural*)* from *Manilkara zapota*) recently became an important niche product for export, providing employment for more than 2000 people in the states of Campeche, Quintana Roo and Yucatán.[a] Besides chicle, the most important

Table 5 Management of the production PFE ('000 hectares)

Reporting year	Natural (tropical forests)					Planted		
	Total	Available for harvesting	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
2005*	7880	8600	8600	163	163	100	34	0
2010	**8400**	**8400**	**750**	**12**	**750****	**171**	**84**	**20.6**

* *As reported in ITTO (2006).*

** *Includes semi-natural planted forests.*

products from tropical regions include copal, products from different palms such as *Chamaedorea* spp (palma camedor or palmilla), *Sabal* spp (palma de sombrero), *Scheelea liebmannii* (palma real), *Byrsonima crassifolia* (fruits of nanche) and *Pimenta dioica* (pimienta gorda).

Forest carbon. According to Gibbs et al. (2007), Mexico's tropical forests contain 4360–5920 MtC in their biomass. Masera et al. (2001) estimated the total forest carbon stock of Mexican forests (temperate and tropical) at about 17.8 GtC. According to the Government of Mexico (2010a), 14% of Mexico's total GHG emissions are produced by deforestation and forest degradation, including as a result of forest fire, erosion and pests. In preparing for REDD+, Mexico has been able to build on its relative strengths, such as policy experience in community forestry and ecosystem services as well as on past investments in forest assessment and management (Government of Mexico 2010a). Mexico is engaged in the Forest Carbon Partnership Facility and is one of the recipient countries of the Forest Investment Program. It is also a leading country in the REDD+ Partnership and is engaged in UN-REDD as an observer. Mexico has a REDD working group in CONAFOR, a working group on climate change in SEMARNAT, and an inter-secretary commission on climate change to ensure the consideration of forests in the wider climate-change agenda. Table 6 indicates Mexico's forest carbon potential.

Forest for protection

Soil and water. Large parts of Mexico's forest estate are classified as water protection areas (*cuencas de amortiguamiento*), particularly in the tropical south-eastern part of the country. For example, 40% of the country's freshwater is produced in the *Selva Lacandona*, a tropical forest in the state of Chiapas.[a] The Government of Mexico supports watershed protection through a system of payments for ecosystem and watershed services (*programa de pago por servicios ambientales e hidrológicos de* ProÁrbol). ProÁrbol produces maps that identify zones that are eligible for payments for hydrological services. No figures are available on the extent of forests set aside for mainly water and soil protection purposes.

Chicle and timber production in a certified *ejido* in Quintana Roo (left: tree of *Manilkara zapota*; right: tree of *Swietenia macrophylla*).

Biological diversity. Mexico is one of the world's top ten most biologically diverse countries with regard to the number of vertebrate and vascular plant species. It has the highest diversity of reptiles of any country and is third for bird diversity and fourth for terrestrial mammals. There are more plant species in Mexico than in the United States and Canada combined. Seventy mammals, 26 birds, 54 reptiles, 196 amphibians, eight arthropods and 47 plants found in forests are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species (IUCN 2011).

Table 6 Forest carbon potential

Biomass forest carbon (MtC)	% forest with canopy cover >60%	Deforestation/ degradation potential to 2030	Enhancement of carbon sink capacity to 2030	Forest area change monitoring capacity	Forest/ GHG inventory capacity	Importance of forest fire/ biomass burning	Engagement in international REDD+ processes
4360–5920	35*	++	+++	+++	+++	+++	+++

+++ high; ++ medium; +low; estimate of national forest carbon based on Gibbs et al. (2007); estimate of % total forest with canopy cover >60% based on UNEP-WCMC (2010).

* *Tropical forests only.*

Mexico has listed 53 plant species in CITES Appendix I and 1439 plant species in Appendix II, including *Swietenia macrophylla* (UNEP-WCMC 2011).

Extent of protected areas. About 24.4 million hectares of tropical and temperate forests and semi-arid woodlands are officially declared as protected areas (*áreas naturales protegidas*), of which 53% (12.9 million hectares) are part of the national system of protected areas (*Sistema Nacional de Areas Naturales Protegidas* – SINAP).[a] This figure is significantly higher than that reported in ITTO (2006), of 17.9 million hectares. Discrepancies remain in the definition and number of protected areas; for example, it appears that some designated protected areas are on private land, and their protection status is unclear (ITTO 2006). In the tropical zone, 19 forested protected areas and one monument – with various designations, such as biosphere reserves, national parks, flora and fauna reserves, and monuments – are integrated in SINAP, covering a total area of about 3.015 million hectares (Box 1).[a] In the temperate zone, twelve forested protected areas are part of SINAP, covering an area of 1.25 million hectares.[a]

Estimate of the area of forest sustainably managed for protection. The majority of Mexico's tropical forests have protected-area status; generally, this status is respected and laws are enforced.[a] Consequently, all those protected areas in SINAP are considered in this report to be under SFM (Table 7).

Socioeconomic aspects

Economic aspects. The direct contribution of the tropical timber sector to employment could be as high as 90 000 jobs, but a considerable number of people employed in the sector work informally and are not counted in official statistics.[a] The contribution of the national forest sector to GDP in 2007 was about US$2 billion (1.5%)[a], compared with 1% in 2003 (ITTO 2006). In 2009, about 26% of the national consumption of wood products was produced domestically and the remainder (mainly cellulose and paper) was imported, valued at more than US$5 billion (CONAFOR 2010).

Livelihood values. It is estimated that 12–13 million people live in forest areas in Mexico, about five million of whom are Indigenous. Most forest-dependent Indigenous people live in conditions of extreme poverty, with limited access to education, public services and labour (Government of Mexico 2010b). Impoverished people tend to rely on fuelwood as an energy source for cooking, which may cause forest degradation where fuelwood is scarce. In Mexico, tropical forests are nearly entirely

Box 1 Forested protected areas in tropical Mexico

Protected area	State	Area (ha)
Calakmul Biosphere Reserve	Calakmul, Campeche	723 185
Sian Ka'an Biosphere Reserve	Quintana Roo	528 148
Los Tuxtlas Biosphere Reserve	Veracruz	155 122
Montes Azules – Selva Lacandona Biosphere Reserve	Chiapas	331 200
Parque Nacional Isla Contoy	Quintana Roo	5126
Pantanos de Centla Biosphere Reserve	Tabasco	302 707
Chamela – Cuixmala Biosphere Reserve	Jalisco	13 142
La Encrucijada Biosphere Reserve	Chiapas	144 868
Yum Balam Flora and Fauna Protection Area	Quintana Roo	154 052
Arrecifes de Sian Ka'an Biosphere Reserve	Quintana Roo	34 927
Lacantún Biosphere Reserve	Chiapas	61 874
Área de Protección de Flora y Fauna Chan-Kin	Chiapas	12 185
Área de Protección de Flora y Fauna Uaymil	Quintana Roo	89 118
Ría Lagartos Biosphere Reserve	Yucatán	60 348
Ría Celestún Biosphere Reserve	Yucatán and Campeche	81 482
Los Petenes Biosphere Reserve	Campeche	282 858
Parque Nacional de Xcalak	Quintana Roo	17,949
Parque Nacional Huatulco	Oaxaca	11 891
Monumento Natural Bonampak	Chiapas	4357
Total		**3 014 539**

Source: www.conanp.gob.mx/que_hacemos/sinap.php.

Table 7 Management of the protection PFE ('000 hectares)

Reporting year	Protection PFE	Attributed to IUCN categories I–IV (tropical only)	Allocated for soil and water	With management plans	Sustainably managed
2005*	5600	1040	-	-	-
2010	**3649****	**3015**	**-**	**3015**	**3015**

* *As reported in ITTO (2006).*

** *Only forested protected areas classified in SINAP in tropical areas.*

owned by *ejidos*, and forest management for timber and NTFPs generates a significant part of family livelihoods.[a]

Social relations. Communities in Mexico are greatly involved in both forest management and conservation. There are many models for good resource management and forest enterprises, such as the PROCYMAF (*Programa de Desarollo Forestal Comunitario*), a community forest management project.[a] Generally, however, *ejidos* and communities lack the organization and funds to manage forests and woodlands effectively.[a] There is also often a divergence between national interests to protect and manage forests and particular local interests. There is an ongoing conflict in tropical forests in the states of Chiapas and Oaxaca over a lack of access to land and insecurity of tenure (Government of Mexico 2010a).

Summary

The management of Mexico's forests differs greatly between the pine and oak forests in the temperate zone, the forests in semi-arid regions, and the moist tropical forests in the south. The majority of tropical forests are managed by communities. Problems that obstruct progress towards the sustainable management of closed forest areas in *ejidos* include a lack of resources and know-how for the economic use of forest resources, and discrepancies in the objectives between communities, the private sector and forest authorities. There have been considerable advances in policies that give greater recognition and rights to *ejidos* and communities. Nevertheless, land allocation and land-use change remain a key issue in Mexico's forests.

Good progress has been achieved in forest certification, although to date much of it has been outside the tropics. The government has taken steps to tackle deforestation and forest degradation through REDD+, address shortcomings in the sector, combat illegal logging and improve fire management.

Key points

- Mexico has no formally designated PFE. Nevertheless, about 12.2 million hectares (compared with 13.6 million hectares in 2005) of tropical forest may be considered to constitute a tropical-forest PFE, comprising 8.40 million hectares of natural production forest (compared with 7.88 million hectares in 2005), 3.65 million hectares of protection forest (compared with 5.60 million hectares in 2005) and 171 000 hectares of planted forest (compared with 100 000 hectares in 2005).
- Differences in estimates of the PFE between 2005 and 2010 are most likely due to the lack of a formal PFE rather than to real change.
- Overall, the rate of deforestation has apparently slowed but is still high in some states. Over-harvesting and the illegal harvesting of forest resources are still widespread, although now less so in the tropics than in the temperate zone.
- An estimated 750 000 hectares of the tropical production PFE and the entire protection PFE is under SFM.
- Considerable efforts are under way to increase the planted-forest estate, including with local broadleaved species.
- *Ejidos*, local communities and private owners hold tenure rights to more than 90% of Mexico's forests. The area of state-owned forests is less than 5%. Nevertheless, continuing conflicts over land use and land-use change are apparently inhibiting SFM in some states, including in the tropics.
- Mexico is actively pursuing REDD+ as a major new instrument for encouraging the protection

and management of natural forests, mainly through community-based forest management.

Endnotes

a Government of Mexico (2010b).

b Information derived from discussions held with representatives of government, civil society and the private sector at the international workshop on governance and REDD, held 30 August–3 September 2010 Oaxaca, Mexico.

c Personal communications with officials at SEMARNAT, 2010.

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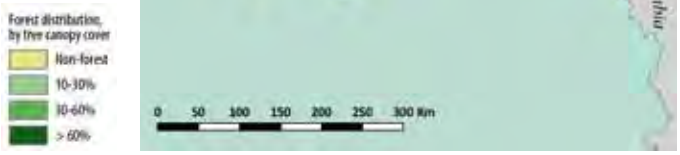
PANAMA



Forest resources

Panama has a land area of 7.48 million hectares and an estimated population in 2010 of 3.5 million people (United Nations Population Division 2010). Panama is ranked 60th out of 182 countries in UNDP's Human Development Index (UNDP 2009). It can be divided into four biogeographical zones: the Cordillera de Talamanca, which extends southwards from Costa Rica in the west, with peaks of more than 3000 m; the central lowlands, which are bisected by the Panama Canal; the largely forested eastern region (*Darién*), characterized by a series of mountain ranges (San Blas and Portobello) up to 1000 m in altitude and hilly landscapes up to 800 m; and the lowlands on the Caribbean coast. Nearly 90% of the country lies below 1000 m.

FAO (2010a) estimated the forest area at 4.29 million hectares (57% of the land area), while the Government of Panama (2009a) estimated it at 3.07 million hectares (41% of the land area).

Forest types. The prevalent forest type in Panama is deciduous tropical semi-humid forest, together with dry, moist submontane and montane forests. Stands of the tropical semi-humid deciduous forest are heterogeneous, with *Cavallinesia platanifolia* an emergent species above the forest canopy. *Anacardium excelsum* and *Hura crepitans* are among the most common species in the dominant storey. The lower storey contains various species of palms as well as species from the Cicadaceae, Rubiaceae, Mirsinaceae, Musaceae and other families.

Panama's mangroves cover about 174 000 hectares (Spalding et al. 2010) on the Pacific coast and, to a lesser extent, on the Atlantic coast. Tropical evergreen humid forests, receiving 2500 mm rain per year or more, occur typically in low-lying and medium-altitude areas of the Atlantic coast, where they cover a considerable area. Other forest types characterized by the dominance of a few species are:

- Oak (*Quercus* spp) montane forests, which are found in the Talamanca mountains. These are sometimes fully closed, with a dominant storey of two species of oak and a few other species.
- Cativo (*Prioria copaifera*) forests, which are found alongside mixed forest stands, always in the proximity of rivers on inundated areas at low altitudes, covering about 40 000 hectares.
- Orey (*Campnosperma panamensis*) forests, which occur on poorly drained ground in the western Atlantic coastal region in Bocas del Toro Province, covering about 3500 hectares.

Permanent forest estate. According to existing land-use plans, 75% (5.6 million hectares) of the land area in Panama is suitable for forest use.[a] In some areas, forests are used in shifting cultivation and for cattle-ranching with low productivity. The 1994 Forest Law (*Ley Forestal* 1/94) classifies forest into production, protection and 'special' areas; the latter includes scientific, historic, educational, tourism and recreational areas. Indigenous territories (*comarcas*[1]) contain an estimated 150 000 hectares of production forest. About 140 000 hectares in the provinces of Colon, Bocas del Toro and Veraguas have not yet been harvested and may also be considered potential production forest. The Government of Panama (2009a) reported 2.3 million hectares of permanent production forests, which is an increase of nearly 300 000 hectares over that reported for 2005. The production PFE shown in Table 1 is unchanged from 2005 but the protection PFE has increased due to the classification of additional protected areas.

1 In Panama, the *comarca indígena* is an administrative region for an area with a substantial Indigenous population. Three *comarcas* are equivalent to provinces and two smaller *comarcas* are subordinate to provinces and considered equivalent to a *corregimiento* (municipality).

Table 1 Permanent forest estate

Reporting year	Estimated total forest area range (million ha)	Total closed natural forest ('000 ha)	PFE ('000 hectares)			
			Production		Protection	Total
			Natural	Planted		
2005*	2.9–3.5	3052	350	56	1580	1986
2010	**3.1–4.3**	**2110****	**350‡**	**71**	**1880‡**	**2301**

* *As reported in ITTO (2006).*

** *Calculated using the ratio of forest with greater than 60% forest cover estimated by UNEP-WCMC (2010) (49.2%) and the total natural forest area as estimated by FAO (2010a).*

‡ *According to Government of Panama (2009a).*

Forest ecosystem health

Deforestation and forest degradation. On average, Panama lost an estimated 42 000 hectares of forest per year in the 1990s (1.18% per year, FAO 2010b). ANAM (2008) estimated the deforestation rate of natural forests between 2000 and 2008 at about 27 800 hectares (0.96%) annually, significantly less than in the previous decade, and FAO (2010b) put the rate at 0.36% for the period 2005–10. The highest rate of deforestation was in Darien Province, where nearly 4400 hectares were being cleared per year, followed by Colon Province (3700 hectares), the Ngäbe Bugle *comarca* (3400 hectares) and Bocas del Toro Province (3000 hectares) (ANAM 2008). Drivers of deforestation include urbanization, cattle-ranching, agro-industrial development, unregulated shifting cultivation (*rozas*), open mining, poor logging practices, charcoal-making and fire (ITTO 2005). Table 2 shows the estimated area of degraded and secondary forests.

Vulnerability of forests to climate change. Human-induced forest fire currently affects, on average, about 7000 hectares of forest annually.[a] The main issue related to vulnerability and adaptation to climate change pertains to low-lying villages and communities that would be threatened by a rise in sea level. This is especially true for the Kuna Yala (also known as San Blas) *comarca*, since most of its 47 communities are on low-lying coralline atolls. Some communities have already indicated a need to re-locate to the mainland.

SFM policy framework

Forest tenure. Forest ownership is divided into public, private, *comarcas* and, since 2008, a new category of Indigenous land rights known as *tierras colectivas*. The majority of the forest estate, however, is state-owned (Table 3). The 1972 Constitution recognizes *comarcas* and gives the Indigenous communities therein authority to manage their lands. In total, the *comarcas* comprise 28% of the national territory, several of which are mostly forested (e.g. Emberá Wounaan *comarca*, 90%; Kuna Yala *comarca* 86%, Government of Panama 2009b). As of 2008, the government agency responsible for legal landholding titles, *Programa Nacional de Administración de Tierras,* had legalized 102 000 land titles, but none in natural forest areas.

Criteria and indicators. The Government of Panama used the ITTO C&I in its submission to ITTO for this report.[a]

Forest policy and legislation. Forests do not receive high political priority in Panama due to their low contribution to economic development.[a]

Table 2 Forest condition

	PFE	Non-PFE	Total
	'000 ha		
Area of primary forest	-	-	700
Area of degraded primary forest	-	-	2000
Area of secondary forest	-	-	730
Area of degraded forest land*	-	-	900

* *An estimated 2 million hectares of former forest land is thought to be heavily degraded, mainly in the Central Cordillera.*

Source: Government of Panama (2009a).

Table 3 Forest area, by tenure

Ownership category	Total area	Of which PFE	Notes
	'000 ha		
State ownership (national, state or provincial government)	3955	3955	The 1994 Forest Law states that state forests include all natural forests, the soils on which those forests are located, and state lands suitable for forestry. Nevertheless, under certain conditions state forest lands can be titled (Larson 2006).
Other public entities (e.g. municipalities, villages)			
Total public	**3955**	**3955**	
Owned by local communities and/or Indigenous groups	753	753	Natural forests in *comarcas*.
Private owned by individuals, firms, other corporate	60	0	Regulations for forest management clearly recognize private property rights to forests.

Source: Government of Panama (2009a).

Under a recent amendment to Law 30 (*Ley sobre Estudios de Impacto Ambiental*, 1994), environmental impact assessment processes may be bypassed if the government determines there is a 'social interest' in doing so. In 2010 an office was created in the Ministry of the Presidency (*Ministerio de Presidencia*) called ProDar, the goal of which is to develop the Darien Gap, an area of forest separating Darien Province from Colombia. Plans that could affect forests there include the construction of a connecting road with Colombia (the 'missing link' in the Pan American Highway), the construction of an electricity transmission line to Colombia through the Emberá Wounaan *comarca*, and petroleum exploration. Mining is another development priority for the government, which could affect forests in the Cordillera de Talamanca.

In 2008 the Government of Panama published the National Forest Development Plan (*Plan Nacional de Desarrollo Forestal: Modelo Forestal Sostenible*). Key elements of that policy are the establishment of a PFE; inventories and forest management plans for production and protection forests; and environmental impact assessments for production forestry. With a change of government, however, the future of this plan is uncertain.

The main laws pertaining to forests are set out below.

- Panama's first specific forest law (Law 1/94) was passed in 1994, replacing Law 39 (1966), with the aim of conserving and managing forest resources sustainably. It emphasizes logging and reforestation and established the National Fund for Forest Development and Protection (*Fondo de Protección y Desarrollo Forestal* – FONDEFOR) to assist in forest promotion, protection, management, supervision, control and research, and extension. By mid 2010, however, the fund was still not functioning, and all forest-related taxes were going to general revenue.[a] Law 1/94 is currently being revised with a view to incorporating, among other things, forest management planning, forest certification, forest auditing, regulations for FONDEFOR, direct and indirect incentives for natural and planted forests, the demarcation of the PFE, the participation of stakeholders, and the creation of a C&I national commission.
- Law 24/1992 created incentives for reforestation and Article 43 of Law 1/94 states further that all private forest land covered by forests, either natural or planted, is exempt from national taxes, provided that the landowner is registered in the *Registro Forestal* and a certificate of ownership has been issued. Although aimed at enterprises, associations, community organizations and cooperatives, according to some commentators only commercial enterprises have benefited from the incentives so far. Problems relate to tax evasion, the over-stating of costs, and a failure to maintain plantations over time.
- The Wildlife Law (24/95) establishes that wildlife is part of the natural patrimony of Panama and provides for the protection, restoration, research, management and development of the country's genetic resources, including rare species.
- The 1998 General Law on the Environment (*Ley General de Ambiente*, 41/98) establishes the basic principles and norms for the protection, conservation and restoration of the environment and promotes the sustainable use of natural resources. It governs the administration of the

environment and integrated social and economic objectives, and recognizes the right of Indigenous communities to manage forests in the *comarcas* (Article 98).

- Decree Law No 2 (2003) approves a set of forest management guidelines for Panama.
- Law 5 (*Ley sobre Delito contra el Medio Ambiente*, 2005) sets out penalties for environmental crimes, such as illegal logging.
- The *Tierras Colectivas* Law (*Ley 72 sobre Tierras Colectivas,* 2008) establishes a procedure for the awarding of collective ownership of lands traditionally occupied by Indigenous peoples and communities that are not within the *comarcas*.

Panama is highly centralized, but this may change. The aim of Law 37 on the Decentralization of Public Administration, enacted in 2009, is "the promotion of systematic decentralization of public administration in the municipalities, to achieve sustainable development of the country through the delegation and transfer of administrative, economic, political and social competence of the Executive Body, in a gradual, progressive, orderly, regulated and responsible manner".

Institutions involved in forests. The 1998 General Law on the Environment established the National Environment Authority (*Autoridad Nacional del Ambiente* – ANAM) as an autonomous entity. ANAM has a mandate to rule on matters of natural resources and the environment, including forests, and to ensure compliance with and the enforcement of applicable laws, regulations and national policies. ANAM develops basic principles and norms for the protection, preservation and restoration of the environment and promotes the sustainable use of natural resources, including forests. There are about 130 forest professionals in Panama, of whom approximately 50 work for ANAM.[a] Within ANAM, the forest department (*Departamento de Desarrollo y Manejo Forestal*) is responsible for the implementation of the National Forest Development Plan, but it has limited capacity.

In 2008 the Aquatic Resources Authority (*Autoridad de los Recursos Acuáticos de Panamá*) assumed responsibility for mangrove forest management outside protected areas. The Authority of the Panama Canal (*Autoridad del Canal de Panamá*) has a specific mandate for the management and conservation of forests in the vicinity of the Panama Canal.

Various NGOs are active in forest management and conservation, including the National Association for the Conservation of Nature (*Asociación Nacional para la Conservación de la Naturaleza*), the NATURA Foundation (*Fundación NATURA*) and the National Reforestation Association of Panama (*Asociación Nacional de Reforestadores de Panamá*).

Status of forest management

Forest for production

Integrated land-use planning has been applied in several provinces since 2005. In that year, the first integrated forest plan was prepared for 27 000 hectares in the Emberá-Wounaan *comarca*, with the help of WWF. Plans have also been prepared for an additional 45 000 hectares in the *comarcas*.

Forest management in natural forests is carried out by way of various types of timber-cutting licences. These include logging permits for domestic use (e.g. for housing and boat–building), special permits for subsistence (granted to poor individuals for cutting a small number of trees for personal use or for sale to commercial enterprises), five-year forest concessions for areas 1000–5000 hectares in size, and 20-year concessions for areas larger than 5000 hectares.

Logging in natural forests on private lands requires a forest inventory, a management plan and the marking of the trees to be cut. On state lands, an environmental impact assessment is also required.

The allocation of concessions larger than 5000 hectares is subject to public bidding. On sites smaller than 5000 hectares, the entity seeking the concession must publish its intentions for three consecutive days in a national newspaper so that any conflicting claims on the area in question can be addressed. If any of the area overlaps with a *comarca*, authorization by the *comarca* authority is required.

Under the Forest Law (1994), permits and concessions for logging on *comarcas* and Indigenous reserves are authorized by ANAM and by the congress of the respective *comarca*, after a study of the "scientific management plan" (Article 44). Nevertheless, virtually no incentives or special programs are available to promote or facilitate the

Twelve-year-old teak plantation on former pasture land in Panama.

management of natural forests, which encourages the high-grading of forests (mainly through cutting permits), without regard to sustainability.[b]

Before 2002, 29 forest concessions were granted over 67 150 hectares; since then, no new forest concession licences have been requested or issued. Seventeen permits (covering 3400 hectares of forest) have been issued on private farms and 66 permits (covering 15 000 hectares) have been issued to communities. Six community permits have been in operation since the end of 2004, while ANAM had granted 5854 subsistence permits as of 2008.[b]

As of mid 2009, forest inventories had been conducted over 127 000 hectares (including 94 500 hectares in the PFE). Seventeen forest management plans had been approved in the PFE for an area of 25 300 hectares, integrated forest/land-use management plans had been developed for about 47 000 hectares, and an additional 140 000 hectares were under consideration for further management planning.[a] Nevertheless, over the majority of the production PFE, selective logging is conducted under existing community permits, generally done without regard to forest management guidelines (ITTO 2005). Moreover, Indigenous communities have been known to sell their rights to such permits to private companies at low prices.[a]

Forest management is occurring in some privately owned plantations and national parks, and in privately owned tracts of forests located mostly in eastern Panama. The Forest Law stipulates that the granting of licences for new concessions is conditional on the preparation of integrated forest management plans for SFM and independent monitoring of implementation, but few such plans have been prepared.

Silviculture and species selection. No formal silvicultural systems are applied in natural forests. The most commonly harvested tree species are shown in Table 4; 12–15 tree species are harvested and marketed to a significant extent. Species commonly harvested in the past include *Carapa guianensis* (tangare), *Prioria copaifera* (cativo), *Tabebuia rosea* (oak), *Calophyllum brasiliense* (maria), *Copaifera aromatica* (cabimo), *Dalbergia retusa* (cocobolo), *Ocotea* spp (bambito) and *Swietenia macrophylla* (caoba). Species now being considered in the market include *Miroxylon balsamum* (bálsamo), *Platymiscium pinnatum* (quira), *Hieronyma alchorneoides* (zapatero), *Puteria* spp (platano), *Gyranthera darinensis* (cucharo) and *Astronium graveolens* (zorro). Since 1970 about 50 species have been used by rural communities for local use.[a]

Planted forest and trees outside the forest. In 2009 there were about 71 000 hectares of planted forest[a], an increase of 15 000 hectares over that reported in ITTO (2006). Most are privately

Table 4 Commonly harvested species for industrial roundwood

Species	Notes
Anacardium excelsum (espavé)*	Important timber species over the past ten years with an annual cut of more than 5000 m^3.
Miroxylum balsamum (bálsamo)*	Major timber species in the national market annual cut more than 4000 m^3.
Bombacopsis quinata (cedro espino)*	Important timber species that has maintained its value for many years.
Cedrela odorata (cedro amargo)	Old secondary forests, annual cut nearly 2000 m^3.
Tectona grandis (teca)*	From plantations, increasingly important in the national timber market; nearly 7000 m^3 per year.

* *Also listed in ITTO (2006).*

Source: Government of Panama (2009a).

owned.[a] About 1.2 million hectares of land is potentially available for plantation development.[a] Of the total planted forest estate, 59 000 hectares have been established since 1992[a,b], the majority by private and community landowners. While the main plantation species before 1990 was *Pinus caribaea* (pino caribe), *Tectona grandis* (teak, teca) has become the major species, with more than 47 000 hectares established since 1995.[a] Combined, teca and pino caribe (11 000 hectares in 2008) account for about 82% of the planted area. Other planted species include valuable timber species such as *Cordia alliodora* (laurel, planted as a shade tree for cacao), *Bombacopsis quinata* (cedro espino), *Terminalia amazonia* (amarillo), caoba, zapatero, *Dipteryx panamensis* (almendro) and cocobolo.

Forest certification. Nine companies have valid FSC certificates covering a total area of 16 430 hectares (FSC 2011); all are for teak plantations. No natural forests have been certified.

Estimate of the area of forest sustainably managed for production. Of the 350 000 hectares of production forests, 27 000 hectares managed by the forest enterprise of five communities in Río Tupiza in the Emberá-Wounaan *comarca* can be considered as sustainably managed for timber production, as can an area of about 17 000 hectares in Río Marragantí (Table 5). Another 18 000 hectares have been inventoried in Río Tuqueza and an inventory for 10 000 hectares in Río Chucunaque is being prepared (Diaz 2009, I. Diaz, pers. comm., 2010). The total area of forest covered by management plans is about 72 000 hectares. More than 1000 small landowners manage about 60 000 hectares of planted forest (ANAM 2008), which can also be considered as well managed.

Timber production and trade. Total roundwood production in 2005 was estimated at 1.54 million m^3, the majority of which was for fuelwood (FAO 2010a). Official industrial log production was estimated at 42 000 m^3 in 2009, down from 78 000 m^3 in 2005 (ITTO 2011), but there is also considerable production that is not officially registered.[b]

Sawnwood production in 2009 was estimated at only 9000 m^3, down from about 30 000 m^3 in 2005 (ITTO 2011). The production of veneer and plywood was negligible (ibid.). Total installed sawmill capacity is unknown[a], although it has been estimated at 200 000 m^3 (ITTO 2006). The primary processing industry is very small. There are about 250 small secondary processing units using antiquated equipment located in the periphery of Panama City and in the central provinces.[a]

Panama exported about 7000 m^3 of tropical hardwood logs in 2009, down from about 37 000 m^3 in 2008 and nearly 80 000 m^3 in 2004. The main exported timber is a planted species, teca, but a significant quantity of bálsamo is also exported.

Non-timber forest products. Numerous wildlife species provide important sources of protein in Indigenous territories, including *Agouti paca* (conejo pintado), saino and venado. Many plants are collected for medicinal purposes. Handicraft products are important, such as the palm fruit *Phytelephas seemannii* (tagua, known as vegetable ivory) and more than 70 species producing fibres such as *Astrocaryum* spp (chunga, used for baskets), *Socratea durissima* (jira) and, in particular, *Carludovica palmata* (the Panama-hat palm). The wood of *Dalbergia retusa* is also the main raw material for wooden handicrafts. Poles and the leaves of the palms *Cryosophila guagara* and *Sabal mauritiiformis* (guágara) and various species of bamboo are used for local construction. Fruits and nuts from forest trees are collected for local use and sale, including *Borojoa patinoi* (borojó), a fruit with aphrodisiac properties, the fruit of *Quararibea cordata*, which was introduced from Colombia, and the oil of *Jessenia bataua* (aceite de trupa, an alternative to palm oil). The key cultural plant for both the Kuna and the Embera is *Genipa*

Table 5 Management of the production PFE ('000 hectares)

Reporting year	Natural					Planted		
	Total	Available for harvesting	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
2005*	350	86	63	0	0	56	32	12
2010	**350**	**86****	**72**	**0**	**44**	**71**	**47**	**16**

* *As reported in ITTO (2006).*

** *Comprising forests under concession or private and community permits.*

americana, which is used for body-painting (C. Potvin, pers. comm., 2010).

Forest carbon. According to Government of Panama (2009b), forests and other wooded land stock 1250 million tonnes of carbon in the five carbon pools (above and below-ground living biomass, dead wood, litter, and soil organic carbon), of which 620 million tonnes are in living forest biomass. Gibbs et al. (2007) estimated the forest biomass carbon stock at 509–763 MtC and FAO (2010a) estimated it at 367 MtC.

Panama was one of the first countries to prepare a REDD+ readiness plan for the Forest Carbon Partnership Facility. Panama is participating in UN-REDD and is a member of the REDD+ Partnership. Panama's engagement in global REDD negotiations was high to early 2010, but it is unclear how the new government will position itself. Panama has also submitted five reforestation projects to the CDM.

A good proportion of Panama's forests are intact, and there is considerable potential to enhance carbon stocks through forest restoration and reforestation (Government of Panama 2009b; Table 6).

Forest for protection

Soil and water. Forests managed principally to protect soil and water cover about 156 000 hectares.[a] An estimated 406 500 hectares are classified under the National System of Protected Areas of Panama (*Sistema Nacional de Áreas Protegidas de Panamá* – SINAP) as protection forests.[a] Most of this forest is situated in the watershed of the Panama Canal, which covers an area of 518 000 hectares (ITTO 2005); forests have the important function of protecting the Canal from siltation and ensuring an adequate supply of water for the locks. The Ministry of Health, supported by ANAM, has a program of forest restoration and reforestation in small watersheds that serve as water sources for rural communities and municipalities, supporting 200 tree nurseries.[a]

Biological diversity. Panama is very biodiverse for its size, with more than 10 400 species of vascular plants, 259 mammal species, 957 bird species, 229 reptile species and 179 amphibian species, and 1059 plant species are endemic.[a] Eleven mammals, 16 birds, 50 amphibians, one insect and eleven plants found in forests are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species (IUCN 2011). Four plant species are listed in CITES Appendix I, 462 species – mainly from the families Orchidaceae, Cactaceae and Zamiaceae, but also the tree species *Swietenia macrophylla*, *S. humilis*, *Guaiacum officinale* and *G. sanctum* – are listed in Appendix II, and three are listed in Appendix III (UNEP-WCMC 2011).

Protective measures in production forests. No protective measures are applied in the production PFE beyond some general measures described in the Forest Law. However, in those areas where integrated forest management plans are being implemented, high standards of soil and water protection are being applied.[a]

Extent of protected areas. Currently 34% of the total land area of Panama is classified as under protection. The legal basis for this is Resolution JD-022-92, which defines the SINAP, and the 1998 General Law on the Environment. SINAP (which includes the production PFE) covers more than 2.95 million hectares, of which 2.69 million hectares are terrestrial and 1.88 million hectares are forested.[a] The smallest protected area is 290 hectares in size, the largest greater than 0.5 million hectares.[a] Protected areas (not including the production PFE) are distributed according to the following management categories (not all of which are forested):

- Seventeen national parks with a total area of 1.3 million hectares, of which 1.08 million hectares are forested (IUCN category II).

Table 6 Forest carbon potential

Biomass forest carbon (MtC)	% forest with canopy cover >60%	Deforestation/ degradation potential to 2030	Enhancement of carbon sink capacity to 2030	Forest area change monitoring capacity	Forest/ GHG inventory capacity	Importance of forest fire/ biomass burning	Engagement in international REDD+ processes
509–763	49	++	++	++	+	+	++

+++ high; ++ medium; + low; estimate of national forest carbon based on Gibbs et al. (2007); estimate of % total forest with canopy cover >60% based on UNEP-WCMC (2010).

- Three natural monuments totaling 5700 hectares (IUCN category III).
- Five forest wildlife sanctuaries (136 000 hectares), six (partly forested) wetlands (192 000 hectares) and two protected landscapes (13 000 hectares), all corresponding to IUCN category V.

There are also 20 areas covering a total of 580 000 hectares in hydrological reserves, natural recreational areas, biological corridors, multiple-use areas and municipal protected areas not classified into IUCN categories.[a]

The Darien National Park encompasses nearly 59% of the total forested protected area. Twenty-four of the 65 protected areas in SINAP are reported to be interconnected.[a]

Estimate of the area of forest sustainably managed for protection. An estimated 722 000 hectares of forests in the protection PFE are covered by administrative instruments (ITTO 2005) and benefit from some form of management.[a] Simple management plans exist for 29 protected forested areas, covering about 368 000 hectares, although these are generally not implemented due to a lack of financial resources and personnel.[a] Oestreicher et al. (2009) concluded, however, that a great majority of Panama's forests in protected areas has been protected effectively by applying a balance of strong surveillance and enforcement measures and stakeholder participation to find protection strategies that generate alternative livelihood options and economic benefits from conservation for local communities. The core protected forest area in the watershed of the Panama Canal/Chagres National Park (about 180 000 hectares) is generally considered well managed.[b] About 108 000 hectares of forested protected areas are physically demarcated.[a] These areas, together with the core forest zone of the Panama Canal/Chagres National Park and the high mountain cloud forest area of the La Amistad International Park/Bocas del Toro (which stretches across the border between Panama and Costa Rica and covers about 80 000 hectares) comprise the estimate of the protection PFE considered to be under SFM shown in Table 7.

A member of the Kuna Yala community, Panama.

Socioeconomic aspects

Economic aspects. The contribution of the forest sector to GDP was a low US$510 million in 2008 (about 0.3% of GDP).[a] The sector makes an important contribution locally, however, particularly in Indigenous communities. The National Forest Development Plan estimated the potential value of forest services at US$3180 per hectare, of which US$782 is the estimated carbon value. The forest sector employs about 10 600 people, many of them working in forest plantation development. An additional 2000 people are employed in processing units such as sawmills and timber workshops.[a]

Table 7 Management of the protection PFE ('000 hectares)

Reporting year	Protection PFE	Attributed to IUCN categories I–IV	Allocated for soil and water	With management plans	Sustainably managed
2005*	1580	1040	326	396	180
2010	**1880**	**850****	**406‡**	**396**	**368**

* *As reported in ITTO (2006).*

** *According to UNEP-WCMC (2010). The Government of Panama (2009a) estimated 1.1 million hectares.*

‡ *156 000 hectares are allocated strictly for watershed protection; 406 000 hectares are considered protection forests in more general terms.*

Livelihood values. Forty-four per cent of Panama's population lives in rural areas. Most of these people are classified as either poor or extremely poor (Larson 2006). Forests are generally considered a common good and there is little awareness among stakeholders – local communities, settlers invading forest areas from other regions, and commercial logging operators – of sustainable management practices. ANAM gives special consideration to the *comarcas*, where community forest concessions can contribute to the livelihoods of local communities. Such an approach has been tested through an ITTO project in the Kuna Yala communities on the Atlantic coast, with limited success.

Social relations. Indigenous peoples comprise 10% of the Panamanian population. The seven major Indigenous groups – Ngabes (60% of the total Indigenous population), Kunas (21%), Emberá, Buglé/Bokata, Wounaan, Nasos and Bri-Bri (Moreno 2005) – (headed by a total of eleven traditional authorities) are represented in an apex body, the *Organisation Coordinadora Nacional de los Pueblos Indigenas de Panamá*, which acts as a united body in Indigenous matters (C. Potvin, pers. comm., 2010). There is constant migration between *comarcas* and *tierra collectivas* and urban centres for schooling and employment (ibid.).

Summary

The management of Panama's PFE remains problematic. Some pilot efforts have been initiated and increased attention has been paid recently to the preparation of inventories and forest management plans, but small-scale subsistence logging is still being carried out with little oversight and makes a significant contribution to continuing forest degradation. Forest plantations are continuously being developed, mainly on private properties, and are the main driver of forest development. The wood-processing industry is in a poor state, with antiquated equipment and an under-supply of legally produced timber. Large areas of forest are classified as protected, but a relatively small area of these is considered to be under SFM. Forest management appears strongest near the Panama Canal, indicating the importance of forests for watershed protection, while increased efforts are being undertaken to improve the management of production and protection forests in the *comarcas*.

Key points

- Panama has an estimated PFE of 2.30 million hectares (compared with 1.99 million hectares in 2005), comprising 350 000 hectares of natural production forest (the same as estimated for 2005), 1.88 million hectares of protection forest (compared with 1.58 million hectares in 2005) and 71 000 hectares of planted forest (compared with 56 000 hectares in 2005).
- An estimated 44 000 hectares of the production PFE is under SFM. No forest is certified. An estimated 368 000 hectares of the protection PFE is under SFM.
- The forest law recognizes the rights of Indigenous communities to manage forests in Indigenous reserves (*comarcas*).
- Until recently, at least, the Government of Panama has been fully engaged in REDD negotiations and initiatives. The new government has placed an emphasis on development, including through the economic development of Darien.
- ANAM has insufficient human and financial resources to carry out the field-level monitoring and control of forest operations necessary to ensure adherence to forest-related laws and regulations.
- The private sector and civil society have been involved only minimally in the preparation of SFM policies and strategies. REDD-readiness planning and ANAM's new forest strategy may lead to a more inclusive role for all stakeholders in forest-based development.
- There is a lack of information on the state of the forests and silviculture in the country's natural forests and an apparent lack of research and training capacity.
- Illegal logging is widespread in the humid forests, even in protected areas, and remains a significant impediment to SFM.

Endnotes

a Government of Panama (2009a).

b Information derived from the report of, and discussions with participants at, a training workshop on ITTO criteria and indicators, held 29 March–2 April 2004, Panama City, Panama, attended by 42 people from government, civil society and the private sector.

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PERU

Forest distribution, by tree canopy cover
Non-forest
10-30%
30-60%
> 60%

Forest resources

Peru has a land area of 129 million hectares and an estimated population in 2010 of 28 million people (United Nations Population Division 2010). It is ranked 78th out of 182 countries in UNDP's Human Development Index (UNDP 2009).

Peru has three broad ecoregions: the desert coastal region, which covers 13.6 million hectares; the semi-arid Andean mountain range (*sierra*), which covers 39.2 million hectares; and the Amazon Basin, including the eastern humid slopes of the Andes, covering 75.7 million hectares. FAO (2010a) estimated Peru's forest cover at 67.9 million hectares, which is 53% of the total land area; 92% of these forests are in the Amazon Basin. Other estimates of forest area include 71.3 million hectares[a] and 72 million hectares (Government of Peru 2010).

Forest types. The main forest type in Peru is humid forest (rainforest) in the Amazon. It covers about 57 million hectares, with sub-types that depend on altitude and soils, particularly their position in relation to rivers. Terrace and hill forests – on rolling terrain with moderate slopes – are the most widespread humid forest sub-type, covering about 37 million hectares. The alluvial forests, including those on the lower river terraces, offer some of the best potential for integrated forest management and agroforestry because of their vigorous growth, flat terrain and good accessibility; their upper stories are generally 35–40 m in height. These forests have been used intensively in the past, leaving large expanses of secondary forest (*purma*) dominated by stands of fast-growing, light-demanding pioneer species.

There are about 11.2 million hectares of arid and semi-arid forests on the coast and semi-humid forests in mountain and inner-mountain valleys.[a] Peru has about 5300 hectares of mangroves at Tumbes, in the extreme north bordering Ecuador (Spalding et al. 2010).

Permanent forest estate. Under the 2000 Forest Law (*Ley 27308/2000*), the forest is classified into the following categories: production forests (permanent and in reserve); forests on protection land; forests for future use (forest plantations, secondary forests and degraded forests for restoration); natural protected areas; forests in Indigenous and rural communities; and local forests. Permanent production forests are intended for timber and non-timber production and the conservation of forest resources, and an approved forest management plan is required. As of 2010, 33.3 million hectares of permanent production forests had been classified within the PFE.[a] However, only an area of 18.7 million hectares has so far been allocated for production purposes (Kometter 2010), and this figure is used in Table 1 for the production PFE. The area of protection forest is about 19.4 million hectares, including forests designated in the national protected-area system, privately protected areas, and regional protected areas (*áreas de conservación regionales*).[a] About 15.4 million hectares of forests are unallocated. The total planted forest is estimated at 820 000 hectares[a], nearly 600 000 hectares of which are for timber and fuelwood production and the remainder are for protection.[a] The map in Box 1 shows Peru's production forests.

Forest ecosystem health

Deforestation and forest degradation. The estimated average annual rate of forest change in Peru in the period 1990–2000 was 269 000 hectares, or 0.4%; between 2000 and 2010 it was 94 000 hectares (0.1%) (FAO 2010b). Direct causes of deforestation include the development

Box 1 Permanent production forests, Peru

Note: *Inserted as supplied, in original language.*
Source: *Government of Peru.*

of new infrastructure such as highways (e.g. *carretera* Iquitos–Nauta, the Brasil–Peru Inter-ocean Highway and *carretera* Pucallpa–Lima); new settlements in the Amazon Basin, including the expansion of urban centres; the expansion of the agricultural frontier, including for cash crops and shifting cultivation; the expansion of oil exploitation and hydro-electric schemes; mining in the southern part of the Peruvian Amazon; illegal logging; and the illicit cultivation of coca (Government of Peru 2010). Indirect causes of deforestation include migration to the Amazon region; agricultural policies favouring cash-crop development; development policies that favour energy generation; and new investment opportunities due to globalization (ibid.). About one-third of the forest estate is degraded or secondary (Table 2).

Vulnerability of forests to climate change. Peru is highly vulnerable to climate change, having low-lying coastal areas; arid and semi-arid areas, forested areas and areas liable to forest decay; areas prone to natural disasters; areas liable to drought and desertification; areas of high urban atmospheric pollution; areas with fragile ecosystems, including mountainous ecosystems; and an economy that is highly dependent on income generated from the production, processing, export and/or on consumption of fossil fuels and associated energy-intensive products.

Peru has 70% of the world's tropical glaciers, many of which are retreating at a rapid rate (there has been a decrease of 30% of glacial mass in 40 years; Government of Peru 2008). A prolonged glacial melt will exacerbate water shortages, mainly in the drier areas of the country.

Peru is strongly affected by hydro-meteorological phenomena associated with el Niño. An estimated 72% of registered emergencies (e.g. droughts, heavy rains, floods, frosts, hailstorms, avalanches and landslides) are related to these phenomena, which increased more than six-fold between 1997 and 2006. Climate models project that el Niño will intensify in coming decades.

According to the Government of Peru (2008), there was a mean increase in temperature in the 20th century of 0.31 °C and climate models project that there will be a minimum increase in mean temperature of 2.6 °C in the next 50 years. Almost the entire agricultural sector is suffering from

Table 1 Permanent forest estate

Reporting year	Estimated total forest area, range (million ha)	Total closed natural forest ('000 ha)	PFE ('000 hectares)			
			Production		Protection	Total
			Natural	Planted		
2005*	65.2–86.4	64 204	24 600	200–300	16 300	41 150
2010	**67.9–72.0**	**55 990****	**18 700‡**	**820†**	**19 400**	**38 920**

* *As reported in ITTO (2006).*
** *Calculated using the ratio of forest with greater than 60% forest cover estimated by UNEP-WCMC (2010) (81%) and the total natural forest area as estimated by FAO (2010).*
‡ *Includes only state production forests for timber use.*
† *Comprises 580 000 hectares of production plantation, 240 000 hectares of plantations for protective purposes.*

Table 2 Forest condition

	PFE	Non-PFE	Total
	'000 ha		
Area of primary forest	30 300	10 400	40 700
Area of degraded primary forest	5600	7100	12 700
Area of secondary forest	1200	4500	5700
Area of degraded forest land	-	-	-

Source: Derived from Government of Peru (2010).

increasing water stress due to melting glaciers and changing precipitation patterns. The productivity of especially small-scale agricultural production systems is under threat, particularly in mountainous regions, jeopardizing the income of smallholder families**.**

Through a supreme decree, the Government of Peru recently established the National Commission for Climate Change (*Comisión Nacional de Cambio Climático*) led by the Ministry of Environment (*Ministerio del Ambiente* – MINAM) comprising representatives of government agencies, NGOs and the private sector. The 2003 Climate Change National Strategy is being updated. Forests and trees play an important role in Peru's climate-change adaptation strategy. However, adaptation and mitigation strategies remain separate, and forest activities are considered to deal with mitigation rather than adaptation.

SFM policy framework

Forest tenure. Table 3 shows Peru's forest area by tenure. Forest lands are classified as public forests, Indigenous forests or private forests. Communities own an estimated 12.6 million hectares of the country's forests (ITTO & RRI 2009), and nearly 1200 Indigenous communities possess land rights in the Peruvian Amazon. However, there is uncertainty over this ownership.[a]

Criteria and indicators. Peru has developed standards for forest management. It has adopted national C&I based on the Tarapoto Process, and concession management plans are based on these. The Government of Peru used the ITTO C&I in its submission to ITTO for this report.[a]

Forest policy and legislation. The revised national forest strategy prepared in 2002 was officially adopted by the Peruvian government in August 2004 (in *Decreto Supremo* 031-2004-AG) (ITTO 2006). It is implemented through the Forestry and Wildlife Law (*Ley Forestal y de Fauna Silvestre – Ley* 27308), which was adopted in 2000. The law prescribes several options for SFM and reforestation, including 40-year concessions for commercial timber, NTFPs, ecotourism and environmental services (Article 10); the sustainable management of forests belonging to Indigenous communities (Article 12); the sustainable management of local forests by local governments and rural populations (Decree 014/2001); and the establishment of 40-year reforestation concessions (Article 28) (ITTO 2006).

As a consequence of the ratification of the United States–Peru Trade Promotion Agreement, in 2007

Table 3 Forest area, by tenure

Ownership category	Total area*	Of which PFE	Notes
	'000 ha		
State ownership (national, state or provincial government)	54 500**	39 300	PFE: publicly administrated forests, including forest concessions for timber and Brazil nut, state reforestation and protected areas.[a]
Other public entities (e.g. municipalities, villages)		2900	Forests reserved for communities and Indigenous groups (ITTO & RRI 2009).
Owned by local communities and/or Indigenous groups	13 200	13 200	*Tierras de comunidades indígenas* (ITTO & RRI 2009).
Private owned by individuals, firms, other corporate	1950	1650	Industrial owners and smallholders combined.[a] (ITTO & RRI 2009 gave a figure of 5.2 million hectares.)

* *Note that the total is in the range given in Table 1.*

** *Includes 15.2 million hectares of forests that are not yet classified.*

the Government of Peru embarked on a process to reform the forest policy and law as well as to restructure and decentralize the system of forest administration and governance. This was done on a fast track through a series of supreme decrees, including the issuance of a new forest law. However, the outcome was highly controversial and led to a prolonged period of (at times violent) protest by civil society and Indigenous people. Ultimately it led to the rescinding of the forest law and other related decrees and to the formation of a national roundtable for dialogue and reconciliation.

The approval of transference of responsibilities from the National Institute of Natural Resources (*Instituto Nacional de Recursos Naturales* – INRENA, the former forest service) to regional governments for forest-sector administration and governance was enacted by Supreme Decree No 011-2007-AG. Decentralization focuses on four key faculties: administration; control; monitoring; and promotion. The process of decentralizing facilities to regional governments has been slow and problematic, and the transfer of funding and resources is proving to be a major obstacle.

Based on the extended reform dialogue since 2007, a process to completely review the forest law and forest policy was launched in 2009 through the creation of a multi-stakeholder platform to advance the reform process in a participative and transparent way. The proposed new law emphasizes issues relating to the governance of forest resources and SFM and particularly refers to participatory forest management and the need to apply the principle of free, prior and informed consent to the management and conservation of forest resources. The draft law proposes the creation of the National Forest and Wildlife Service (*Servicio Nacional Forestal y de Fauna Silvestre* – SERFOR) under the Ministry of Agriculture as the national forest authority. It further recognizes regional governments as the regional forest authorities following the prescriptions of Article 51 of the Organic Law on Regional Governments (*Ley Orgánica de Gobiernos Regionales*).

The National Forest Conservation Program for Climate-Change Mitigation (*Programa Nacional de Conservación de Bosques para la Mitigación del Cambio Climatico*) was launched in July 2010 and is considered to be the country's major forest development plan. The project Conserving Community Forests (*Conservando Bosques Comunitarios*) is the Program's first intervention, aiming to generate direct financial transfers to Indigenous communities that contribute to forest conservation.

Institutions involved in forests. Restructuring and decentralization processes are ongoing in the administration of forests in Peru and there have been rapid and sometimes chaotic changes (Kometter 2010). The first steps were taken in 2007 with the dismantling of INRENA and the redistribution of its forest administration and governance functions to the Ministry of Agriculture (*Ministerio de Agricultura* – MINAG), the newly created MINAM, and the Agency for the Supervision of Forest Resources and Wildlife (*Organismo Supervisor de Recursos Forestales y del Fauna Silvestre* – OSINFOR). OSINFOR was created in June 2008 under the Presidency of the Council of Ministers (*Presidencia del Concejo de Ministros*) and oversees forest-related taxation, the sustainable management of forest goods and services and forest conservation. Within MINAG, a new General Directorate of Forests and Wildlife (*Direccion General de Flora y Fauna Silvestre* – DGFFS) was created in 2008. However, for most of the period since its creation the DGFFS has operated with a very limited budget and few staff. In mid 2010, based on the proposals made in the draft forest law, SERFOR was made operational under MINAG, with particular functions in a new system of decentralized forest management under the regional authorities for forests and wildlife (Government of Peru 2010). The National Service for Protected Areas (*Servicio Nacional de Areas Naturales Protegidas* – SERNANP) under MINAM manages the National System of Public Protected Areas (*Sistema Nacional de Areas Naturales Protegidas por el Estado* – SINANPE). MINAM is also responsible for the development of REDD+ in Peru.

Indigenous peoples' associations have an increasing influence on the development of forest policies in Peru. The Inter-ethnic Association for Development of the Peruvian Jungle (*Asociación Interétnica de Desarrollo de la Selva Peruana*) and the National Institute for the Management of Andean, Amazonian and Afro-Peruvian Settlements (*Instituto Nacional de Desarrollo de Pueblos Andinos, Amazónicos y Afroperuanos*), which deals with the protection of the interests and cultural heritages of Indigenous peoples in Peru as well as territorial reform, are both strongly involved in forest issues.

Box 2 Active forest concessions by administrative region (December 2009)

Region	Number of concessions	Total area (ha)	Average area (ha)
Huánuco	48	284 342	5923
Loreto	250	2 644 756	10 579
Madre de Dios	85	1 267 111	14 907
San Martin	34	494 668	14 549
Ucayali	171	2 871 925	16 794
Total	**588**	**7 562 802**	**12 861**

Source: Based on Kometter (2010).

The National Strategic Planning Centre (*Centro Nacional de Planeamiento Estratégico*) also plays a role on questions relating to forest-tenure allocation and forest use.

National development institutions such as the Peruvian Amazon Research Institute (*Instituto de Investigación de la Amazonía Peruana*) continue to play important roles in the promotion of SFM at the local level. National and international NGOs are very active in Peruvian forestry and are influential in the development of policy. For example, WWF Peru, *Foro Ecológico*, Conservation International Peru, ProNaturaleza (*Fundación Peruana para la Conservación de la Naturaleza*) and *Red Ambiental* are important in driving forest conservation and the forest concession reform process. Various private-sector organizations are also involved, the most active being the National Forestry Chamber (*Cámara Forestal Nacional*), the National Timber Corporation (*Corporación Nacional de la Madera del Perú*) and regional forest producer associations, in particular those of Madre de Dios and Ucayali. The University Agraria La Molina has a strong forestry faculty that is actively involved in SFM research and serves in an advisory capacity to MINAG regarding CITES listings of timber species.

Status of forest management

Forest for production

Details on the allocation of forest concessions in Peru given in ITTO (2006) were still valid in 2010. As of the end of 2009, 588 forest concessions had been registered in the Huánuco, Loreto, Madre de Dios, San Martín and Ucayali regions of Peru over a total area of 7.56 million hectares (Kometter 2010; Box 2). Five hundred forest concessions had approved and valid contracts with government, 27 concession contracts were under review, contracts had been annulled in 29 concessions, and 32 contracts were in the process of annulment. Of all concessions (most of them established between 2002 and 2004), 85% had contracts at the beginning of 2010 (Kometter 2010).

The average area per concession is quite small – 12 900 hectares. Given their relatively small size, their financial viability will depend in large measure on their ability to obtain good prices. Many are in formerly selectively harvested areas such as the flood zone along Amazonian tributaries and constitute what in some areas will be the third intervention within the last 30–40 years (ITTO 2006). Since many primary species are no longer present in large volumes, the concessions are increasingly harvesting lesser-known species and intensifying their logging operations.

In addition to forest concessions, there are two other concession types that allow for the exploitation of timber: Brazil nut concessions and reforestation concessions. There are a total of 983 Brazil nut concessions, all located in Madre de Dios, covering an area of 864 000 hectares (Kometter 2010). As of the end of 2009, 293 reforestation concessions covering 135 000 hectares were registered in Peru, with most (245) located in Madre de Dios over an area of 112 000 hectares.

The forest law still in force (Law 27308, 2000) specifies forest audits every five years. The renewal or suspension of concession agreements depends absolutely on the results of such audits, which are based on the application of a set of C&I for SFM derived from ITTO and the Tarapoto Process (ITTO 2006). In addition, inspections are still being carried out in forest concessions as part of the country's CITES Appendix II mahogany observation strategy (Kometter 2010).

Silviculture and species selection. The regulations for concession agreements require the application of

detailed silvicultural prescriptions. Concessionaires must apply a polycyclic management system with a minimum rotation of 20 years.[a] A minimum diameter limit is determined for each species, and at least 10% of adult trees of each species must be retained in each harvest area as seed trees.[a] Liberation thinning, refinement and enrichment planting are specified to help regenerate forests after harvesting.

At least 100 species are used for timber, but about 25 meet 80% of the demand.[a] In the past, the most important timber species harvested in the Peruvian Amazon was *Swietenia macrophylla* (caoba). While still an important species, caoba is no longer in the top ten harvested species by volume. However, the falsification of information concerning the illegal cutting of caoba and other illegal practices have been reported: in 2008, for example, 32 concessions covering an area of more than 400 000 hectares were prosecuted for such offences.[a]

Peru and Bolivia are the largest exporters of caoba, while *Guazuma* spp (bolaina) and *Calycophyllum spruceanum* (capirona) are the most traded species in the domestic market. Other important species include *Virola* spp (cumala) *Amburana cearensis* (ishipingo), *Dipteryx micrantha* (shihuahuaco), *Hura crepitans* (catahua) and *Cariniana decandra* (cachimbo). Table 4 shows the five most commonly harvested species, ranked by average sawnwood production for the period 1991–2008. The most important fuelwood species are *Prosopis pallida* (algarrobo), *Eucalyptus globulus* (eucalipto), *Calycophyllum spruceanum* (capirona), *Acacia macracantha* (huarango) and *Polylepis* spp (queuña).[a]

Planted forest and trees outside the forest. Peru has the third-largest area of forest plantations in tropical America (820 000 hectares). Most plantations are located outside the Amazon in the Andes and the main species being planted are *Eucalyptus globulus*, *Polylepis* spp and *Alnus acuminata.* Many of these plantations are on poor soils and have had only limited success.[a] Reforestation was declared of national interest by Supreme Decree 003-2005-AG (2005); a national reforestation plan has been developed and is to be launched shortly.

In the Amazon, a considerable number of long-term reforestation and enrichment-planting trials of native species such as *Cedrelinga catenaeformis* (tornillo), *Simarouba amara* (marupa), *Parkia velutina* (pashaco) and others in the Peruvian Amazon (e.g. in Jenaro Herrera, Bosque Von Humbolt and Tingo Maria) have been established, with good results (ITTO 2006). However, these trials have not yet been expanded to an operational scale. Reforestation concessions have been created to promote planted forests in the Amazon using valuable species. Numerous such concessions have been registered but, to date, the associated regulations have not been put in place.

Forest certification. The Government of Peru promotes voluntary forest management certification as a tool for SFM.[a] Since 2004, a national working group on forest certification coordinated by WWF Peru has been working on the establishment of an FSC-accredited system for voluntary certification. According to Kometter (2010), a total area of 713 380 hectares was certified as of early 2010, including 15 forest concessions covering 458 600 hectares and 16 community forest areas.[a] Combined, three export-oriented forest enterprises (Aserradero Espinoza, Empresa Forestal Venao, and A&A Perú) have 256 100 hectares of certified forest. Twelve native communities have a group certificate over a total area of 150 700 hectares (ibid.). The certified area has increased more than tenfold since 2005.

Table 4 Commonly harvested species for industrial roundwood

Species	Notes*
Eucalyptus globulus (eucalipto)	258 000 m^3; from planted forests in Andean valleys.
Virola spp (cumala)**	218 000 m^3; from low-lying and low hill Amazon forests.
Cedrelinga catenaeformis (tornillo)**	173 300 m^3; from low hill Amazon forests.
Chorisia intregrifolia (lupuna)	147 100 m^3; from terrace and low hill Amazon forests.
Cedrela odorata (cedro)**	127 000 m^3; from inundated and low hill Amazon forests.

* *Volumes are average sawnwood production for the period 1991–2008.*

** *Also listed in ITTO (2006).*

Source: Kometter (2010).

Estimate of the area of forest sustainably managed for production. Since 2005, regulated concession management in the Peruvian Amazon has been launched. All active concessions must have a forest management plan and are closely monitored. Nevertheless, it is too early to assess the effect of this new system on SFM. Table 5 shows the estimated sustainably managed production forest in Peru comprising the FSC-certified forest area and the 890 000 hectares under Brazil nut concession (Kometter 2010).

Timber production and trade. There has been a steady increase in log production in Peru in recent years, from 1.29 million m^3 in 2003 to 2.37 million m^3 in 2009 (ITTO 2010). Sawnwood production in 2009 was 1.12 million m^3, more than double that in 2003. The export of logs is not permitted but about 40% (480 000 m^3) of sawnwood production is exported (ibid.). The maximum sustainable harvest under a 40-year polycyclic system is estimated to be in the range 25–40 m^3 per hectare (ITTO 2006); current off-take would appear to be well below that. There are about 250 sawmills in Peru, most of which have a small installed capacity (averaging 2900 m^3 per year). Only about 25% of sawmills have band-saws and a capacity of 10 000 m^3 per year or more (ibid.). The export value of timber products increased from US$66 million in 2000 to US$191 million in 2008 (WWF Peru 2009).

Non-timber forest products. The use of NTFPs is widespread in Peru. Over 130 products have been identified in the Amazon for local consumption and national and international trade. Tara (obtained from *Caesalpinia spinosa*) is the basis of a growing industry in Peru. It is an excellent source of environmentally friendly tannins (tara tannins). It is used as a hydrocolloid thickener and gelling agent and has application in frozen desserts, instant soups, cream cheese, baked goods and other products.

Logs at the Port of Pucallpa, Peru.

Brazil nut is another important NTFP produced for export in Amazon forests, with an annual production of more than 1 million kg. Extracts of *Lonchocarpus nicou* (barbasco) are exported as a vegetative insecticide.

The production of palm hearts (palmito, 200 000 kg per year) is also important. Medicinal plants, such as cat's claw (*Uncaria tomentosa* – uña de gato, 500 000 kg per year), and sangre de grado (*Croton lechleri*), are increasingly popular.[a]

Forest carbon. Gibbs et al. (2007) estimated the forest biomass carbon stock in the range 7690–11 520 MtC and FAO (2010a) estimated it at 8560 MtC. Land use, land-use change and forestry contribute about 60% (110 000 gigagrams of CO_2e) of Peru's annual GHG emissions.

MINAM is responsible for REDD+ and coordinates the National Commission on Climate Change. A multi-stakeholder REDD Group (*Mesa REDD*) was formed in 2008 to support MINAM in the further development of REDD+ in Peru (Government of Peru 2010).

Table 5 Management of the production PFE ('000 hectares)

Reporting year	Natural					Planted		
	Total	Available for harvesting	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
2005*	24 600	8000	5000	59	560	200–300	8	0
2010	**18 700****	**8431**	**7563‡**	**713**	**1603**	**820**	**-**	**0**

* *As reported in ITTO (2006).*

** *Potential timber concession areas as classified by law (Government of Peru 2010).*

‡ *Only timber concessions (*unidades de manejo forestal *and community concessions) valid as of end 2009 counted here.*

Peru is a participant in the Forest Carbon Partnership Facility, and its REDD readiness preparation proposal was approved in March 2011. Peru is a recipient country of the Forest Investment Program, and it benefits from bilateral support programs in REDD+ in the Amazon region. Several REDD+ pilot projects are under way in the country's forested regions. The proportion of intact forests with crown cover greater than 60% is high (81% of the total forest area). There is also considerable potential to enhance carbon stocks through forest restoration and reforestation in deforested landscapes. Table 6 summarizes Peru's forest carbon potential.

Forest for protection

Soil and water. Soil and watershed conservation are of considerable importance in Peru, particularly in the Andes. The National Program for the Management of Water Catchments and Soil Conservation (*Programa Nacional de Manejo de Cuencas Hídrograficas y de Conservación de Suelos*), which is implemented by *Agrorural*, is conducting the country's most extensive forestry program with the aim of applying participatory approaches to soil and water conservation based on reforestation. In 2008, a legislative decree (Decree 1081) was enacted to create the National System for Water Resources (*Sistema Nacional de Recursos Hídricos*), which emphasizes the protection and restoration of watersheds. A total of 389 000 hectares of forest is classified as exclusively for soil and water protection. In addition, in 2007 an area of about 367 000 hectares was reforested for the single purpose of protecting destabilized watersheds.[a]

Biological diversity. Peru has a great range of geographical conditions and is very biodiverse. It contains 10% of the global total of flowering plant species (40 000–50 000 plant species), 462 mammals, 1816 birds, 360 reptiles, 332 amphibians, 2000 sea fish and 797 freshwater fish (ITTO 2006). Thirty-seven mammals, 61 birds, 77 amphibians, two reptiles and seven plants found in forests are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species (IUCN 2011). Eight plants are listed in CITES Appendix I, 363, including caoba, are listed in Appendix II, and three (including cedro) are listed in Appendix III (UNEP-WCMC 2011).

Protective measures in production forests. Management-plan prescriptions for forest concessions give clear and detailed instructions on leaving protection strips along streams, and they specify species to be protected and refer to wildlife protection in concession areas. There are also prescriptions for reduced impact logging and related measures.[a] Tree species that are officially excluded from commercial harvesting are palo de ora, romerillo, cedro de altura and nogal.[a]

Extent of protected areas. In 2001, new natural protected areas were defined and existing protected areas were reclassified. The well-developed and relatively well-funded system of protected areas, SINANPE, now contains 61 protected areas covering an area of 18.5 million hectares, or 15% of the country. Protected areas include national parks, national reserves, national sanctuaries and other zones (Box 3). SINANPE is complemented by regional conservation areas (*areas de conservación regionales* – ACRs). Recently there has been a move to encourage the creation of ACRs by regional governments: Presidential Resolution 205-2010-SERNANP (dated 26 October 2010) is designed to stimulate the creation of ACRs through regional governments that are also financing such areas. Three ACRs have been created: Choquequirao, Bosque de Puya Raimondi-Titankayocc and Ampiyacu–Apayacu.

A large part of the protected-area network is heavily forested. An estimated 13.7 million hectares of forested land are classified under IUCN protected area categories I–IV.[a] Many protected areas are

Table 6 Forest carbon potential

Biomass forest carbon (MtC)	% forest with canopy cover >60%	Deforestation/ degradation potential to 2030	Enhancement of carbon sink capacity to 2030	Forest area change monitoring capacity	Forest/ GHG inventory capacity	Importance of forest fire/ biomass burning	Engagement in international REDD+ processes
7690–11 520	81	+++	++	++	+	++	+++

+++ high; ++ medium; + low; estimate of national forest carbon based on Gibbs et al. (2007); estimate of % total forest with canopy cover >60% based on UNEP-WCMC (2010).

Box 3 Categories of protected areas

Category	Number	Area (ha)
National parks	12	7 967 119
National reserves	13	3 719 347
National sanctuaries	9	317 366
Historical sanctuaries	4	41 279
Landscape reserves	2	711 818
Protection forests	6	389 987
Communal reserves	8	1 777 466
Reserved zones	9	3 396 364
Hunting reserves	2	124 735
Wildlife refuges	2	8 591
Small islands		140 833
Total SINANPE	67	18 594 909
Regional conservation areas	5	695 227
Private conservation areas	20	124 991
TOTAL	**92**	**19 415 127**

Source: Kometter (2010).

under pressure, however, including from conversion to other land uses (particularly shifting cultivation but also monoculture agriculture and illegal crops such as coca), small-scale and large-scale timber theft, illegal mining, oil and gas exploration, and illegal hunting and fishing.

In 2001 INRENA granted an area of 135 832 hectares as a 'conservation concession' for a period of 40 years to a private association (the Amazon Watershed Conservation Association – *Asociación para la Conservación de la Cuenca Amazónica*). In 2010 a total of 423 000 hectares were under such concessions and another 55 000 hectares were under ecotourism concessions. These areas are not counted as part of the protected-area network. In such concessions, protection activities, ecotourism and the sustainable use of NTFPs may be carried out, but not logging. It is expected that more concessions will be granted in the future for NTFPs and conservation.

Estimate of the area of forest sustainably managed for protection. Large areas of the protection PFE are under no imminent threat due to their remoteness but are not counted here as under SFM. A total area of about 11.6 million hectares of protected area is clearly defined and is covered by some sort of management planning.[a] The area of protection PFE managed sustainably is estimated at 1.88 million hectares (Table 7). This includes the core water protection forests of about 60 000 hectares and the totally protected portion of the Peruvian part of the transboundary protected areas of Tambopata (1.09 million hectares) and El Condor (253 000 hectares), both of which have been supported by ITTO and other international donors, plus the areas under conservation and ecotourism concessions.

Socioeconomic aspects

Economic aspects. The contribution of the forest sector to GDP is about 1.02% of a total GDP of US$1.03 trillion.[a] An estimated 250 000 jobs are generated directly by forestry activities, over 50% of them in the Peruvian Amazon (ITTO 2006). The forest industry, including many small and medium-sized enterprises, are mostly located in Lima, Trujillo, Chiclayo, Cuzco, Iquitos, Pucallpa and Tarapoto and employ more than 82 000 people (ibid.). The contribution of forestry, however, is not only made through direct employment but also through the provision of a wide range of goods for consumption, handicrafts and small commerce. Fuelwood collection is still the main extractive use of the country's forests, in particular in forest-poor mountain areas. Small-scale logging is important both economically and socially in the Amazon, and nearly all forest areas close to the main rivers have been heavily harvested.

Livelihood values. Many NTFPs are used and traded locally, such as fruits and vegetables like aguaje (*Mauritia flexuosa*), camu-camu and palmito, local bamboo (*Guadua angustifolia*), palms and

Table 7 Management of the protection PFE ('000 hectares)

Reporting year	Protection PFE	Forests attributed to IUCN categories I–IV	Allocated for soil and water	With management plans	Sustainably managed
2005*	16 300	3130	390	-	1540
2010	**19 400**	**3404****	**389**	**11 600**	**1880**

* *As reported in ITTO (2006).*

** *According to UNEP-WCMC (2010).*

fibres. Wildlife, particularly fish, is an important source of protein throughout the Amazon.

Social relations. The Peruvian Amazon remains a frontier for settlers from other parts of Peru, many of whom engage in small-scale agriculture and the gathering of forest products, often illegally. Poaching, the illegal harvesting of valuable timber species and illegal mining are all widespread.[a] Narcotic crops, particularly coca, are planted by shifting cultivators in fields and small openings in the forests. The social impacts of the new concession system are unknown. Logging by outsiders of Indigenous and community lands can cause intra-community conflicts, including over the distribution of payments.

More than 1354 Indigenous communities (*comunidades nativas*) are known to make their living in the Peruvian Amazon, occupying about 14.95 million hectares or 17% of the total area of the Peruvian Amazon. Their livelihoods are closely interlinked with forests. An estimated 13.5 million hectares of potentially productive forests are in areas claimed by Indigenous peoples and about 1.75 million hectares are situated within Indigenous reserves. About 100 timber licences are located in the immediate vicinity of Indigenous territories (G. de Freitas, pers. comm., 2009). While new forms of collaboration and benefit-sharing are being established between concession-holders and local people, the new situation is also prone to misunderstanding and conflict. Although REDD+ is developing rapidly in Peru, many local and Indigenous people see it as a threat. Considerable efforts are needed to clarify REDD+ and related forest issues with local stakeholders.

Summary

The forest sector of Peru has been undergoing rapid change. After signing the Trade Promotion Agreement with the United States in 2007, the Government of Peru embarked on a new process to reform the forest policy and law as well as to restructure and decentralize the system of forest administration and governance. This was done on a fast track through a series of supreme decrees, including the issuance of a new forest law, decentralization efforts and new central institutions. However, the outcome was highly controversial and led to a prolonged period of protest by civil society and Indigenous peoples. Nevertheless, Peru has taken significant steps towards integrating the forest sector into the broader macroeconomic objectives of sustainable development and has put in place a system of control that allows further progress in SFM. An independent forest-control mechanism has been established and a broad coalition of stakeholders from the public and private sectors and civil society works together to develop the forest agenda. The Government of Peru is engaged in the development of REDD+ with a nested approach and in a broad stakeholder dialogue to develop REDD+ as a major instrument for forest-based development in the Amazon. Peru still faces some major challenges in enforcing and applying regulations and planning instruments in the country's vast Amazon forests and in guaranteeing the rights of Indigenous and local people.

Key points

- Peru has an estimated PFE of 38.9 million hectares (compared with 41.1 million hectares in 2005), comprising 18.7 million hectares of natural production forest (compared with 24.6 million hectares in 2005), 19.4 million hectares of protection forest (compared with 16.3 million hectares in 2005) and 820 000 hectares of planted forest (compared with 200–300 000 hectares in 2005).
- An estimated 1.60 million hectares of the production PFE is under SFM. About 713 000 hectares of natural production forest is certified (compared with 59 000 hectares in 2005). An estimated 1.88 million hectares of protection PFE is under SFM. Large areas of the protection PFE, even if not formally under SFM, are under no imminent threat due to their remoteness.
- The rate of deforestation has declined. The country has an ambitious plan to reduce deforestation to zero by 2020 and has put in place programs (e.g. the National Forest Conservation Program) for this purpose.
- A broad consultation process on the preparation of a new forest law and policy is under way and new institutions have been created to manage forests on the principles of SFM.
- Despite the difficult macro-economic situation for the timber trade, Peru has increased its exports of hardwood timber and further developed its domestic timber industry.

Nevertheless, most exports are in the form of sawnwood and there has been only limited development of further-processing in Peru.

- There is considerable potential for REDD+ in Peru. However, many local and Indigenous people see it as a threat, and considerable efforts are needed to clarify REDD+ and related forest issues with local stakeholders.

Endnote

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SURINAME

Forest resources

In 2010 the estimated population of Suriname was 524 000 people (United Nations Population Division 2010), and the country is ranked 97th out of 182 countries in UNDP's Human Development Index (UNDP 2009). A lowland region and the southern highlands account for 80% of the country and form part of the pre-Cambrian Guyana Shield that straddles Suriname, Guyana and French Guiana. Along the northern edge of the shield lies a savanna belt, beyond which is a narrow swampy coastal plain where 90% of the population is concentrated. The estimated forest area is 14.8 million hectares (FAO 2010, Government of Suriname 2009a), which is 91% of the total land area (16.3 million hectares).

Forest types. Three broad forest zones can be distinguished, corresponding to the three major biogeographical zones: the hydrophytic forests in the north, which comprise swamp forests, mangroves and ridge and marsh forests; xerophytic savanna forests in the savanna belt; and the predominant mesophytic humid forest types of the Guyana Shield. These, in turn, comprise the following forest types[a]:

- high dryland forest (rainforest) – 13.3 million hectares
- high savanna forest or dry evergreen forest – 132 000 hectares
- low savanna forest – 18 000 hectares
- high swamp forest – 483 000 hectares
- low swamp forest – 239 000 hectares
- mangrove forest – 100 000 hectares
- marsh forest – 468 000 hectares
- ridge forest – 35 000 hectares.

The Government of Suriname (2009a) estimated the total area of mangroves at 115 000 hectares, but FAO (2010) put the area at 100 000 hectares and Spalding et al. (2010) at about 50 900 hectares.

Permanent forest estate. There is no formally established PFE in Suriname. Nevertheless, all formally established nature reserves and other protected and conservation areas have been established by explicit legal documents that provide strict guidelines for protection and use, thus providing a reasonable guarantee that those protected areas will be maintained as such. Since the establishment of the first protected areas in the 1950s, no protected area has been revoked. Recently, a procedure has been introduced to use a compatible GIS–GPS system to determine the exact location of boundaries and whether any given point on the ground is inside or outside the nature reserve or other protected area.

Concession areas are also allocated on the basis of explicit legal documents that provide information on boundaries as well as guidelines for their management and use. In practice, however, there are few guarantees that these areas will remain in the category of production forest. In the past, some concessions have been converted to protection areas or assigned to other economic uses (such as mining or large-scale agriculture). This was the case, for example, for the community forest in the Brokopondo district, which was allocated to Cambior (now Iamgold) for gold-mining, and some concessions in the district of Marowijne, which have been allocated to China Zhong Heng Tai Investment (Suriname) NV for large-scale oil-palm plantations. The vast majority of forests in Suriname is legally classified "as forests to be provisionally maintained"; forests thus classified will be maintained as forest until such time that they are legally designated to a specific use.

In Table 1, PFE has been taken to include all formally established protected forest areas and all forest concessions and formally designated community forests, but forests "to be maintained provisionally" have been excluded. Also excluded are forested lands of the state that are leased to private individuals for conversion (mainly to agriculture), as well as privately owned forested land that is currently used for timber production but could be converted to non-forest at any time at the discretion of the owners.

Thus, 5.32 million hectares of forest may be considered to be designated as production forest in the PFE, while 2.19 million hectares have been designated for protection and conservation.

Since the PFE has restricted formal status, its demarcation on the ground is minimal. Concessionaires are supposed to demarcate their concession boundaries but, in practice, this is generally confined to the cutting and maintenance of outer boundaries of the cutting compartment under harvest.

Forest ecosystem health

Deforestation and forest degradation. Suriname does not face the population and migration pressures that have led to deforestation in many other countries. According to FAO (2010), Suriname lost 18 000 hectares of forest between 1990 and 2010 (0.1%). The estimated forest loss since 1650 is 400 000 hectares[a], or less than 3% of the extant forest estate. Until about 1980, mining on forested land was mainly for bauxite, which was exported. In the 1980s, however, gold-mining emerged as an activity of growing importance, both economically and environmentally. The total area of forest destroyed due to gold-mining is about 90 000 hectares[a], including 30 000 hectares in the last decade (Fox 2010). An estimated 14 000 small-scale miners and service providers work in Suriname's interior (ibid.). There is no significant occurrence of forest fire from natural causes.

At least 13 million hectares of Suriname's forest estate is primary forest[a]; Table 2 presents an estimate of 13.8 million hectares, which is slightly less than the estimate shown in FAO (2010). Of the 4.5 million hectares of forest designated for timber production, an estimated 744 000 hectares have been logged selectively over time and more intensively, though still selectively, in the last five decades. This forest is considered 'selectively logged primary forest'. The low intensity of harvesting over relatively long felling cycles has helped to maintain these forests in relatively good shape. About 250 000 hectares of forest are used for shifting agriculture and could be considered degraded; the extent of this area is not increasing.[a] There is also

Table 1 Permanent forest estate

Reporting year	Estimated total forest area, range (million ha)	Total closed natural forest ('000 ha)	PFE ('000 hectares)			
			Production		Protection	Total
			Natural	Planted		
2005*	13.6–14.8	14 100	6890	7	4430	11 327
2010	**14.8**	**14 100****	**5319‡**	**13†**	**2194**	**7513**

* *As reported in ITTO (2006).*

** *Calculated using the ratio of forest with greater than 60% forest cover estimated by UNEP-WCMC (2010) (95.5%) and the estimated total natural forest area.*

‡ *Includes inactive concessions (either not issued or revoked or lapsed), active concessions, and community forests.*

† *Government of Suriname (2009a). The status of this planted forest in the PFE is unclear and is not included in the total.*

Table 2 Forest condition

	PFE	Non-PFE	Total
	'000 ha		
Area of primary forest	6769	7037	13 806
Area of selectively logged primary forest	744	0	744
Area of degraded primary forest	0	250	250
Area of secondary forest	0	0	0
Area of degraded forest land	0	90	90

Source: ITTO estimate based on Government of Suriname (2009a) and FAO (2010).

degraded forest in the vicinity of mining operations, although the extent of this is unquantified.

Vulnerability of forests to climate change. The mean annual temperature in Suriname is projected to increase by 0.9–3.3 °C by 2060 (McSweeney et al. undated). Increased rainfall variability and changes in the geomorphology of the coast and in water resources are also projected (Government of Suriname 2002). Suriname's low-lying coastal zone is vulnerable to seal-level rise. This is Suriname's most fertile land, where most economic activities are practised and where the population is mostly concentrated (ibid.). Inland forests are vulnerable to increased drought and forest fire in extreme el Niño years.

SFM policy framework

Forest tenure. According to the 1987 Constitution, all forests, except those on privately owned land, belong to the state. Accordingly, Table 3 shows that almost all of Suriname's forest estate is publicly owned, although more than 1 million hectares have been allocated as private concessions (see below).

The Constitution does not provide for collective rights or the collective use of land, but Amerindian and Maroon people (the latter being descendants of slaves of African origin) claim these rights.

Criteria and indicators. The Forest Management Act (1992) provides criteria for the sustainable use of forest resources. The Government of Suriname used the ITTO C&I in its submission to ITTO for this report.[a]

Forest policy and legislation. The Forest Management Act (1992) covers the sustainable and rational use of forest resources, taking into account the interests of forest-dwellers and the conservation of nature and biological diversity. It provides rules governing timber production (and, to some extent, timber processing) and export. It covers the various licences for forest harvesting, including different types of timber concession and the use of community forests.

A national forest policy was adopted in 2003 after an extensive process of consultation with stakeholders. This policy provides broad guidelines for the use of forests for production, protection and conservation. According to the policy, the main goal of forest management is "enhancing the contribution of the forests to the national economy and the welfare of the current and future generations, taking into account the preservation of the biodiversity". It contains economic, sociocultural and environmental goals of equal weight. The Interim Strategic Action Plan for the Forest Sector was published in 2008.

An environmental law was drafted in 2001 and a revised version is under review by the Ministry of Labour, Technological Development and Environment. If enacted, this law will have important procedural consequences for the issuance of timber licences and the installation of timber-processing units. In the absence of agreed national C&I, the environmental impact assessments described in the draft law will be essential for monitoring progress towards SFM.

Table 3 Forest area, by tenure

Ownership category	Total area	Of which PFE	Notes
	'000 ha		
State ownership (national, state or provincial government)	14 752	7513	PFE includes nature reserves and other protected areas, MUMAs, community forests, inactive concessions, and active concessions held by firms, associations, individuals or families. Non-PFE includes 'forests to be provisionally maintained', and forest for which leases have been issued for clearing and development.
Other public entities, including municipalities, villages, etc.*	0	0	With its centralized government structure, Suriname's regional governments at the district and local levels do not own (forest) land.
Total public	**14 752**	**7513**	
Owned by local communities and/or Indigenous groups	0	0	
Private owned by individuals, firms, other corporate	24	0	

Source: Government of Suriname (2009a).

Institutions involved in forests. The government institutions responsible for the management and protection of Suriname's forest resources are the Ministry of Physical Planning, Land and Forestry Management, the semi-autonomous Foundation for Forest Management and Forest Control (*Stichting voor Bosbeheer en Bostoezicht* – SBB), and NB (the Nature Conservation Division of the old Suriname Forest Service – *Lachtwet en BosBeheer*, LBB). SBB is responsible for the enforcement of the Forest Management Act (1992) and, consequently, for the management of production forests. NB is responsible for the enforcement of the Nature Conservation Act (1954) and the Game Act (1954) and, consequently, for the management of nature reserves and other protected areas. There has been an ongoing process to establish a single authority for the management of production and protection forests, the Forest and Nature Management Authority (Bosnas), but this is still pending.

Suriname has one university (Anton de Kom University of Suriname) with a modest school for forestry, one for biology and another for the environment. Most currently active forestry professionals in Suriname, however, received their education abroad. The Institute for Natural Resources and Engineering Studies is a well-established training institute for forestry technicians, one level below the Bachelor of Science. The Interim Strategic Action Plan for the Forest Sector includes an ambitious training component in line with the recommendations made on the training needs of the forest sector in the context of ITTO pre-project proposal PPD 97/04(I). The Jan Starke Vocational Training and Recreation Center provides forest-related vocational courses, although it is in decline.

Status of forest management

Forest for production

There are several systems for timber harvesting, including concessions, community forests and incidental cutting licences (ICLs). The procedures for granting concessions and licences were not transparent in the past.

Although for a decade or longer prior to the establishment of SBB, ICLs had become a popular way to evade the relative rigid requirements for concessions, in the last decade this practice has been redressed almost completely. ICLs are now restricted to salvage logging areas and conversion forests.

In early 2010, a total area of 1.22 million hectares[1] were under 68 active concessions, comprising 34 licences for areas smaller than 5000 hectares in size (116 000 hectares in total), ten licences for areas 5000–10 000 hectares in size (69 000 hectares in total), three licences for areas 10 000–15 000 hectares in size (32 300 hectares in total), five licences for areas 15 000–25 000 hectares in size (83 700 hectares in total), twelve licences for areas 25 000–50 000 hectares in size (411 000 hectares in total), and four licences for areas 100 000–150 000 hectares in size (507 000 hectares in total). In addition, community cutting licences have been issued for 437 000 hectares, and 114 000 hectares have been designated as community forests for Indigenous or Maroon communities. Six ICLs have been issued for a total of 54 800 hectares, and one ICL for Submerged Wood has been issued for 116 000 hectares. In total, cutting licences of all forms have been issued for about 2 million hectares of forest.[b]

Effective forest management and forest production control were virtually non-existent when SBB was established in 1998 with a mandate to establish a leaner and more cost-effective forest management organization than the Forest Service it replaced. SBB subsequently developed a comprehensive computerized log-tracking system, LogPro, to monitor harvesting operations, the payment of forest fees and forest planning at the FMU level. Although this system is still under development it has already proved useful in promoting SFM. GIS technology was introduced in the forest sector with the support of the WWF Guianas program for the mapping and planning of forest operations on the ground. Initially this was done for SBB's own operations, but the system has been extended gradually to logging companies and other private operators in the forest to facilitate the mutual exchange of planning and other information related to ground-level activities. Training courses in the use of GIS were conducted for representatives of the private sector, including consultants, who are being hired increasingly by logging companies to prepare

1 In October 2010 this had reportedly increased to 1.3 million hectares in 62 concessions, comprising 18 intensively managed concessions covering 605 000 hectares, 16 extensively managed concessions covering 55 000 hectares, and 28 "idle concession or preparatory harvesting activities" covering 640 000 hectares.[b]

the planning of their operations to the (higher) standards that now prevail.

The management and control style adopted by SBB can be categorized as either *intensive forest management* (for large concessions) or *extensive forest management* (for small concessions).

Operators with a relatively large production capacity, including operators that produce mainly for export, were deemed capable of causing extensive damage to a large area of forest in a relatively short time. A high priority was therefore placed on ensuring their adherence to stringent regulations. Application for concessions larger than 5000 hectares must include a business plan (including a financial feasibility plan for wood-processing and logging activities, and a forest management plan) that sets out the intended approach of the applicant to the development of the concession, if granted. After the granting of the concession and before any actual harvesting, a more detailed overall management plan must be submitted to SBB indicating the division of annual cutting areas and the infrastructure to be built. In addition, specific planning is required for each annual cutting area for that year, including 100% inventories and the detailed layout of skidding roads, taking into account the maximum allowable cut as suggested by the Celos Management System (normally 20–25 m^3/hectare) and the selection and marking of the trees to be felled (in the field as well as on tree maps to be included in the planning documents for submission to SBB for approval). Since the requirements for 100% inventories in cutting blocks were introduced, about 17 500 hectares (175 blocks of 100 hectares each) have been surveyed in this way.

Restricting harvesting to inventoried 100-hectare cutting blocks allows the close monitoring of the actual cut in relation to inventoried stock. According to observations of 87 cutting blocks exploited between 2006 and 2009, the average harvest in intensively managed concessions was 12.3 m^3 per hectare.[a] The average annual harvest area for concessions and community forests in the PFE is about 13 500 hectares.

The approved harvest plan forms the basis of production control by SBB. The trees actually cut are labelled with a polyethylene label with a unique number that is issued by SBB from LogPro, its computerized log-tracking system. These label numbers, together with the tree number as assigned in the 100% tally and indicated on the tree map included in the approved harvest plan, must be entered in a felling register, as prescribed by law. The label numbers are thus linked to the tree numbers of the inventory. When the logs are prepared for transport from the production site their label numbers are entered in a way bill. If the original log is cross-cut prior to transport from the production site, the resulting smaller logs are numbered with new labels linked to the number of the original log (and therefore automatically to the tree number assigned in the 100% tally). A copy of the felling register must be presented to the forest guard covering the particular production area, who forwards it to SBB headquarters, where it is entered into LogPro. Systematic inspections of sawmills and other processing facilities are also conducted to ensure that any timber not seen during earlier inspections is detected, registered, and entered into LogPro.

Despite the establishment of these elaborate planning and administrative procedures, for a variety of reasons only a relatively small area and only a few operators are presently under such 'intensive' management.

Extensive forest management is confined to smaller operators, including those active in community forests. Such operators must maintain the boundaries of their concessions and of the annual cutting areas in which they are active (just as in intensive management). Systematic 100% inventories are not required, but the felled timber must be registered in a felling register, as required for intensive management operations. Extensive forest management is applied in concessions where the impact of harvesting on the economy and the environment is relatively low. The ultimate goal is that all concessions are managed according to the procedures of intensive management. All granted licences, whether for intensively managed or extensively managed concessions, are monitored by SBB.[b] An estimated 10–20% of (commercial) production is not registered (FAO 2010).

Although there is growing interest among private forest-owners to produce timber on a sustainable basis, for which they seek assistance from the growing number of consultants available for this kind of supporting service, the practice is not well established and cannot be enforced by SBB given

Forest river scene near Botopasie, Suriname. © *istockphoto/B. Coenders*

its current capacity.[a] It should be noted that timber production in conversion forests is, by definition, unsustainable.

Under SBB, significant progress has been made towards SFM in Suriname's forests, but for a variety of reasons the impact is currently sub-optimal.[a] A major constraint is the relatively low educational level of the forestry workforce, although, to some extent, this problem has been reduced by the development of a group of reasonably competent forestry professionals acting as consultants to assist in the planning of operations by both smaller and larger operators. Another major constraint for the industry is a lack of capital, which hampers the acquisition of equipment that would, for example, enable the effective application of reduced impact logging techniques. An even bigger constraint is of an institutional nature: the formal establishment of the Bosnas has been delayed for more than four years, with a consequent impact on the availability of the resources needed for adequate coverage of the entire production forest area.[a]

Silviculture and species selection. The forests are characterized by a wide variety of species – more than 600 tree species have been described. Some 50 species are known as class A commercial species and about 100 as class B. There has been a significant shift in the last three decades in the species harvested for industrial roundwood. An important reason for this shift pertains to the restricted access to the production forests in more remote parts of the interior during the country's civil war (1986–1993), which led to the use of species previously considered useless or of low value. Many such species proved highly suitable for some very demanding applications in construction and furniture manufacturing.

About 375 000 hectares of the PFE have been inventoried for their standing timber stocks. Table 4 lists some of the most commonly harvested species.

Planted forest and trees outside the forest. In ITTO (2006) the area of forest plantations, and the area of plantations under management plans, were both reported at 7000 hectares. In this report, the estimated planted-forest area has been adjusted to 13 000 hectares on the basis of Suriname's submission[a], but the area under management plans is probably zero (Table 5). The predominant

Table 4 Commonly harvested species for industrial roundwood

Species	Annual harvest quantity (m^3)		Notes
	PFE	Non-PFE	
Qualea spp*	27 175	6507	Harvested predominantly from high dryland forest.
*Dicorynia guianensis**	22 114	8136	
*Goupia glabra**	11 019	3851	
Vochysia tomentosa	4621	5502	
Vatairea guianensis	6644	1674	

* *Also listed in ITTO (2006). In the case of Qualea, Q. rosea was specified in ITTO (2006).*
Note: *Data are averages for 2004–2008.*
Source: *Government of Suriname (2009a).*

Table 5 Management of the production PFE ('000 hectares)

Reporting year	Natural					Planted		
	Total	Available for harvesting	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
2005*	6890	1740	73	0	0	7	7	0
2010	**5319**	**2000**	**899**	**89**	**247**	**13**	**-**	**0**

* *As reported in ITTO (2006).*

planted species for industrial purposes is *Pinus caribaea*, comprising about 58% of the plantation estate. The principal indigenous species are *Cedrela* spp, *Cordia alliodora* and *Simaruba amara*; the main broadleaved exotic species are eucalypts. There is little information about standing volume, growth rates or current condition. No expansion of the plantation estate, or replanting of harvested sites, is planned.

Forest certification. The FSC has certified one forest area operated by Timberindustry Suriname NV, with a total production area of 23 858 hectares (FSC 2010).

Estimate of the area of forest sustainably managed for production. Of the 1.30 million hectares in the PFE under concessions (plus another 170 000 hectares under ICLs), 899 000 hectares are covered by, in total, 21 management plans.[a] Two concessions (one of which is FSC-certified), covering a total of about 89 000 hectares, are under harvest using reduced impact logging to a high standard. A further 158 000 hectares of concessions are being harvested using 'controlled' logging (i.e. natural directional felling, and planned skidding), and 655 000 hectares are being harvested using sometimes poor techniques.[a] Given the low volume of timber extracted per hectare, the first two of these harvesting categories (a total of 247 000 hectares) may be considered to be under SFM. Apart from some areas where gold-mining is occurring, the remainder of the production PFE is likely to be under little threat of deforestation or degradation.

Timber production and trade. The annual production of industrial roundwood in 2009 was estimated at 190 000 m^3, up from about 94 000 m^3 in 1999 and 159 000 m^3 in 2004. Sawnwood production increased from 28 000 m^3 per year in 1999 to 65 000 m^3 per year in 2009, plywood production decreased from 4000 m^3 in 1999 to 1000 m^3 in 2009, and veneer production increased from zero in 1999 to 3000 m^3 in 2009 (ITTO 2011). Installed national sawmilling capacity is estimated at 280 000 m^3 per year. In total, more than 160 species are harvested.[a] In 2009, Suriname exported logs valued at US$2.70 million and sawnwood valued at US$2.80 million (ITTO 2011).

Non-timber forest products. NTFPs are used to varying degrees by different groups, predominantly people living in the country's interior. Apart from incidental small-scale efforts, no significant inventory of NTFPs has been conducted to date. There is a significant export trade of Surinamese wildlife: FAO (2010) reported that wildlife exports (mainly birds) were worth about US$404 000 in 2007 (a reduction of more than US$500 000 compared to 2004, due largely to a ban on bird

Table 6 Forest carbon potential

Biomass forest carbon (MtC)	% forest with canopy cover >60%	Deforestation/ degradation potential to 2030	Enhancement of carbon sink capacity to 2030	Forest area change monitoring capacity	Forest/ GHG inventory capacity	Importance of forest fire/ biomass burning	Engagement in international REDD+ processes
663–2753	96	+	+	++	++	+	++

+++ high; ++ medium; + low; estimate of national forest carbon based on Gibbs et al. (2007); estimate of % total forest with canopy cover >60% based on UNEP-WCMC (2010).

imports in the European Union during an outbreak of Avian flu). In 2006 an estimated 55 000 kg of medicinal plants valued at US$453 000 were exported to the Netherlands.

Forest carbon. Suriname has a large and mostly intact forest resource. The REDD+ mechanism is designed to assist countries like Suriname by providing positive incentives for conserving forests and improving forest management. Taking into account Suriname's developmental needs, REDD+ could assist in mitigating some of the drivers of deforestation and forest degradation.

Gibbs et al. (2007) estimated Suriname's forest biomass carbon stock at 663–2753 MtC, and FAO (2010) estimated it at 3165 MtC. Box 1 shows the quantity of carbon contained in Suriname's forests estimated by Tjon (1998) on the basis of observations in 30 plots distributed over a range of forest types.

Box 1 Forest carbon stock, Suriname

	Carbon store (MtC)	
	PFE	Non-PFE
Above-ground biomass	1340	1210
Soil	365	330

Source: Based on estimates by Tjon (1998) of carbon stocks in various forest.types.

Nearly one-third (31%) of Suriname's GHG emissions are produced by the land-use change and forest sector (Government of Suriname 2002). Since 2009 the Government of Suriname has been developing a REDD+ readiness preparation proposal in the framework of the Forest Carbon Partnership Facility and is a member of the REDD+ Partnership. The preparation of a national REDD+ strategy is coordinated by the National REDD+ Working Group, which comprises representatives of governmental institutions, forest-dependent communities (Indigenous and Maroon peoples), the timber industry, academia, civil society and other observers (Government of Suriname 2009b). Table 6 summarizes Suriname's forest carbon potential.

Forest for protection

Soil and water. No part of Suriname's forest is managed exclusively for the protection of soil and water, but the relative lack of human pressure means that, in effect, vulnerable slopes in the hinterlands, the productive capacity of the soils, and the water storage and production capacity of the vast majority of forested lands are generally well conserved. Nevertheless, threats do exist. For example, some waterways are contaminated with mercury as a result of uncontrolled gold-mining, and river siltation and soil erosion are prevalent (ITTO 2003b, Fox 2010).

Biological diversity. Suriname has large intact forest ecosystems of global significance and forests have extremely high conservation and ecological values, particularly in the swamps and on the Guyana Shield. The inventoried biota comprises 5800 species of plant, including 200 endemic species, 185 species of mammals, 668 species of birds, 152 species of reptiles, 95 species of amphibians and 790 species of fish (Malone 2007); it is certain that much remains to be discovered. Five mammals, one amphibian, one arthropod and one plant are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species (IUCN 2011). Two plant species are listed in CITES Appendix I, 30 in Appendix II and one in Appendix III (UNEP-WCMC 2011).

Protective measures in production forests. Harvesting guidelines to protect soil, water and conservation values devised by SBB must be incorporated in the harvesting plans of concessionaires and approved prior to actual harvesting. They include the maximum allowable cut per hectare and the alignment and maximum area of skidding roads to be constructed in a felling

compartment. In addition, rules are stipulated in concession agreements regarding the storage and disposal of chemicals, machine oils and other chemical waste. These are closely monitored by SBB and adhered to reasonably well by loggers, although standards related to the spillage of used motor oils and waste may slip through control from time to time, meaning that adherence may be less than optimal.[a]

Extent of protected areas. According to the Government of Suriname (2009a), an estimated 1.89 million hectares of forest are contained within protected areas classified in IUCN protected-area categories I–IV, including 1.15 million hectares of lowland evergreen broadleaved rainforest. The estimate of UNEP-WCMC (2010) is slightly lower, at 1.46 million hectares. Of particular significance is the Central Suriname Nature Reserve, created in 1998 (1.6 million hectares). A further 245 000 hectares are in protected areas classified as IUCN protected area categories V–VI. Just under 1.5 million hectares of protected areas are covered by management plans (Table 7).[a]

Estimate of the area of forest sustainably managed for protection. Most of the protected area – and a large area of 'unprotected' forest in remote parts of the country – is intact due to a lack of development pressure. Therefore, all protected areas subject to management plans are assumed to be under sustainable management.

Socioeconomic aspects

Economic aspects. Forest-based activities contributed about 2% of Suriname's GDP, which was worth about US$1.8 billion in 2007. The formal market value of timber and NTFPs was estimated at about US$19 million and the value of the informal market was estimated at US$2.52 million.[a] In addition, the Water Supply Company of Suriname reported a production of 32 million m^3 of drinking water in 2007, with an estimated market value of US$18 million.[a] The water-bottling industry has developed rapidly in the last decade and currently comprises at least five significant-sized companies. Local consumption as well as exports of bottled water are growing steadily, although no data on the value of these were available for this report.

The Government of Suriname charges a fee per m^3 of timber felled and per hectare of forest concession held. However, there are inconsistencies in the fee structure: for example, there is little difference in the level of fees for timber according to the marketability of species and therefore there is little incentive to use lesser-known species (moreover, local forestry entrepreneurs consider the fees to be too high). The fees per area of concession are very low, which tends to encourage the application for and holding of large concessions for speculation rather than production. For these reasons, a revision of the forest charges system has been prepared, and will soon be enacted, in which the number of timber classes for fee calculation will be increased, there will be greater differentiation between timber classes, and, overall, the average fee per m^3 will be reduced by about 50%. Concurrently, the fee per area of concession will be increased significantly, which will help to compensate government for the decrease in revenue resulting from the reduction in the fee per m^3. The fee per area will be lower for remote areas to encourage their development and to alleviate pressure on timber production areas closer to existing infrastructure.

An estimated US$60 million has been invested in foreign-owned logging operations and processing equipment. The Government of Suriname invests in SFM through its funding of SBB and NB. Combined, those two institutions have an annual budget for forest management, administration, research and human-resource development of about US$2.56 million. Annual grants and loans from international organizations amount to about US$850 000.[a] In total, just under 1100 people work in the forest sector to implement or support forest management, including 133 with professional qualifications (45 in government and 88 in the private sector) and 135 trained (part-time or full-time) forest workers (51 in government and 84

Table 7 Management of the protection PFE ('000 hectares)

Reporting year	Protection PFE	Attributed to IUCN categories I–IV	Allocated for soil and water	With management plans	Sustainably managed
2005*	4430	1390	1160	-	-
2010	**2194**	**1890**	**0**	**1460[a]**	**1460**

* *As reported in ITTO (2006).*

in the private sector). The private sector comprises 29 logging companies and about 30 consultants (17 of whom are university-trained). In addition, the wood-processing sector has about 2400 employees.[a] About 250 people are employed in the management of protected areas (FAO 2010).

Livelihood values. An estimated 65 000 Amerindian and Maroon people rely on forests for 50% or more of their livelihoods, particularly in the districts of Sipaliwini, Brokopondo, Para and Marowijne.[a] Forest resources are important for medicines, building materials and fibres, but particularly for wild animals, fruit, seeds and nuts, which are major food sources. More than a thousand plant and animal species are known to be used in one form or another (van Andel et al. 2003).

People inhabiting the more remote hinterlands have very large areas of forests available for subsistence purposes: while their daily activities would mostly be confined to a couple of kilometres from their settlements, they may also undertake longer trips by boat or by foot away from their settlements (e.g. for prospecting, hunting and fishing). The issue of 'how much land' is required for customary use has emerged in discussions regarding the land rights claims of Amerindian and Maroon peoples, and an attempt has been made to identify the extent of the area around their settlements that could eventually be declared their economic zone. In the settlements closest to Paramaribo and other urban centres, the need to share living space has given rise to a certain balance, whereby traditional lifestyles tend to be confined closer to settlements. However, in large part this issue remains to be resolved.

About 550 000 hectares of forest has been allocated to Amerindian and Maroon peoples as community forests. SBB considers these to be under 'extensive' management[b], although some have been over-exploited due to weak communal business management capacity, which allows the forest to be logged by entrepreneurs from outside the communities on the basis of very poor agreements.[a] SBB, Celos (an agricultural research organization) and WWF are working together to provide training that will enhance the capacity for sustainable management among communities in the Pokigron and Marshall Creek region.

Social relations. Suriname's people comprise a racial mix of Amerindians, Creoles, Hindus, Maroons, Javanese, Chinese and Caucasians. About 10% of the population is Amerindian or Maroon, who claim collective land-use rights, including to forests.

Amerindian and Maroon groups have sought international support for their land-rights claims, including through the Inter American Court of Justice. In 2007 this court delivered a verdict in favour of the Saramaccan tribes, who had filed a complaint that the Government of Suriname had neglected their land rights by granting concessions and other rights to people from outside their community without their permission. The Court ordered the government to redress the disputed acts and to recognize the claimed rights.

Land rights continue to be a difficult issue between the government, tribal communities and other stakeholders. The government has established an official working group to help find a resolution.[a]

Seminars, workshops and other interactive communication modalities involving all relevant stakeholders have, to a certain extent, proven effective in reconciling views over forest policy development and SFM. Well-identified stakeholder groups with strong voices in such processes are:

- The Platform for the Timber Sector in Suriname (PHS), comprising a relatively small but vocal number of private logging entrepreneurs, with a persistent dislike of any initiative undertaken by the SBB.
- Representatives of Indigenous and Maroon people who live in the forests in the hinterlands of the country.
- Several national and international NGOs, including Conservation International, WWF and Tropenbos Suriname.[a]

SBB has also often been able to provide effective mediation in conflicts between concessionaires over boundary demarcation. Where this mediation proves insufficient, the protagonists may take the case to a judicial court. Conflict prevention, or the early resolution of emerging conflicts between the Government of Suriname (particularly the forest management agencies) and private operators, is attempted by providing for a representation of relevant stakeholders in the governing bodies of the forest management agencies. Representatives of stakeholders are also included in ad hoc committees and work-groups dealing with particular issues regarding the sustainable use and management of the country's forest resources.[a]

Not all attempts at conflict resolution have been successful. Some stakeholders have failed to take their seats in the governing bodies of existing and proposed management agencies. It has also proven very hard to obtain agreement between the forest management agencies and some stakeholders, particularly the PHS, on most of the issues subject to discussion.[a]

In all sectors, including the forest sector, the rules and requirements regarding health and safety in the workplace are set out in the Safety Act (1947), which is administered by the Ministry of Labor, Technological Development and Environment. The Directorate for Labor in this ministry conducts frequent inspections in different working locations, including sawmills and timber-harvesting sites. There is close correspondence between the prevailing labour regulations and International Labour Organization (ILO) conventions. Labour unions play a role in assuring that ILO recommendations and regulations are taken into account and adhered to. However, labour unions have only a limited role in companies active in the forest sector.[a]

Among the 29 enterprises interviewed in the context of the present report, two deaths were recorded in forest-based operations in the three years to 2009. In addition, three cases of permanent disabilities and six instances of injuries followed by complete recovery were recorded.[a]

The contribution of members of the Amerindian and Maroon communities to tree-spotting and botanical research regarding plant species in the forest is indispensable, as is their contribution to all forms of surveys in forest areas in the hinterlands.[a]

Summary

Suriname has taken some important steps towards SFM. A GIS–GPS system has been introduced to help locate boundaries of protected areas and to assist in the mapping and planning of forest operations. A computerized log-tracking system is being rolled out. There is almost no deforestation, and most of the forest estate is primary forest. There is an interim strategic action plan for implementing the national forest policy. About 2 million hectares of forest are under licence, although not all concessions are currently under harvest. There has been an ongoing process to establish a single authority for the management of production and protection forests, the Bosnas, but this is still pending. A number of steps have been taken to improve conflict resolution in Suriname's forests, but land rights are an ongoing issue between government, Amerindian and Maroon peoples, and other stakeholders.

Key points

- More than 90% of Suriname is forested, and very little deforestation is taking place. Gold-mining has become a significant cause of forest and environmental degradation.
- Suriname has an estimated PFE of 7.51 million hectares (compared with 11.3 million hectares in 2005), comprising 5.32 million hectares of natural production forest (compared with 6.89 million hectares in 2005) and 2.19 million hectares of protection forest (compared with 4.43 million hectares in 2005).
- As of late 2010, 62 logging concessions had been allocated over a total area of 1.3 million hectares.
- An estimated 247 000 hectares of the production PFE is under SFM, including 89 000 hectares that are certified.
- An estimated 1.46 million hectares of the protection PFE is under SFM.

Endnotes

a Government of Suriname (2009a).

b Personal communications with officials of the Government of Suriname, 2010.

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TRINIDAD AND TOBAGO

Forest resources

Trinidad and Tobago consists of two main islands and a number of small islets; it has a total land area of 513 000 hectares. In 2010 it had an estimated population of 1.34 million people (United Nations Population Division 2010) and it is ranked 64th out of 182 countries in UNDP's Human Development Index (UNDP 2009).

Trinidad, the much larger island, is traversed by three ranges of hills running more-or-less east to west with a highest point in the northern range of 936 m. Tobago has a central ridge that runs for two-thirds the length of the island and rises to 576 m. FAO (2010) estimated the forest area at 226 000 hectares. A new forest-cover map of Trinidad and Tobago under development by the United States Department of Agriculture, expected to be available by the end of 2010, will provide new information on the country's forest resources.[a]

Forest types. There are nine forest types in Trinidad and Tobago: evergreen seasonal forest; semi-green seasonal forest; deciduous seasonal forest; dry evergreen forest; montane forest; mangrove forest; herbaceous swamp; palm marsh; and marsh forest. The most widespread forest formation is evergreen (about 94 000 hectares – FAO 2010) and semi-evergreen seasonal forest (about 14 000 hectares – Pantin & Ram 2010), characterized in the lowlands by two main canopy species, *Carapa guianensis* (crappo) and *Eschweilera subglandulosa* (guatecare). Tropical evergreen submontane and montane forests occur in the northern range of hills. There are also about 14 000 hectares of swamp forests (FAO 2010). Mangrove forests cover about 6500 hectares. The largest area of mangrove cover is Caroni Swamp, which is south of Port of Spain (Spalding et al. 2010). Mangrove forests are widely used for timber and charcoal production and play an important role as near-shore fisheries, including for oyster, crabs and shrimps (ibid.).

Permanent forest estate. An estimated 131 500 hectares of state-owned forests are designated as 'proclaimed forest reserves' and 11 700 hectares are designated as 'unproclaimed forest reserves', comprising both natural and planted forests. These – and some other protection forests – constitute the PFE (Table 1). Only state forests are counted, since the permanency of private forest is unreported. FAO (2010) reported that the PFE (for production) was 'fixed' at 143 000 hectares. Due to agricultural encroachment, squatting for housing, and illegal quarrying, however, the actual forest area has been reduced.

Table 1 Permanent forest estate

Reporting year	Estimated total forest area, range (million ha)	Total closed natural forest ('000 ha)	PFE ('000 hectares)			
			Production		Protection	Total
			Natural	Planted		
2005*	0.248–0.259	250	128	15.4	59.1	202.5
2010	**0.226**	**150****	**127**	**15.4**	**59.1**	**201.5**

* *As reported in ITTO (2006).*

** *Calculated using the ratio of forest with greater than 60% forest cover estimated by UNEP-WCMC (2010) (66.4%) and the estimated total natural forest area.*

Forest ecosystem health

Deforestation and forest degradation. According to FAO (2010), the total forest area decreased by 3600 hectares between 2005 and 2010 and by 14 300 hectares between 1990 and 2010. Both natural forests and plantations are affected by over-harvesting, encroachment, fire and other forms of damage, although the extent of these has generally not been quantified (ITTO 2006). FAO (2010) reported that fire affected about 9500 hectares of forest and other wooded land in the five-year period 2004–08. ITTO (2003) identified non-legal settlement (squatting) as a major cause of deforestation in forest reserves. Another factor that has resulted in forest degradation is strip-mining of sand and gravel; this activity has degraded forests in large areas of the forest reserves, especially along the southern foothills of the northern range. Table 2 presents available estimates of forest condition.

Vulnerability of forests to climate change. As a small island state, Trinidad and Tobago is among the most vulnerable countries to climate change and has a relatively low adaptive capacity. According to the Caribbean Community (CARICOM 2010), the direct effects of temperature rises in the Caribbean are periodical heat stress of the vegetation, increased biodiversity loss, coral bleaching and an increased risk of insect-borne diseases. The effects of climate change and climate variability include an increased frequency of flooding and extreme weather events (such as hurricanes, which can have a major effect on forest structure). Rising sea level is of concern, mainly in the Caroni Basin and for coastal settlements. Increased coastal erosion has been observed at Cedros and saltwater intrusion is a problem on the southwest peninsula of Trinidad. Trinidad and Tobago is involved in the regional efforts of the Caribbean Community to address climate change, which are coordinated by the Caribbean Community Climate Change Centre.

SFM policy framework

Forest tenure. Most forested land is owned and administered by the state (Table 3). State-owned forest accounts for 192 200 hectares, including all the PFE, and the remainder is owned privately.

Criteria and indicators. Trinidad and Tobago has a long history of systematic forest management. For example, its block management and shelterwood systems have been applied for more than 60 years (ITTO 2006), but it lacks a system of C&I suited to its needs. Trinidad and Tobago's submission to

Table 2 Forest condition

	PFE	Non-PFE	Total
	'000 ha		
Area of primary forest	-	-	62.4
Area of degraded primary forest	-	-	-
Area of secondary forest	-	-	146*
Area of degraded forest land	-	-	-

* *'Other naturally regenerated forest'.*
Source: FAO (2010).

Table 3 Forest area, by tenure

Ownership category	Total area	Of which PFE	Notes
	'000 ha		
State ownership (national, state or provincial government)	192	143	Includes some planted forests.
Other public entities (e.g. municipalities, villages)	-	-	
Total public	**192**	**143**	
Owned by local communities and/or Indigenous groups	-	-	
Privately owned by individuals, firms, other corporate	34	-	

Note: FAO (2010) estimated the area of forest under public ownership in 2005 at 174 000 hectares and the area of forest under private ownership at 56 000 hectares.
Source: ITTO estimate based on Government of Trinidad and Tobago (2010).

ITTO for this report was not in the ITTO C&I reporting format.

Forest policy and legislation. Trinidad and Tobago adopted its first forest policy for the sustainable management of its PFE in 1942. A revision was made in 1981 to take into account the significant social, economic, political and technological changes that had taken place in the country since 1942, but it was never adopted by government. A further revision took place in 1998 and while the cabinet has approved this revision it has not been adopted formally. There is an absence of an agreed strategy and policy in the forest sector (ITTO 2006).

Recently a new draft forest policy (2008) and a draft protected-areas policy were produced and public consultations undertaken. It is expected that the final review of both these policies will be completed shortly for approval by Cabinet. The purpose of the draft national forest policy is to guide the sustainable management of the forest resources of the nation, including their use and the impacts and consequences of that use. It covers natural as well as plantation forests, includes deforested and degraded forest lands, and addresses forests located on both private and public lands. The draft national forest policy recognizes that while a few government agencies will have primary responsibility for implementing the policy it will inform the behaviour, programs and activities of all stakeholders, including state, private and community groups.[a]

Institutions involved in forests. In Trinidad, the Forestry Division of Agriculture, Land and Marine Resources is the state's sole management authority for the forest sector, having responsibility for forestry, watershed management, wildlife, parks, use, research and services in support of the private forest sector. In the last decade, three strategic plans were produced for the Forestry Division to cover the periods 2001–05, 2006–09 and 2009–12, respectively. It is expected that the latter plan, if approved, will enable the Division to be more effective and efficient in delivering goods and services demanded by emerging challenges. Apart from a restructuring of the existing professional staff, several specialist positions are being sought to meet the challenges of added roles and responsibilities (the seeking of specialist positions was also reported in ITTO 2006). In Tobago, forests are under the jurisdiction of the Assistant Conservator of Forests, who reports to the Secretary of Agriculture, Land Marketing and the Environment. In 2008 the total number of people employed in public forest institutions in the country was 946 (19% of whom were women), including 16 with a university degree or equivalent (FAO 2010).

Civil-society organizations are gradually becoming more involved in forest management. Through the National Reforestation and Watershed Rehabilitation Programme, for example, several community-based groups and organizations are becoming active in the growing and protection of forests. Others are involved in the protection of leatherback turtles during the nesting season (from April to August) and in other conservation-oriented activities.[a]

Status of forest management

Forest for production

Both natural forests and particularly planted forests are actively managed. About 75 000 hectares of natural forests are regarded as intensively managed and have management plans. All forest reserves and the external boundaries of the PFE have been fully demarcated. However, the boundaries are not properly maintained and there are frequent incursions/encroachments. The police force and honorary game wardens participate in forest patrols to help control illegal activities. The most recent official forest inventory was carried out in 1969; the lack of up-to-date data is an obstacle to forest policy reform and financing (Patin & Ram 2010).

Up to the 1980s, management plans for forest reserves were written and followed. These lapsed or were not followed in a period spanning the early 1980s to 2003, but new management plans were written for all forest reserves for the period 2004–08 and are being revised at present.[a] The management of natural forests has followed a form of selection known as the 'open-range system', with diameter limits as the main form of control. Individually licensed loggers are allowed to cut a specified number of trees or volume as defined by the Forestry Division. In many cases this has amounted to a 'logger's selection system', uncontrolled by the Forestry Division. In order to ensure adequate controls a block system of management was introduced, in which areas are opened up for sale on a polycyclic basis. Several variations of this

system have been employed from time to time, known variously as silvicultural marking in blocks and the periodic block system.

Because forest resources are limited, there are no forest concessions. Some 400 private loggers (mainly wood-workers) are registered (licensed) by the Forestry Division and allotted marked trees for extraction and use. Illegal encroachment and illegal logging certainly occur in the PFE, although their extent is unknown; the police-assisted patrols no doubt reduce their prevalence. In the case of plantations, particularly *Tectona grandis* (teak) and *Pinus caribaea* (Caribbean pine), coupes to be clearfelled are sub-divided into five-hectare units and coupes to be thinned are sub-divided into ten-hectare plots for allocation to sawmillers, licensees, furniture manufacturers and logging contractors.

Silviculture and species selection. The harvesting of plantation teak and Caribbean pine provided up to 28% of the local timber supply in 2008 (Table 4). Enrichment planting in natural forests is still practiced in depleted and poorly stocked forest to improve the growing stock and thereby support multiple use and sustainability.

Planted forest and trees outside the forest. The total industrial planted-forest area is reported to be stable at about 15 400 hectares, with felled plantations replaced with new plantations but no new areas planted.[a] The planted forest estate comprises 9100 hectares of teak (introduced from Myanmar in 1913), 4200 hectares of Caribbean pine and other pine species, and 2100 hectares of mixed hardwoods.

Other species planted on a limited scale in both pure and mixed stands, including by enrichment planting, include *Cedrela odorata* (cedar), *Cordia alliodora* (cypre), *Swietenia macrophylla* (mahogany) and *Tabebuia rosea* (apamate).

In 1998 the government approved a private reforestation program and made subsidies available to assist private forest farmers. To date, 3907 hectares of mixed hardwood forest have been established on private lands. In 2004 the government also established the National Reforestation and Watershed Rehabilitation Programme to reforest denuded lands across the country. Operations commenced in 2005 and 1722 hectares of forests have been planted in various areas. By the end of 2010 the total planted forest in both state lands and private lands was likely more than 21 000 hectares.[a]

Forest certification. So far no forests have been certified in Trinidad and Tobago (e.g. FSC 2010).

Estimate of the area of forest sustainably managed for production. Of the natural forests, ITTO (2006) reported that 15 000 hectares had been managed for many years according to management plans which conform to basic principles of SFM and are harvested according to the periodic block system, which is considered generally consistent with sustainability; there is no evidence to suggest that the management of these forests has changed (Table 5). The balance of production forest has been managed under the open-range system and is now considered to be degraded (ITTO 2006). On the basis of an estimate provided by the Government of Trinidad and Tobago, FAO (2010) reported that 143 000 hectares of natural forest were under sustainable management.

Timber production and trade. Trinidad and Tobago produces modest quantities of industrial timber and depends mainly on imports to cover its needs for sawnwood, plywood and paper products. Its net timber import bill in 2008 amounted to about US$80 million.[a] Total industrial roundwood production in 2009 was about 50 000 m^3, which

Table 4 Commonly harvested species for industrial roundwood

Species	Harvested volume (m^3), 2008
Tectona grandis (teak)*	9536 (17.7% of total harvest)
Spondias mombin (hogplum)	6266 (11.6%)
Cedrela odorata (cedar)	6254 (11%)
Pinus caribaea (Caribbean pine)*	5711 (10.6%)
Virola surinamensis (cajuca)	1857 (3.5%)
Others (estimated)	24 232 (45%)
Total (estimated)	53 856 (100%)

* *Also listed in ITTO (2006). In the case of* Pinus caribeaa, Pinus *spp were listed.*

Source: Government of Trinidad and Tobago (2010).

Table 5 Management of the production PFE ('000 hectares)

Reporting year	Natural					Planted		
	Total	Available for harvesting	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
2005*	128	75	75	0	15	15.4	15.4	0
2010	**127**	**75**	**75**	**0**	**15**	**15.4**	**15.4**	**0**

* *As reported in ITTO (2006).*

(along with about 1750 m^3 of imported logs) yielded about 31 500 m^3 of sawnwood and 2000 m^3 of veneer (ITTO 2011). Plantation areas to be thinned or clearfelled are allocated to sawmillers and woodworkers on a quota system. Annual blocks to be thinned or clearfelled are notified for sale; sawmillers are expected to indicate their interest in working in particular areas. In 2009 there were 89 licensed sawmills whose combined input capacity was 100 000 m^3 per year.[a] These ranged in size from typical family enterprises to large companies and processed both the domestic supply of timber and imports of round logs and squares from neighbouring Guyana and Suriname. In 2009 there were 118 registered and several unregistered furniture factories that processed lumber into finished products for domestic use and for exports.[a]

Non-timber forest products. Little information was available for this report on the domestic production of the country's major NTFPs. Bamboo is grown as a commercial crop. Some NTFPs are imported from Venezuela and the countries of the Guyana Shield. Edible products such as wild tubers, bush meat, honey, beeswax and thatching grass are used extensively by rural communities but the royalty rates for such items are nominal and there is very little data capture of their harvest. In 2005 an estimated 12 000 kg of bush meat and 60 000 kg of 'other plant products' were harvested from forests (FAO 2010).

Forest carbon. FAO (2010) estimated the forest carbon stock in the living forest biomass at 19 MtC. Alternatively, using forest data produced by UNEP-WCMC (2010) the forest biomass carbon stock can be estimated at 25–32 MtC.[b] Trinidad and Tobago is not engaged in international REDD+ processes. There is, however, a carbon sequestration project – the Nariva Ecosystem Restoration and Carbon Sequestration Project, which is financed by an investment loan from the World Bank. It comprises two components. The first is to sequester carbon through afforestation and reforestation of selected areas of the Nariva wetland ecosystem and the second is to mitigate methane emissions through the restoration of surface hydrology. Table 6 summarizes Trinidad and Tobago's current forest carbon potential.

Forest for protection

Soil and water. There are about 2000 hectares of protection plantations in the coastal regions. It is generally recognized that there is a need to reforest and rehabilitate critical watersheds, but land outside the forest is generally occupied. Efforts are being made to rehabilitate degraded land through tree-planting in parts of the islands. Some 37 000 hectares of forest are reportedly managed primarily for the protection of soil and water [a] (FAO 2010 reported an area of 51 300 hectares).

Biological diversity. Trinidad has surprising biodiversity for its size, brought about by its proximity to other Caribbean islands and,

Table 6 Forest carbon potential

Biomass forest carbon (MtC)	% forest with canopy cover >60%	Deforestation/ degradation potential to 2030	Enhancement of carbon sink capacity to 2030	Forest area change monitoring capacity	Forest/ GHG inventory capacity	Importance of forest fire/ biomass burning	Engagement in international REDD+ processes
19–32	66	+	+	-	-	+	-

+++ high; ++ medium; + low; estimate of national forest carbon based on FAO (2010) and ITTO; estimate of % total forest with canopy cover >60% based on UNEP-WCMC (2010).

particularly, to continental South America. More than 2280 species have been recorded, 215 of them endemic. There are over 100 mammals (the richest mammal biota in the Caribbean), 420 birds and 70 reptiles. One bird and eight amphibians found in forests are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species (IUCN 2011). Thirty plants are listed in CITES Appendix II (UNEP-WCMC 2011).

Protective measures in production forests. Forest management plans prescribe measures to protect riverbanks, rare plants and wildlife in production forests.

Extent of protected areas. A system of 61 national parks and other protected areas was proposed in 1980. About 40 such national parks and other protected areas have been established and are managed by the Forestry Division; two are being developed with funds from the Inter-American Development Bank. FAO (2010) reported that 100 000 hectares had been proposed for the system of national parks and protected areas, but only 8000 hectares of forests were being managed in the system. FAO (2010) reported that the conservation of biodiversity was the primary designation for 19 500 hectares of forest.

Estimate of the area of forest sustainably managed for protection. Insufficient information was available to estimate the area of sustainably managed protection PFE (Table 7). Some protection forests are covered by management plans and are used widely for ecotourism.

Socioeconomic aspects

Economic aspects. Forests cover most requirements for fuelwood and some of the nation's timber needs. At present, about 10 000 people are employed in local forest-related jobs and many others are linked indirectly to forestry. The Tourism Master Plan aims to make Trinidad and Tobago the foremost tourism destination in the Caribbean. This will involve ecotourism, in which forests will undoubtedly play a substantial role.[a]

Shoreline forest vegetation, Trinidad and Tobago.
© istockphoto/R. McClean

In 2005 the forest sector generated an estimated 7.42 million Trinidad and Tobago dollars. Total public-sector expenditure in the sector in that year – including on the conservation of forest biodiversity, reforestation, the protection of soil and water, forest stand improvement, the establishment and management of protected areas, and patrols to protect turtles during the nesting season – was 88.1 million Trinidad and Tobago dollars (FAO 2010).

Pantin and Ram (2010) reported that total public expenditure (capital and recurrent) on forest-related activities amounted to US$10.78 million in 2005, US$10.71 in 2008 and US$12.43 million in 2009, which was about 0.1% of GDP and less than one-third the estimated 'basic' annual funding requirements for SFM. They concluded that the underfunding was due primarily to "incorrect price signals and insufficient recognition of economic values of forest services and products". They recommended that greater emphasis be placed on generating revenue for the provision of forest ecosystem services, such as water production.

Livelihood values. Forests do not generally provide the living area of the poor but they provide important subsistence products for many people. There is no direct conflict between timber harvesting and livelihood interests, but forest is still being cleared for agriculture, mining for sands

Table 7 Management of the protection PFE ('000 hectares)

Reporting year	Protection PFE	Attributed to IUCN categories I–IV	Allocated for soil and water	With management plans	Sustainably managed
2005*	59.1	29.2	-	12	-
2010	**59.1**	**8**	**-**	**12**	**-**

* *As reported in ITTO (2006).*

and gravels, oil and gas exploration, and other purposes.

Social relations. Although there are no significant social conflicts associated with the management of the country's forests, the draft forest policy proposes the increased involvement of local communities in forest management. Some ten sites have been earmarked for recreation and are visited by approximately 300 000 people annually.[a]

Summary

There has been little change in the status of forest management in Trinidad and Tobago since 2005. A new draft forest policy and a draft protected areas policy have been produced and have undergone a process of public consultation. Management plans for forest reserves are being revised. The lack of up-to-date information about the forests, the lack of a modern forest policy, and the underfunding of forest management all hinder the application of SFM.

Key points

- Trinidad and Tobago has an estimated PFE of 201 000 hectares (similar to 2005), comprising 127 000 hectares of natural production forest (compared with 128 000 hectares in 2005), 59 100 hectares of protection forest (as for 2005) and 15 400 hectares of planted forest (as for 2005).
- An estimated 15 000 hectares of the natural production PFE is under SFM. No forest is certified, and no estimate was possible for the area of protection PFE under SFM.
- A new draft forest policy and a draft protected-areas policy have been produced and have undergone a process of public consultation.

Endnotes

a Government of Trinidad and Tobago (2010).

b ITTO estimate.

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VENEZUELA

Forest resources

Venezuela has a land area of 91.2 million hectares and a population in 2010 of 29 million people (United Nations Population Division 2010). It is ranked 58th out of 182 countries in UNDP's Human Development Index (UNDP 2009). Venezuela comprises three main biogeographical regions: a narrow coastal area; the Andean mountain range, which reaches 5000 m above sea level and supports dry and humid montane and cloud forests; and the basins of the Orinoco and Amazon rivers. The Orinoco Plain is part of the *llanos* biome[1], which covers 31% of the country. The Guayana region (the states of Bolivar and Amazonas), which is part of the Guiana Shield, occupies about half the country and contains 70% of its forests. FAO (2010) estimated Venezuela's forest area at 46.3 million hectares.

Forest types. Tropical humid forest, Venezuela's most extensive forest type, occurs in the Orinoco delta, the Guayana region and in small areas south and southwest of Lake Maracaibo; it stretches from sea level to 400 m in altitude. The most common species found in the tropical humid forest are *Couroupita guianensis, Ceiba pentandra, Coumarouna punctata*, *Erisma uncinatum* and *Carapa guianensis*. Tropical mountain forest is found in three zones: the Merida range; the coastal range by the Caribbean; and the eastern massif in the states of Sucre and Monagas. Cloud forest forms in the Andes between 500 and 2000 m. Valuable timber species found in Venezuela's cloud forest include *Cedrela mexicana, Guarea* spp, *Roupala montana, Terminalia* spp, *Virola sebifera, Rollinia fendleri, Calophyllum brasiliense* and, in higher areas, species of *Podocarpus*. Deciduous forest occurs in the *llanos*, generally on flat ground of the Orinoco Plain, but has nearly disappeared due to conversion to agriculture and pasture. Once-common species in these forests include *Swietenia macrophylla* (caoba), *Bombacopsis quinata, Tabebuia pentaphylla* and *Ceiba pentandra*. Venezuela has an estimated 356 900 hectares of mangroves, a significant part of which is under threat (Spalding et al. 2010).

Permanent forest estate. The entire forest area is contained within specially designated areas (*áreas bajo régimen de administración especial* – ABRAEs) managed for specific purposes according to law. About 16.2 million hectares of the country's estimated 46.3 million hectares of forest are allocated for production as part of the PFE, but 3.38 million hectares of these are classified as protection forests[a] and are therefore not included in the estimate of production PFE shown in Table 1. The production PFE is made up of 15 forest reserves (12.8 million hectares, of which two reserves, El Caura in Bolivar and Imataca in Delta Amacuro and Bolivar, make up about 8.8 million hectares) and four forest lots (*lotes boscosos* – covering about 83 000 hectares). The total planted forest area is about 845 000 hectares, a considerable part of which is in forest reserves. The total area of officially classified protection forests (forests in protected areas and forests set aside for soil and water protection) is at least 19.6 million hectares (Table 1).

Forest ecosystem health

Deforestation and forest degradation. FAO (2010) estimated the average annual rate of deforestation between 2000 and 2010 at 288 000

1 An extensive system of grasslands, seasonally-flooded plains and forests shared by Venezuela and Colombia. It is located to the north and west of the Orinoco River and borders the Amazon Basin along its entire southern edge. About 61% (27.5 million hectares) of the *llanos* biome lies within Venezuela.

Table 1 Permanent forest estate

Reporting year	Estimated total forest area, range (million ha)	Total closed natural forest ('000 ha)	PFE ('000 hectares)			
			Production		Protection	Total
			Natural	Planted		
2005*	49.5–55.0	49 926	13 000	863	20 600	34 463
2010	**46.3**	**25 300****	**12 920‡**	**845**	**19 640†**	**33 405**

* *As reported in ITTO (2006).*

** *Calculated using the ratio of forest with greater than 60% forest cover estimated by UNEP-WCMC (2010) (54.7%) and the total natural forest area estimated by FAO (2010).*

‡ *Areas for permanent forest production, including forest reserves (*reservas forestales*) and forest vocation land areas (*areas de vocación forestal*) within the ABRAEs, less those forests classified as ABRAEs for protection (Government of Venezuela 2010).*

† *Includes environmental recovery and protection areas (*áreas de protección y recuperación ambiental *(APRA) – 15.2 million hectares; wildlife fauna reserves (*reservas de fauna silvestre*) – 0.3 million hectares; 3.38 million hectares of protection forests classified in production ABRAE (Government of Venezuela 2010); and watershed and soil protection areas.*

hectares (0.6%). In the past, deforestation was highest in the *llanos*; for the last 20 years, however, it has been highest in the drier northwestern Zulia region, which has lost almost two-thirds of its forest cover, and south of Orinoco (Guayana region). The main causes of deforestation are the expansion of commercial crops and small-scale farming. A significant part of Venezuela's forest estate is degraded (Table 2), caused partly by small-scale and larger-scale mining, which is also a significant cause of river pollution. Informal gold and diamond miners are particularly active in Bolivar state, where there is a history of violent conflict between miners and local Indigenous peoples. Successive Venezuelan governments have taken steps to control mining in the region but have made relatively little progress.[b]

Vulnerability of forests to climate change. Climate change is considered by the Government of Venezuela to be a significant threat. Extreme weather events such as inundations and extended droughts are occurring with increasing intensity and frequency, claiming lives and causing considerable damage. Venezuela is participating in international negotiations on climate-change adaptation and is playing a leading role on climate-related issues within the Bolivarian Alliance for the Peoples of Our America (*Alianza Bolivariana para los* Pueblos de Nuestra América). Nevertheless, land-use change and human-induced forest degradation are expected to have a larger impact on forest vulnerability in the next two to five decades. Uncontrolled forest fires occur regularly, both in natural and planted forest. There are, on average, more than 3000 forest fires annually, affecting at least 100 000 hectares of forest per year.[a]

SFM policy framework

Forest tenure. There is no forest cadastre in Venezuela and thus it is difficult to estimate the ownership status of forests[a], although the vast majority is owned by the state (Table 3). There are private forest lots in both natural and planted forest areas, but their extent is unknown. The 1999 Constitution recognizes the right of Indigenous people to the collective ownership of forest territories, access to resources and cultural uses (articles 119–126), but no demarcation or formal recognition process is in place.[b] The extent to which local communities have the right to administer, conserve and manage timber resources in ABRAEs remains unclear. Venezuela's legislature passed a new law on Indigenous peoples and communities (*Ley Orgánica de Pueblos y Comunidades Indígenas*) in 2005, which includes a provision ensuring the

Table 2 Forest condition

	PFE	Non-PFE	Total
	'000 ha		
Area of primary forest	-	-	21 000
Area of degraded primary forest	-	-	18 000
Area of secondary forest	-	-	7 000
Area of degraded forest land*	-	-	-

Source: Derived from Government of Venezuela (2010) and personal communications – see endnote b.

Small-scale mining in Guiana, Venezuela.

land and property rights of Indigenous peoples and communities (ITTO & RRI 2009). This law recognizes ancestral rights to forestlands and specifies the process for demarcating and titling Indigenous lands. Approximately 700 000 hectares have been titled to Indigenous peoples' communities in agricultural areas (ibid.).

Criteria and indicators. Venezuela has a long tradition of forest management and professional foresters are involved at all levels of forest production and conservation. The country is an active member of the Amazon Cooperation Treaty Organization, which has developed the Tarapoto C&I framework for SFM and a platform for dialogue between national forest authorities. The Government of Venezuela used the ITTO C&I in its submission to ITTO for this report.[a]

Forest policy and legislation. The framework for forest conservation and management is laid out in articles 127–129 of the country's 1999 Constitution, which define the framework of environmental rights. Sustainable natural resource management is defined as a fundamental task of the state; it is the basic principle of the 2006 Organic Law for the Environment *(Ley Orgánica del Ambiente*), which replaced the 1976 Law for the Environment. The 1983 Organic Law of Land Management (*Ley Orgánica para la Ordenación del Territorio*) defines territories that are under a specific management regime, including natural forests and areas for reforestation and rehabilitation (Article 15). The Penal Law of the Environment (*Ley Penal del Ambiente*), which came into force in 1992, defines offences against the environment. In December 2008 a new law for the management of biological diversity (*Ley de Gestión de la Diversidad Biológica*) was passed, replacing the former law of 2000.

Decree 6070 of June 2008 constitutes the Law on Forests and Forest Management (*Ley de Bosques y Gestión Forestal),* superseding the Forest Law (1966). It contains the framework for SFM and forest protection and recognizes the wider functions of forests for the production of goods and services as well as the environmental and cultural values linked to forests.[a] Since 2009 the Forest Service (*Dirección General de Bosques*) has been developing revisions to the new law, including provisions for the national development plan (*Proyecto Nacional Simón Bolívar*) and the emerging role of forests in climate change. Those revisions are under discussion in the national legislature.

The country's domestic timber trade is regulated by the 1966 Forest Law for Soil and Water (*Ley Forestal de Suelos y de Aguas*) and the international trade by the Fiscal Law (*Ley de Timbre Fiscal, Decreto*

Table 3 Forest area, by tenure

Ownership category	Total area	Of which PFE	Notes
	'000 ha		
State ownership (national, state or provincial government)	46 300	-	No distinction can be made between state ownership categories.
Other public entities (e.g. municipalities, villages)		-	
Total public	**46 300**		
Owned by local communities and/or Indigenous groups	-	-	About 0.7 million hectares have been attributed to Indigenous peoples' groups, but it is unclear how much of this area is forested.
Private owned by individuals, firms, other corporate	120	-	Mainly planted forests owned by private persons or enterprises.

Source: Government of Venezuela (2010).

363/1999*)*. The latter includes tariff instruments for the control of imports and exports and stipulates that logs harvested in natural forests cannot be exported. Industrial logging (since 1978; Decree 269) and mining (since 1989; Decree 2552) are prohibited in Amazonas, the country's second-largest state after Bolivar (ITTO 2006). The extent to which these regulations are still being applied is unclear, however.

A new forest policy to replace the general policy of 1998 (*Politica Nacional de Bosques*) is under preparation, with a view to better encompassing the human dimension and sustainable development approaches to forest management. The principle of the new forest policy is to secure the multiple and sustainable uses of forest resources, with particular emphasis on the livelihood values of forests for local people. Special emphasis will be given to the control of illegal logging and encroachment in forest reserves by shifting cultivators and illegal miners.

Institutions involved in forests. The Ministry for the Environment (*Ministerio del Poder Popular para el Ambiente* – MPPA) is the lead ministry responsible for forests (replacing the former Ministry for Environment and Natural Resources). The Forest Service is the MPPA's implementation agency. Other ministries involved in forest development are the Ministry for Agriculture and Lands (*Ministerio del Poder Popular para la Agricultura y Tierras* – MAT) and the Ministry for Sciences and Technology (*Ministerio del Poder Popular para la Ciencia, Tecnología e Industrias Intermedias*). Particularly south of Orinoco, which is also an important development area, there is a lack of clarity on the relative roles and responsibilities of institutions, in particular between the MPPA, MAT and the Ministry for Energy and Petrol (*Ministerio del Poder Popular para la Energía y Petróleo,* the former Ministry for Energy and Mining).

Other important institutions supporting the development of SFM in Venezuela include the Reforestation Company (*Compañía Forestal de Reforestación*), which deals with plantation forest development and forest restoration on public and private land; and the Institute for National Parks (*Instituto Nacional de Parques*), which deals with forest conservation and protected areas. The Forestry Institute of Latin America (*Instituto Forestal Latinoamericano*) is responsible for forest research, along with other institutions such as the National Forest Products Laboratory (*Laboratorio Nacional de Productos Forestales*) and the Botanical Institute Foundation of Venezuela (*Fundación Instituto Botánico de Venezuela*). The university in Merida, *Universidad de los Andes*, is the main body for high-level forest education in the country.

To monitor forest management and trade in forest products, the MPPA has a functional national forest information statistical system (*Sistema Nacional de Información Estadística Forestal*), initiated with the support of ITTO, and an information system for forest inventory (*Sistema de Información Nacional del Inventario Forestal*), which allows the management of forest growth data and the monitoring of forest carbon. The first comprehensive national forest inventory is under preparation and results are expected in 2012.

Decentralization was proposed in the Law of Decentralization (1989) and reinforced by principles embodied in the 1999 Constitution. However, natural resource management and, in particular, forest management remain under the control of the centrally organized Forest Service – with the exception of urban forestry, which is managed directly by the municipalities (ITTO 2006).

Status of forest management

Forest for production

In mid 2010, the total area managed under integrated forest management plans for goods and services was 4.38 million hectares, comprising three forest reserves – Imataca, Guarapiche and Ticoporo.[a] Timber harvesting in natural forests is done on a relatively small scale in Venezuela. Under the new national forest policy, the integrated co-management of forests in collaboration with local populations will involve multiple land uses and the production of timber, NTFPs and ecosystem services. Model forest and land management plans have been prepared to fully integrate various interests in the management of forest reserves in Ticoporo (187 000 hectares, plan approved in 2008) and Caparo (174 000 hectares, plan currently at the approval stage); both reserves are located in the *llanos*. Only small parts of these reserves are dedicated to timber production and a multiple-use management approach is employed. SFM for timber production is being tested over about 3% of the 3.8 million hectares of the Imataca Forest Reserve in the Guayana region.[a]

Two kinds of permit for timber production are available: forest concessions, granted for areas of more than 5000 hectares; and annual logging permits, for areas smaller than 5000 hectares. Forest concessions are granted for 20–40 years in forest reserves and forest lots, the latter established by the MPPA (ITTO 2006). The forest concession policy lacks clarity. Concessions are officially granted at public auction, but information about the process is not available publicly and the criteria for awarding concessions are not transparent.[b] Concessionaires often struggle to comply with the forest law, but there is no public information on how and to what extent they fail to comply (ITTO 2006).

Because nearly all forest reserves north of the Orinoco River are deforested, all forest concessions are now south of the Orinoco in the Guayana region. In mid 2003, 14 forest concessions were operating in forest reserves and in forest lots over a total of 1.21 million hectares (ITTO 2006). No newer information was available for this report.[b] In June 2010, through Governmental Decree 7.457, the Social Forest Enterprise (*Empresa Socialista Forestal S.A.)* was created under the MPPA to reform forest concession management.

All concessionaires are Venezuelan nationals. Concession management is based on detailed forest management plans (*planes de ordenación y manejo forestal* – POMFs) that include inventories of commercial timber species. High-grading, in which only the most valuable species are extracted, is commonplace (ITTO 2006). By law, all concessions must be managed by professional forest engineers and trained foresters. Harvesting in concessions is carried out on the basis of an annual cutting plan approved by the MPPA. Concessionaires are required to establish line enrichment planting after harvesting at a distance between strips of 30–50 m. Annual logging permits require a simplified management plan prepared by a forest engineer (ibid.).

Silviculture and species selection. The minimum cutting diameter for native species was reassessed through Government Resolution 30 of June 2009. At least 40 species are harvested from natural forests.[a] Commonly harvested species are shown in Table 4; others include *Copaifera officinalis* (aceite), *Tabebuia rosea* (apamate), *Hymenaea courbaril* (algarrobo), *Catostemma commune* (baramán), *Sterculia apetala* (camoruco), *Carapa guianensis* (carapa), *Simarouba amara* (cedro blanco), *Ceiba pentandra* (ceiba), *Brosimum alicastrum* (charo), *Pterocarpus officinalis* (drago), *Hura crepitans* (jabillo), *Qualea dinizii* (guarapo), *Spondias mombin* (jobo), *Nectandra* spp (laurel), *Anacardium excelsum* (mijao), *Mora excelsa* (mora), *Erisma uncinatum* (moreillo), *Piptadenia* spp (palo blanco), *Cordia alliodora* (pardillo), *Manilkara bidentata* (purguo), *Tabebuia serratifolia* (puy), *Peltogyne pubescens* (zapatero) and *Pithecellobium saman* (samán).[a]

Under Government Resolution 217 (2006) the following species are completely protected and may not be harvested: *Tabebuia espectabilis* (acapro), *Swietenia macrophylla* (caoba), *Cedrela odorata* (cedro), *Anacardium excelsum* (mijao), *Cordia thaisiana* (pardillo negro) and *Bombacosis quinata* (saqui saqui).[a] Under Government Resolution 35 (2008), the harvesting of samán, the main species remaining in the scattered forests north of the Orinoco region, is prohibited in the states of Apure, Aragua, Barinas, Portuguesa and Zulia.[a]

Planted forest and trees outside the forest. There has been a tradition of official and private plantations in Venezuela for nearly 60 years. Venezuela had an estimated 727 000 hectares of plantations in 1998 (of which 115 000 hectares were private; ITTO 2006). The MPPA reported an increase of planted forest between 2002 and 2007 of 118 000 hectares (20 000 hectares by private companies), which would bring the planted-forest area to about 845 000 hectares. The majority of the plantations are for industrial purposes. The

Table 4 Commonly harvested species for industrial roundwood

Species	Notes
Pinus caribaea (pino caribe)*	From plantations – about 79% of the total harvest in 2004–08.
Eucalyptus spp	From plantations – about 10% of the total harvest in 2004–08.
Pithecellobium saman (samán)*	From open forests – about 45 000 m^3 per year.
Erisma uncinatum (moreillo)*	From the Guayana region – about 30 000 m^3 per year.
Manilkara bidentata (purguo)	From the Guayana region – about 6000 m^3 per year.

* *Also listed in ITTO (2006).*
Source: Government of Venezuela (2010).

most important species is *Pinus caribaea* (pino caribe), which provides more than two-thirds of the country's total roundwood production. Other planted species include *Eucalyptus* spp, *Gmelina arborea*, *Leucaena leucocephala*, *Fraxinus americana*, *Cupressus lusitanica*, *Tabebuia rosea*, cedro, caoba and *Tectona grandis*.[a]

A new reforestation plan (*Plan Socialista de Plantaciones Forestales*) was approved in early 2010 with the aim of establishing 2 million hectares of additional planted forests in the next 20 years.[a] A plantation program using *Acacia mangium* has been launched in the south of Apure state with the aim of planting 300 000 hectares of new forests there.[a]

Forest certification. As of October 2010, Venezuela had one certified planted forest of *Pinus caribaea* covering an area of 139 650 hectares. Natural-forest certification has not generated interest among producers in Venezuela because the entire production is used to satisfy the domestic market, which is not yet demanding certified timber.

Estimate of the area of forest sustainably managed for production. According to one government estimate, 77% of the volume of timber harvested – 40% from areas under POMFs and 37% from plantations of *Pinus caribaea* – was derived from sustainably managed sources and therefore met the ITTO Year 2000 Objective (ITTO 2006). The estimate of sustainably managed natural-forest PFE given in Table 5 is more conservative and corresponds to timber concessions that have been managed according to forest management plans for more than 25 years. An estimated area of about 510 000 hectares of natural forests is currently managed under rigid silvicultural provisions by eight enterprises in forest reserves and forest lots.[a]

Timber production and trade. Nearly the entire volume of timber production serves the domestic market. ITTO (2011) estimated a total industrial roundwood production in 2009 of 2.35 million m^3 (1.71 million m^3 of which was softwood, mainly *Pinus caribaea*[a]), up from 1.44 million m^3 in 2005. An estimated 93% of roundwood is cut outside forest reserves and forest lots.[a]

A considerable portion of total industrial roundwood production is used for pulp and paper. A large part of the remainder is used for sawnwood: for example, an estimated 950 000 m^3 of sawnwood was produced in 2009 (ITTO 2011). Exports of primary timber products are negligible, but the value of primary wood product imports has grown to over US$59 million per year, mostly comprising sawnwood and plywood (ibid.). Hardwood from Roraima state in the Brazilian Amazon is increasingly important because of a new and well-maintained road system (ITTO 2006).

Non-timber forest products. Between 30 and 50 NTFPs are important and used at the local, regional and national levels. Among them are various palm products for food, construction, medicine and handicrafts, including the fruits of *Bactris gasipaes* (pejibaye), *Dipteryx odorata* (sarrapia), *Mauritia flexuosa* (moriche palm) and *Bactris gasipaes* (pijiguao). The latter two are important food sources for Indigenous communities in the Orinoco delta and the Amazon.[a] Cooking oil is extracted from the *Acrocomia aculeata* palm (corozo). Palm heart (palmito) from *Euterpe oleracea* is an important export product; it is now increasingly planted and integrated into multiple-use forest management plans. Other products are various nuts, including Brazil nut and merey (*Anacardium occidentale*), pepper, cinnamon, bamboo, nutmeg, aniseed, cumin, ginger, cucumber and resins, many sold in the national market. A food additive

Table 5 Management of the production PFE ('000 hectares)

Reporting year	Natural					Planted		
	Total	Available for harvesting	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
2005*	13 000	3120	1480	0	480	863	727	140
2010	**12 920**	**4379****	**4379****	**0**	**510**	**845**	**845**	**140**

* *As reported in ITTO (2006).*

** *Government of Venezuela (2010). Includes the production forest area of the Imataca Forest Reserve (about 1.37 million hectares).*

extracted from *Bixa orellana* (onoto o achote) is also widely used.[a] *Heteropsis spruceana* (mamure), a local liana, has been used as a raw material for furniture but is now threatened by over-use (ITTO 2006).

Forest carbon. Deforestation is a significant factor in Venezuela's carbon budget, accounting for more than 40% of national GHG emissions (UNFCCC undated). Human interference has affected large areas of forest; many forests have been cleared for agricultural and pasture development and other projects. Gibbs et al. (2007) estimated the biomass carbon stock in a broad range of 2326–9202 MtC and FAO (2010) did not provide an estimate. An industrial plantation (Uverito) and a managed protected area (Ticoporo Reserve) have been used as case studies of carbon emissions reduction and sequestration. The Uverito plantation achieved a net carbon storage of 6.2 MtC in 100 000 hectares of new plantations at a net cost of US$17/tC (UNFCCC undated). The Ticoporo Reserve stored an estimated 75 tonnes of carbon per hectare, or 7.5 MtC for 100 000 hectares of natural forest management. The costs for this latter type of project were estimated at about US$700 per hectare, including the opportunity cost of land. Thus, the cost for carbon storage was an estimated US$9 per tonne of carbon (ibid.).

The Bolivarian Alliance of the Peoples of Our America, of which the Government of Venezuela is a member, made a submission to the Conference of the Parties to the UNFCCC in 2010 in which it proposed that polluting countries directly transfer financial and technological resources to pay for the restoration and conservation of forests and jungles, in favour of Indigenous peoples and ancestral social structures. While Venezuela is an active participant in climate-change negotiations, it does not participate in any of the major ongoing international REDD+ initiatives (Table 6).

Forest for protection

Soil and water. A significant area of forest is set aside for the protection of soil and water within ABRAEs. These forests are classified under 'normative protection' (*protección normada*) and include:

- Soil and watershed protection forests (*zonas protectoras*) – 7.9 million hectares.
- Watershed reserves (*reservas hidráulicas*) – 1.7 million hectares.
- Reserves for dams and reservoirs (*zonas de reserva para construcción de presas y embalses*) – 7800 hectares.
- Protected areas for public infrastructure (*áreas de protección de obras públicas*) – 133 400 hectares.
- Critical areas for restoration (*áreas críticas con prioridad de tratamiento*) – 4.5 million hectares.
- Environmental rehabilitation and protection areas (*áreas de protección y recuperación ambiental*) – 2350 hectares.[a]

Fourteen ABRAEs serve primarily watershed protection functions and extend over about 1.74 million hectares.[a] Large tracts of forests in the Guayana region help to regulate the flow of water into the Guri Dam, which provides 70% of the nation's electricity. The most extensive protected areas are in the Andean mountain belt, where forests are important in watershed protection.

Biological diversity. The country harbours a significant portion of the world's biodiversity, ranking in the top 20 countries in the number of endemic plants, birds, amphibians and reptiles (ITTO 2006). More than 8000 plant species have been recognized as endemic, as have some 122 amphibians, 66 reptiles, 40 birds and 15 mammals. Twenty-six mammals, 22 birds, two reptiles, 65 amphibians, four arthropods and

Table 6 Forest carbon potential

Biomass forest carbon (MtC)	% forest with canopy cover >60%	Deforestation/ degradation potential to 2030	Enhancement of carbon sink capacity to 2030	Forest area change monitoring capacity	Forest/ GHG inventory capacity	Importance of forest fire/ biomass burning	Engagement in international REDD+ processes
2326–9202	55	+++	++	++	++	+++	-

+++ high; ++ medium; + low; estimate of national forest carbon based on Gibbs et al. (2007); estimate of % total forest with canopy cover >60% based on UNEP-WCMC (2010).

three plants found in forests are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species (IUCN 2011). Four plants are listed in CITES Appendix I, 163, including *Swietenia macrophylla* and *S. humilis*, in Appendix II, and two in Appendix III (UNEP-WCMC 2011). Several timber species have special protection status under national law, including *Podocarpus rospigliosii, Pterocarpus* spp, *Spondias* spp, *Tabebuia espectabilis, Cedrela odorata, Anacardium excelsum, Cordia thaisiana* and *Pithecellobium saman*.[a]

Protective measures in production forests. The Law on Forests and Forest Management requires that 10% of the managed production forest be protected as a preservation zone, with emphasis on areas along watercourses and swamps.[a]

Extent of protected areas. The estimated total area contained in reserves compatible with IUCN categories I–IV is 17.9 million hectares[a], including 94 ABRAEs, as shown in Box 1.

This amounts to nearly 20% of the national territory, one of the largest proportions of any country worldwide. As well as forests, protected areas include montane ecosystems and other non-forested areas. UNEP-WCMC (2010) estimated the total area of forests in protected areas conforming to IUCN protected-area categories I–IV at 16.5 million hectares. Although the declared protected area is huge, only about 15–20% has land-use and zoning plans. In addition, many conservation sites are subject to unresolved land claims by Indigenous groups (ITTO 2006). Some of the protected areas (e.g. the protected area classified within the Imataca Forest Reserve in northeastern Venezuela) have been seriously affected by commercial gold and diamond mining. In 2008 the President of Venezuela ordered a complete cessation of mining activities in protected areas.[a]

Estimate of the area of forest sustainably managed for protection. Of the 265 ABRAEs with protection status (including 64 protected areas[a]), 71 have forest management plans (Bevilacqua et al. 2004). Thirty-five per cent of the protected areas in IUCN protected-area categories I–IV have management plans or instructions for their use (*reglamentos de uso*) (ibid.). However, many of these areas exist only on paper. Protected areas are used for logging and mining – both illegal and government-sanctioned – and other forms of development, while some protected areas have been designated despite being cleared long ago. It is difficult to secure the integrity of some of these areas, particularly in the *llanos* and south of Orinoco, because of mining and other explorative activities (ibid). For example, it has been reported that legal and illegal miners and loggers have encroached the Cainama National Park – famous for Angel Falls, the world's tallest waterfall – in recent years.[b] Nonetheless, much of the protected-forest estate is intact and faces relatively little development pressure.[a] It is estimated that about 10% of the protection PFE with management plans can be classified as sustainably managed (Table 7).

Socioeconomic aspects

Economic aspects. Forests provide less than 1% of GDP.[a] Data on the number of people employed in the forest sector were unavailable for this report.

Livelihood values. NTFPs are essential for the livelihoods of Indigenous peoples living in the Guayana and Amazon regions. Wildlife and fish still supplement the protein needs of a large part of the population in the states of Bolivar and Amazonas. Wildlife also provides raw material for handicrafts and medicines. Intensified hunting and fishing with new techniques and in-migration into frontier areas may increase pressure on some animal species

Box 1 Protected areas, Venezuela

ABRAE	Number	Area ('000 ha)	% of land area
National parks (*parques nacionales*)	43	13 100	14.3
Natural monuments (*monumentos naturales*)	36	4280	4.7
Wildlife refuges (*refugios de vida silvestre*)	7	251	0.3
Wildlife sanctuaries (*santuario de fauna silvestre*)	1	0.072	0
Wildlife reserves (*reservas de fauna silvestre*)	7	293	0.3
Total	**94**	**17 900**	**19.5**

Source: Government of Venezuela (2010).

Table 7 Management of the protection PFE ('000 hectares)

Reporting year	Protection PFE	Attributed to IUCN categories I–IV	Allocated for soil and water	With management plans	Sustainably managed
2005*	20 600	20 600	1740	7210	-
2010	**19 640**	**16 500****	**1740‡**	**7250†**	**725**

* *As reported in ITTO (2006).*
** *UNEP-WCMC (2010).*
‡ *Including* reservas hidráulicas, zonas de reserva para construcción de presas y embalses *and* áreas de protección de obras *públicas.*
† *Including the protected area in the new management plan of Caparo.*

(ITTO 2006). Some 20 000 Warao Indians in the Orinoco delta have a semi-nomadic lifestyle and depend heavily on mangroves for fishing (Spalding et al. 2010).

Social relations. Significant populations of Indigenous people live in three forest reserves – Sipapo (1.2 million hectares) in Amazonas; Imataca (3.7 million hectares) in Amacuro Delta and Bolívar; and El Caura (5.1 million hectares) in Bolívar. The two main economic activities in these reserves are logging and mining for gold and diamonds, which have brought improved health and education services to local people and induced a trend towards settlement (ITTO 2006). They have also brought non-indigenous settlers (*colonos*) into the areas, increasing conflicts with local people and pressure on existing forest resources, especially along access roads and around settlements. North of the Orinoco River, particularly in the Province of Barinas bordering Colombia, nearly all forest reserves have been encroached by *colonos*.

Summary

Venezuela possesses considerable untouched forest resources in its two largest states of Bolivar and Amazonas. Relatively modest logging concessions and cutting permits have been granted over the past 40 years. Instead of increasing the harvest of natural forests, a well-developed plantation sector is the most important source of industrial timber in the country. Over the past few years, the government has made many political and institutional changes to the forest sector, maintaining strong environmental provisions and increasing legislative provisions for the inclusion of local communities in forest management. SFM has not yet been fully achieved, however. The enforcement of forest regulations still requires strengthening and illegal logging, hunting and encroachment (e.g. mining) are reportedly widespread. Nevertheless, a basis has been laid for the development of SFM and effective forest conservation.

Key points

- Venezuela has an estimated PFE of 33.4 million hectares (compared with 34.5 hectares in 2005), comprising 12.9 million hectares of natural production forest (compared with 13.0 million hectares in 2005) and 19.6 million hectares of protection forest (compared with 20.6 million hectares in 2005).
- Venezuela has the second-largest extent of planted forests in tropical America, with a plantation estate of 845 000 hectares. The government has ambitious plans to continue increasing the estate.
- An estimated 510 000 hectares of the production PFE and 725 000 hectares of protection PFE are under SFM. No natural forest is certified.
- The forests north of the Orinoco River (*llanos*) are heavily degraded and encroached. South of the Orinoco River are extensive and timber-rich forest resources with good potential for SFM, although this area is under increased pressure, with new roads and planned conversion to agriculture.
- A national forest inventory is currently being conducted and a forest database is under establishment, which will help improve the monitoring of forest resources and the implementation of SFM.
- The Ministry in charge of forests and the Forest Service have proposed revisions to the main forest-related laws and are currently formulating a new forest policy.
- A national forest enterprise (*Empresa Socialista Forestal)* was created in June 2010 that will probably replace the former forest concession structure.

Endnotes

a Government of Venezuela (2010).

b Information derived from the report of, and discussions with participants at, a training workshop on ITTO criteria and indicators, held 30 August–4 September 2004, Cuidad Bolivar, Venezuela, attended by 47 people from government, civil society and the private sector, updated through email exchanges in 2010.

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