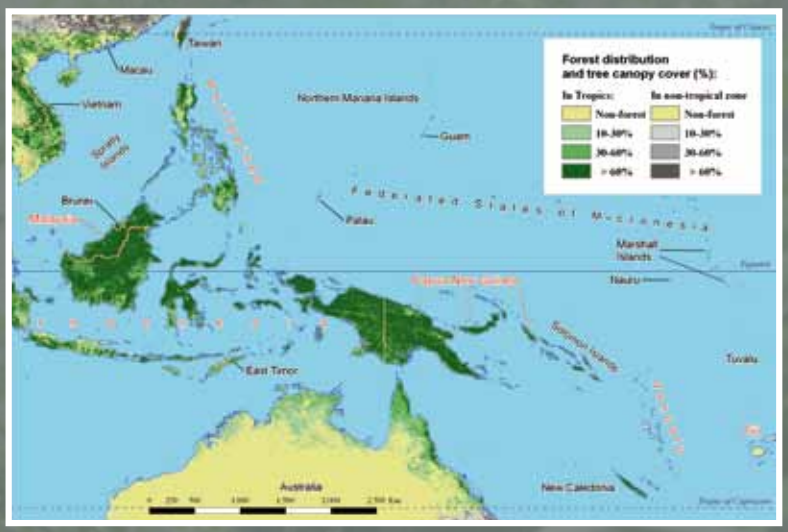
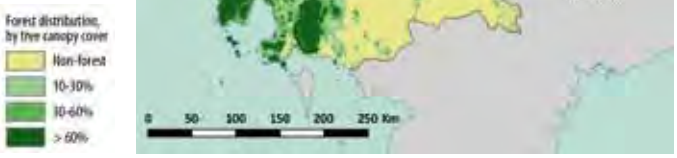
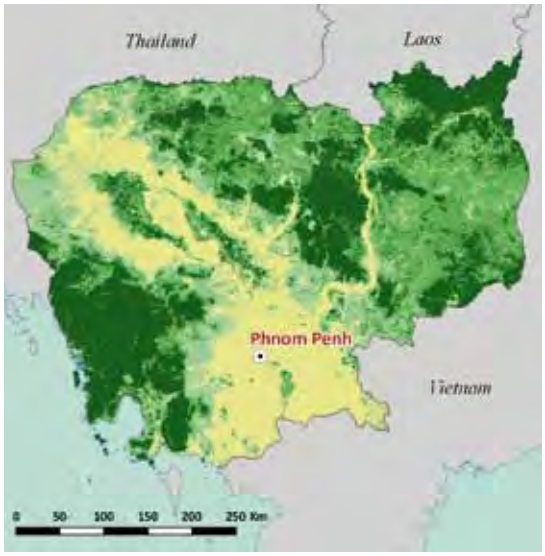
Embargoed for Release until 12:01 GMT on 7 June 2011

ASIA AND THE PACIFIC



CAMBODIA





Forest resources

In 2010 Cambodia's estimated population was 15.1 million people (United Nations Population Division 2010); it is ranked 137th out of 182 countries in UNDP's Human Development Index (UNDP 2009). Geographically, Cambodia is dominated by a large alluvial central plain, through which courses the Mekong River. Mountains and plateaux surround the central plain except in the southeast. The country also contains the largest freshwater lake in Southeast Asia, the Tonle Sap Lake. The climate of Cambodia is tropical, dominated by the annual monsoon cycle, which is accompanied by alternating wet and dry seasons. Cambodia has a relatively large forest resource: FAO (2010) estimated natural forest cover at 10.0 million hectares, which is 55% of the land area (18.1 million hectares). The Government of Cambodia (2011) estimated the forest area at 10.7 million hectares.

Forest types. The Forest Administration conducted an assessment of national forest cover change assessment in 2006 using Landsat ETM+ satellite imagery data. According to this assessment, forest cover comprises the following[a]:

- Evergreen forest – 3.67 million hectares, with the main characteristic species *Dipterocarpus dyeri, D. corbatus, D. alatus, Anisoptera cochinchinensis, Hopea* spp, *Roherea vulgaris* and *Syzygium* spp.
- Semi-evergreen forest – 1.36 million hectares, composed of deciduous dipterocarps such as *Dipterocarpus intricatus, D. obtusifolius* and *Shorea obtusa.*
- Deciduous forest – 4.69 million hectares, composed of deciduous dipterocarps such as *Dipterocarpus intricatus, D. obtusifolius* and *Shorea obtusa.*
- Wood shrubland (dry) – 37 000 hectares, wood shrubland evergreen – 96 000 hectares, and bamboo – 36 000 hectares.
- Other forest – 971 000 hectares, including 73 000 hectares of mangroves (Spalding et al. 2010).

Forests in the west are mainly evergreen and the northeast is largely covered by deciduous forests. The southern and central parts of the country have less forest cover and face a shortage of wood supply, in particular for fuel.

Permanent forest estate. Under the 2003 Law on Forestry, Cambodia's PFE is composed of permanent forest reserves and private forests. Permanent forest reserves consist of three categories: production forests, protection forests and 'conversion forestland'. Production forests comprise forest concessions; production forests not under concession; rehabilitated forests; reserve forestland for reforestation or tree plantations; reserved forestland for forest regeneration; degraded forestland; and community forests under agreement. 'Conversion forestland' is defined as "idle land, comprised mainly of secondary vegetation, not yet designated for use by any sector that shall be classified as permanent forest reserves until the Royal Government decide[s] to use and develop the land for another purpose".[a]

In its submission to ITTO for this report, the Government of Cambodia reported that its PFE comprised all extant forest because the Law on Forestry does not define 'non-PFE'.[a] In the ITTO estimate of PFE given in Table 1, however, the estimated area of conversion forestland has been excluded. As of May 2009, about 1000 km of the PFE boundaries had been demarcated in the field.[a]

The 2010 estimate of PFE is slightly higher than the 2005 estimate. The two estimates are not

Table 1 Permanent forest estate

Reporting year	Estimated total natural forest area, range (million ha)	Total closed natural forest ('000 ha)	PFE ('000 hectares)			
			Production		Protection	Total
			Natural	Planted		
2005*	9.33–11.1	5500	3460	17	4620	8097
2010	**10.0–10.7**	**3900**	**3710[b,**]**	**69[‡]**	**4530[†]**	**8309**

* *As reported in ITTO (2006).*

** *Comprises 3.37 million hectares of former or suspended forest concessions and about 331 000 hectares of community forests that are either operating under community forest agreements (as per the Law on Forestry) or are awaiting MAFF approval (Government of Cambodia 2009a).*

‡ *FAO (2010).*

† *Comprises 1.43 million hectares of protected forests under the jurisdiction of the Forest Administration and 3.10 million hectares of protected areas under the jurisdiction of the Ministry of Environment.*

directly comparable, however: the 2005 estimate comprised the area of forest under concessions at the time, plus the area of protection forest.

Forest ecosystem health

Deforestation and forest degradation. FAO (2010) estimated that forest cover declined by about 637 000 hectares between 2005 and 2010 and by 2.85 million hectares between 1990 and 2010. The Government of Cambodia reported that, in the period 2003–2007, 899 000 hectares of forest were converted legally to agricultural uses and another 224 000 hectares were converted illegally.[a] Estimates of the extent of illegal logging or shifting cultivation and the impacts of fire, storms, drought and pests and diseases on the forest estate were unavailable.[a] In the period 2002–06 the most significant loss of forests occurred in the northwest of the country, notably Banteay, Meanchey, Battambong, Siemreap, Oddar Meanchey and Pailin provinces (Forest Administration 2010).

An estimated 322 000 hectares of primary forest remain in Cambodia, but no data were available on the area of degraded primary forest, secondary forest or degraded forest land (Table 2). Slash-and-burn agriculture, forest land encroachment and land-grabbing are the main causes of forest fire.[a] Issues related to forest fire are generally considered to be a low priority in the country (Fuels and Fire Behaviour Research Capacity Building Project 2008).

Vulnerability of forests to climate change. According to McSweeney et al. (undated), the mean annual temperature of Cambodia increased by 0.8 °C between 1960 and 2005, a rate of around 0.18 °C per decade. The frequency of hot days and hot nights has increased significantly since 1960 in most seasons, but mean rainfall has not shown any consistent change. The mean annual temperature is projected to increase by 0.7–2.7 °C by the 2060s, and by 1.4–4.3 °C by the 2090s (ibid.). All climate-change models predict an increase in rainfall until 2060.

Adapting to climate change and mitigating its effects on forest-based livelihoods is a strategic objective of Cambodia's National Forest Program. Cambodia prepared a NAPA in 2007. According to it, the area of wet forest will decrease while the area of moist forest will increase and the area of dry forest will remain more or less the same. Forest productivity and biodiversity will change accordingly (Government of Cambodia 2007). Climate change and forest degradation in combination may result in increased soil erosion (ibid.). A series of projects are proposed in the NAPA to address these concerns.

Table 2 Forest condition

	PFE	Non-PFE	Total
	'000 ha		
Area of primary forest	-		322
Area of degraded primary forest	-	-	9703
Area of secondary forest	-	-	-
Area of degraded forest land	-	-	-

SFM policy framework

Forest tenure. The 2001 Land Law sets out a comprehensive system of land classification and land ownership rights. It includes provisions on social and economic land concessions, Indigenous land rights, land registration and land-dispute resolution, and it authorizes the enactment of a series of other sub-decrees and legislation. All forests are owned by the state (Table 3). While there is provision in the 2003 Law on Forestry for private forests, there are no privately owned forests.

As much as 85% of Cambodia's population lives in rural areas (Government of Cambodia 2009a). Under the 2003 Law on Forestry (Article 40) the state recognizes the use rights of communities for the purpose of traditional customs, beliefs, religion and living. No forest land is owned by Indigenous communities, but 124 community forests covering a total area of 145 000 hectares in six provinces (Siem Reap, Kampong Thom, Oddar Meanchhey, Koh Kong, Bantaey Meanchhey and Kampong Leng-Kampong Chhnang) have been established for (extendable) 15-year terms under community forestry agreements (an additional 140 sites over about 186 000 hectares have been recognized by provincial authorities but are awaiting approval by the Ministry of Agriculture, Forestry and Fisheries – MAFF).[a] The Government of Cambodia has expressed an intent to extend the area of community forests to 2 million hectares (Government of Cambodia 2009a).

Land appropriation in various forms and conflicts over land-use rights are reportedly widespread (Fraser Thomas Limited 2009), to the extent that, in 2006, the Cambodian Centre for Human Rights reported that land disputes were the "human rights and social problem number one" for rural Cambodians participating in its regular public forums (Centre on Housing Rights and Evictions 2008). In 2006 the Government of Cambodia established the National Authority for Land Dispute Resolution, although this has been criticized as creating "another level of bureaucracy that further confuses the situation" (International Federation for Human Rights 2007).

Criteria and indicators. Cambodia has developed a national format based on the ITTO C&I consisting of seven criteria and 59 indicators for monitoring, assessment and reporting on progress towards SFM.

Table 3 Forest area, by tenure

Ownership category	Total area	Of which PFE
	'000 ha	
State ownership (national, state or provincial government)	10 100	8 336
Other public entities (e.g. including municipalities, villages)	0	0
Total public	**10 100**	**8 336**
Owned by local communities and/or Indigenous groups	0	0
Privately owned by individuals, firms, other corporate	0	0

Source: Government of Cambodia (2009b).

The seven criteria are: extent of forest resources; biological diversity; forest health and vitality; productive functions of forest resources; protective functions of forest resources; socioeconomic functions; and legal, policy and institutional framework. The Government of Cambodia, through its Forestry Administration, used the ITTO C&I in its submission to ITTO for this report.[a]

Forest policy and legislation. In July 2002 the government adopted a national forest policy with the following objectives: to conserve and sustainably manage the country's forest resources; to establish the remaining forest reserves as PFE; to promote the maximum involvement of the private sector and the participation of local people; to establish a coordinated multi-stakeholder process for forestry development; and to promote programs of forestation on arable lands and farms. Forests are also a priority under the National Strategic Development Plan (see Box 1).

The 2003 Law on Forestry, which replaced Decree No 35 of 1988, defines the framework for the management, harvesting, use, development, conservation and protection of forests. The major stated objective is to ensure SFM and customary user rights for local communities. The law refers to a total of 28 regulations, of which eleven remain under preparation by the Forest Administration. For the law to be effective, law enforcement capability needs to be strengthened.[a]

The 2003 Law on Forestry has been criticized because it does not define forest and therefore risks overlapping and competing with other land-related laws, with the result that it "adds to the confusion

that prevails when demarcating the types of lands that can be legally given away for private investment and brought into land markets, and those that should be preserved as public goods" (Guttal 2006).

Box 1 Forests in national planning

At the national level, the Rectangular Strategy for Growth, Employment, Equity and Efficiency (Phase II), supported by the National Strategic Development Plan and supplemented by the Cambodia Millennium Development Goals, emphasizes "ensuring environmental sustainability" and prioritizes the sustainable management and use of natural resources, including forests. The National Strategic Development Plan covers the period of the Fourth Legislature of the National Assembly (2008–13) and sets a national target of 60% forest cover, 450 approved community forests, and a reduction in the dependence on fuelwood of 19% by 2013. The Cambodia Millennium Development Goals also set goals and indicators for the forest sector by 2015, including an increase in the total area of forest and the area of protected forest, and a decrease in fuelwood dependency.

Source: Gurung et al. (2011).

A number of guidelines and codes serve to regulate forest management, including the Cambodian Code of Practice for Forest Harvesting (1999), the construction code for forest engineering works, guidelines for SFM, and a planning manual for the management of forest concessions. In its submission to ITTO for this report, the Government of Cambodia listed one law, three Royal decrees, 14 sub-decrees, one statement, one declaration, ten prakas (declarations), one co-prakas, two announcements, one decision, two orders and one circulation that are relevant to the sustainable management of the country's forests.[a]

The National Forest Program has six sub-programs (Forest Administration 2010):

- forest demarcation, classification and registration
- forest resource management and conservation
- forest law enforcement and governance
- community forestry
- capacity and research development
- sustainable forest financing.

In mid 2007 a partnership between Cambodia and the National Forest Programme Facility was established to strengthen the implementation capacity of the national community forestry program; promote the development of technologies that support community livelihoods and the responsible governance of forest resources management; and seek opportunities to integrate tree seed genetic conservation into community forestry.[1]

Stakeholders have been widely consulted on the National Forest Program and their ideas, comments and suggestions have been taken into account to improve forest management planning and implementation.[a]

Institutions involved in forests. The Forest Administration, which is under MAFF, is responsible for managing forest resources according to the National Forest Sector Policy and the Law on Forestry. Nevertheless, there appears to be some overlap in responsibility with the Fisheries Administration (also under MAFF), which is responsible for the management of 'flooded' forests, and the Ministry of Environment, which is responsible for the management of protected areas.[a] The Ministry of Land Management, Urban Planning and Construction is responsible for identifying the land use, classification and registration of state land to prevent forest encroachment.

In 2003 the Forest Administration was restructured to decentralize power. It now comprises four inspectorates, 15 cantonments, 55 divisions and 170 triages (the lowest subdivision of the Forest Administration) at the local level.

The Forest Administration's GIS and Remote Sensing Unit produces national forest-cover maps and local maps supporting forest demarcation, the evaluation of forest function and forest management plans. The unit is well-organized and capable of producing forest maps by visual interpretation. It is currently receiving training on automated remote sensing analysis (Government of Cambodia 2009a).

Status of forest management

Forest for production

Before 1970 the forests of Cambodia were managed conservatively. Forests were classified into reserves managed for specific objectives such as production,

1 www.nfp-facility.org.

wildlife conservation, research and preservation. The French colonial era ended in Cambodia in 1954 but the centralized forest management system established during it was continued until the early 1970s when a civil war erupted.

In the period 1975–1980, forest governance was destroyed under the Khmer Rouge regime. After the defeat of the Khmer Rouge the forest sector was reformulated under a centralized system (managed by the Department of Forestry and Wildlife) with very limited capacity and almost no equipment or transport capability.

In the early 1990s, a system of forest concessions was introduced. In Cambodia, harvesting intensity is expressed in terms of the volume of merchantable timber or the percentage of the standing merchantable volume to be removed. The rate of extraction in evergreen and mixed evergreen forest was set at 30% of the total volume available for harvest. Before 1993, felling was mainly done manually using axes and extraction was by buffalo or elephant, but harvesting has been mechanized since the advent of logging concessions.

The hasty introduction of the concession system in 1994 caused widespread damage to the forest. Field inspections and observations indicated that "the state of the current concession forest management is alarmingly at odds with the goal of sustainability" (World Bank 2000). There was no reliable assessment of resources and the processing facilities set up had significant over-capacity. The period 1994–1998 was also one of uncontrolled illegal logging, and wood extraction soon reached unsustainable levels (ITTO 2006). Attempts to get the concessionaires to manage their forests sustainably and pay more taxes did not meet with success. Most companies continued to log high-value species as quickly as possible, without following the prescribed 25-year harvesting cycle (the nominal duration of the concession). The recommended level of harvest was an average of 10 m^3 per hectare, but this would scarcely have been economically viable and concessionaires typically harvested four to five times that amount (ibid.).

Between 1994 and 1997 the government granted 36 commercial forest concessions covering about seven million hectares or around 70% of Cambodia's forests. In this way, the government sought to raise much-needed revenue for national development. Foreign timber companies started investing from late 1994, peaked in 1996, and the last concession was granted in 1997. In 1998 the government began to restructure the sector through the Forestry Reform Program supported by the World Bank. In 2000 the Forest Administration stipulated that no cutting permits would be issued until 100% inventories of current annual coupes had been completed, 5% inventories had been carried out for the next four annual coupes, and the companies had made the required minimum royalty payments (ITTO 2006).

In 2001 the government introduced additional legal requirements for concessions, such as the preparation of long-term strategic forest management plans consistent with international standards, and the renegotiation of model forest concession investment agreements. In December 2001 the government suspended all logging activities in concessions. The licences of 17 companies covering 3.50 million hectares in 24 concessions were cancelled and twelve concessions covering a total area of 3.37 million hectares were suspended. In addition the Forest Administration closed, and sometimes destroyed, 1351 illegal sawmills and 653 small wood-processing plants (ITTO 2006).

Some concessionaires have prepared strategic forest management plans according to the model, including an environmental and social impact statement, for review by the Ministry of Environment. Strategic forest management plans have three levels:

- A long-term forest management plan for an entire concession based on the length of the contract (20–30 years).
- A medium-term forest management plan for a compartment (3–5 years).
- Annual planning for coupes and blocks, focusing on yield planning for a one-year period.

According to the Government of Cambodia an area of 6.24 million hectares is under management plans[a], but given the logging ban the status of these plans is unclear. There was no legal logging in the period 2004–07.[a] In 2007, however, a system of annual bidding coupes was introduced for forests not under concession with the primary aim of meeting domestic wood needs. Under this

Shifting cultivation in Cambodian evergreen forests.

system, divisions of the Forest Administration conduct inventories, tree-marking and social and environmental impact assessments for annual coupes and prepare one-year management plans. When a management plan is approved by the chief of the Forest Administration the coupe is offered for public bidding and the successful bidder harvests the coupe according to the management plan. Monitoring is conducted centrally by the Forest Administration.

As of 2009 the Forest Administration had issued three bidding coupe management plans to three separate companies covering, in total, 5000 hectares.[a] No harvesting permits were issued between 2004 and 2007 due to the suspension of logging in concessions.

The MAFF has created the Cambodian Forestry Stamp in order to:

- Mark legal logs prior to their removal from first log landing.
- Mark illegal logs that are evidence of forest offences.

All trees in the coupe that are allowed to be felled should be marked with the Cambodian Forestry Stamp. A Forest Administration official assesses the quality and quantity of the harvested forest products and records the information in 'Book A', which needs to be approved by the Forest Administration chief. After the payment of royalties and premiums to the government, logs are given four marks with the Cambodian Forestry Stamp on both cutting ends prior to transport from the first landing. A transport permit is issued to allow the transportation of the log to its final destination. Logs impounded or detained by the Forest Administration are given three marks of the Cambodian Forestry Stamp in a triangular shape on both cutting sides and in the middle.

The preparation of forest management plans is hindered by the difficulty in obtaining data at the sub-national level. Many local communities have limited education, which makes any public consultation and planning difficult. Nevertheless, the Government of Cambodia reported the existence of 65 management plans covering 6.24 million hectares (a significantly larger area than

the total estimated production PFE), although no additional information on the nature of these management plans was available.[a] MAFF has also issued small-scale harvesting permits without the need for forest management plans, especially for *Hopea odorata*, which is used in boat-making.[a]

Despite the ban on logging, a report by the NGO Global Witness (Global Witness 2007) alleged that Cambodia's army, military policy, police and Forest Administration are all "heavily involved in illegal logging" and made specific allegations against a number of people. The international monitoring company SGS was contracted by the Government of Cambodia as the independent monitor of forest crime monitoring and reporting in Cambodia in 2003–05. In response to the Global Witness report the company stated that, while it was not within the SGS mandate to conduct criminal investigations beyond field verification of the facts presented in Forest Administration and Ministry of Environment reports or in other reports received from individuals or organizations, "No verifiable evidence related to the persons named in the Global Witness report was ever submitted to SGS by any organisation" (SGS 2007). An ITTO diagnostic mission reported in 2004 that timber was available in major towns and prices were stable, an indication that the effect of the logging ban had been to stimulate a significant illegal timber industry (ITTO 2004).

Silviculture and species selection. The model forest concession agreement and the SFM guidelines require that forests are managed under a selective cutting system based on AAC and size specifications. The guidelines have elaborate provisions for the demarcation of area, inventory, tree-marking, stream buffers and conservation measures, roading standards, skid-trail alignment, directional felling, the location of log landings, post-logging operations, etc. These guidelines are being implemented to a certain extent in the annual bidding coupes. Pre-inventory and post-harvest inventories could be used for monitoring and evaluating the cumulative effects of the silvicultural system over time.[a] Table 4 shows the main species harvested in the annual bidding coupes.

Planted forest and trees outside the forest. In its submission to ITTO for this report, the Government of Cambodia did not provide data on planted forests.[a] FAO (2010) reported a planted forest area of 69 000 hectares and an annual

Table 4 Commonly harvested species for industrial roundwood

Species	Notes
Dipterocarpus alatus (chhoeuteal tan)*	Sawnwood, veneer, plywood; 7221 m^3 average annual harvest over three years to 2008.
Anisoptera glabra (mersawa, phdiek)*	Sawnwood, veneer, plywood; 5001 m^3 average annual harvest over three years to 2008.
Sindora coshinchinensis	1337 m^3 average annual harvest over three years to 2008.
*Tarrietia javanica**	Sawnwood (decorative, furniture); 691 m^3 average annual harvest over three years to 2008.
Parinarium annaamensis	901 m^3 average annual harvest over three years to 2008.

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

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*	3460	3370 (suspended)	150	0	0	17	7	0
2010	**3710**	**5****	**150‡**	**0**	**0**	**69**	**-**	**0**

* *As reported in ITTO (2006).*
** *Annual bidding coupes issued by the Forest Administration. In addition, MAFF has issued small-scale harvesting permits, but the area covered by these is unreported.*
‡ *Although the Government of Cambodia (2009b) reported that 6.24 million hectares of forest were under management plans, the nature and status of those management plans is unclear. Therefore, the estimate reported in ITTO (2006) is repeated here.*

plantation establishment rate (in 2003–07) of 5855 hectares.

Forest certification. The Government of Cambodia has expressed interest in developing a national forest certification system, and the Law on Forestry (2003) includes several of the requirements for certification (FAO 2010). However, as of November 2010 no forest had been certified in Cambodia (e.g. FSC 2010).

Estimate of the area of forest sustainably managed for production. No evidence is available to suggest that any forest in Cambodia's natural-forest production PFE is under SFM (Table 5).

Timber production and trade. Recorded wood production in Cambodia fell when forest concessions were cancelled or suspended; industrial log production was estimated to have been constant at 118 000 m^3 per year in the period 2005–09, compared to 130 000 m^3 in 2004 and 291 000 m^3 in 1999 (ITTO 2011). The recorded timber is obtained from government-approved land conversion activities and from annual bidding coupes. As indicated above, however, illegal logging was reportedly significant, at least in the mid 2000s. The reported volume of timber exports was small in 2009, comprising 3450 m^3 of logs and 17 000 m^3 of sawnwood (ibid.).

Non-timber forest products. Many rural people depend on NTFPs to supplement subsistence needs and generate income; it has been estimated, for example, that about 70% of the population of rural Cambodia relies at least partly on NTFPs for food and cash income, and that about 90% of farmers' income, especially in northeast Cambodia, comes from NTFPs (Lund 2006). A survey of 502 households in four provinces found that most poor households derived 10–40% of their livelihood value from NTFPs, most better-off households derived 0–20% of their livelihood value from NTFPs, and a few poor households were highly specialized in NTFP collection (Hansen 2006). In 2005 an estimated 559 tonnes of bamboo, 185 tonnes of liquid resin and 4.5 tonnes of rattan were harvested in forests (FAO 2010).

Forest carbon. Mitigating the effects of climate change on forest-based livelihoods is a strategic objective of the National Forest Program. The program includes the development of carbon-based financing mechanisms and considers the CDM and REDD as possible sources of forest-sector financing (Forest Administration 2009a). Data on forest carbon are inconclusive; Gibbs et al. (2007) estimated the national-level forest biomass carbon stock at 957–1914 MtC, Eggleston et al. (2006) estimated it at 1222 MtC and FAO (2010) estimated it at 464 MtC. The country is undertaking a national REDD readiness process with the support of the Forest Carbon Partnership Facility and UN-REDD (Table 6). The Forest Administration is responsible for REDD-related activities; for example, it is the designated seller of forest carbon. The implementation of REDD is undertaken by an informal REDD working group led by the Forest Administration, which includes representatives of key line agencies (e.g. the Ministry of Environment, the Fisheries Administration and the Ministry of Land Management, Urban Planning and Construction), development partners and civil-society groups. It reports to both the Technical Working Group on Forestry and Environment (the main forum for review by government and development partners) and the National Climate Change Committee. Two government-approved REDD pilots, in Oddar Meanchay Province in the northwest and in Mondulkiri Province in the southeast, are receiving technical support from PACT Cambodia and the Wildlife Conservation Society.

Forest for protection

Soil and water. There are laws, rules and regulations (eg the 2003 Law on Forestry, Royal decrees 1993 and 1999, and sub-decrees 75, 76 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 the international REDD+ processes
957–1914	39	++	+++	+	+	++	+++

+++ 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 2 Number of endangered, rare and threatened forest-dependent species, Cambodia

Forest-dependent species group	Total species	Of which			Important species
		Endangered	Legally protected	Endemic	
Trees	930	78	930	-	*Diospyros* spp, *Dalbergia cochinchinensis, Dalbergia bariensis, Afzelia xylocarpa, Pterocarpus pedatus*
Flowering plants	-	-	-	-	-
Ferns	-	-	-	-	-
Mammals	133	22	123	80	*Pseudonovibos spiralis, Bos sauveli, Naemorhedus sumatraensis, Manis javanica, Rhinoceros sondaicus*
Birds	548	8	545	340	*Leptoptilos dublus* (greater adjutant), *Pseudibis davisoni* (white-shouldered ibis), *Pseudibis gigantea* (giant ibis), *Stema acuticauda* (black-bellied tern), *Ephippiorhynchus asiaticus* (black-necked stork)
Reptiles	97	7	88	50	*Nja kaouthia* (monocled cobra), *Naja siamensis* (Indochinese spitting cobra), *Ophiophagus hannah* (king cobra), *Lycodon cardarmimensis* (Cardarmom wolf snake)
Amphibians	35	01	28	3	-
Freshwater fish	500	21	500		Giant barb, *Thynnichthys thynnoides*, Seven-line barb, thicklip barb, thinlip barb, *Tor sinensis*
Butterflies	59		59		*Stichophthalma cambodia* (Cambodian junglequeen), *Meandrusa gyas* (brown gorgon), *Actias rhodopneuma* (lunar moth), *Actias maenas* (maenas silkmoth), *Actia sinensis* (moon moth)

Source: Government of Cambodia (2009b).

77) addressing the role of forests in the protection of soil and water. The general procedures for ensuring the protection of downstream catchments values is stated in the Cambodian Code of Practice for Forest Harvesting (Section 4) and in the Guideline for Sustainable Forest Management, but these are not being implemented or monitored.[a]

Biological diversity. Fauna surveys covering about 305 000 hectares of the production forest estate were conducted by the Wildlife Conservation Society in 2001 and by Conservation International (covering about 402 000 hectares of the protection forest estate) in 2005.[a] The data in Box 2 are derived largely from those surveys.

Thirty-three mammals, eleven birds, three amphibians, two reptiles and one plant found in forests are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species (IUCN 2011).Three plants are listed in CITES Appendix I and 34 in Appendix II (UNEP-WCMC 2011).

Protective measures in production forests. Detailed guidelines have been developed for commercial forestry operations in order to protect watersheds and to prevent or minimize soil erosion and stream siltation. Regulations also provide for wildlife protection.

Extent of protected areas. The Government of Cambodia estimates that the total area of forests in protected areas that conform to IUCN protected-area categories I–IV is about 4.05 million hectares, comprising evergreen forest, semi-evergreen forest, deciduous forest, dry wood shrubland and evergreen wood shrubland.[a] This is an increase of nearly 700 000 hectares over the area reported in ITTO (2006), but no information is available on the nature of this change. UNEP-WCMC (2010) estimated the total area of forest in IUCN protected-area categories I–IV at 3.85 million hectares.

Of the 25 protected areas in IUCN categories I–IV reported by the Government of Cambodia, twelve are in IUCN categories I and II and 13 are

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*	4620	3360	4200	-	-
2010	**4530**	**4050[a]**	**551****	**1490[a]**	**-**

* *As reported in ITTO (2006).*
** *FAO (2010).*

in categories III and IV.[a] Overall, the number of protected areas in categories I–IV has decreased over that reported in ITTO (2006), but no information is available on the reasons for this change.

Estimate of the area of forest sustainably managed for protection. There are management plans for nearly 1.5 million hectares of forest in protected areas.[a] No additional information was available for this report on the management status of the protection PFE (Table 7).

Socioeconomic aspects

Economic aspects. The Government of Cambodia reported that, since all forest logging activities were suspended in 2001, the forest sector made no contribution to national GDP in the period 2003–08.[a] However, this does not take into account illegal activities or subsistence and traditional uses, the official logging of annual bidding coupes, or logging carried out under small-scale harvesting permits. No recent information is available on employment, income, recreational facilities or other benefits.

Livelihood values. Few data are available on the quantity of forest products harvested for subsistence use. No quantitative data are available on the role of NTFPs in maintaining livelihoods[a], although, given that an estimated 85% of Cambodia's population is rural, this role is considerable.

Social relations. Under the Council for Land Policy, three pilot projects have been established to develop enabling legislation consistent with the 2001 Land Law for the registration of communal lands of Indigenous peoples. One of these pilots is in a heavily forested region (Government of Cambodia 2009a).

The country's community forestry program has increased in scope and size since 1992. A sub-decree on community forestry management (Sub-decree 79, 2 December 2003) provides for an increase in the number (and area) of community forests and encourages local communities to participate in SFM. The Forest Administration is committed to increasing the area of community forests to a total of 2 million hectares (Government of Cambodia 2009a), up from the 145 000 hectares that are currently covered by community forestry agreements involving 124 communities (although the Forest Administration 2010 reported that there were 377 community forestry areas covering 348 000 hectares). In 2004 the government established a community forestry office within the Forest Administration; this office supports the establishment of community forests and is in charge of developing the national community forestry program (Government of Cambodia 2009a).

There are articles in the Law on Forestry and the sub-decree on community forestry management to provide opportunities for communities to receive benefits from forest management. For example, the community may use the forest for traditional purposes without the need for permits. However, these articles have only been applied in the relatively small area of forest under community forestry agreements.[a]

The Forest Administration promotes capacity-building among Indigenous people, local communities and other forest-dwellers through its working group on the law/regulation extension program, a public-awareness program, and community forestry. The involvement of Indigenous people, however, is only moderate.[a] Poor roading in remote and rural areas causes difficulties in conducting forestry extension and forestry awareness programs in local communities.

The Government of Cambodia has established a national conflict-resolution committee and provincial conflict-resolution sub-committees to help resolve problems between forest stakeholders.[a]

Summary

Deforestation is still occurring at a rapid pace in Cambodia. Even though an estimated 85% of the country's people live in rural areas, only a small area of forest is under community forest management. Nevertheless, the Government of Cambodia is looking to increase this area to two million hectares and a community forestry office has been established within the Forest Administration. All forest is state-owned, and conflicts over land tenure are a significant problem. The area of natural forests under management plans appears to have increased in protection forests (and possibly in production forests) since 2005. Following a moratorium between 2004 and 2007 there have been moves to reintroduce commercial logging in natural forests, but to date the area of forest in which harvesting is permitted is small. Illegal logging is significant but unquantified.

Key points

- Cambodia has an estimated 8.31 million hectares of PFE, comprising 3.71 million hectares of natural production forest, 4.53 million hectares of protection forest and 69 000 hectares of industrial timber plantations. However, data on Cambodian forests are often inconsistent and unreliable.
- A moratorium on logging has been partially lifted, but no part of the production PFE is considered to be under sustainable management. Insufficient information was available to estimate the area of protection PFE under sustainable management.
- The rates of both legal and illegal deforestation are significant.
- A 'forestry stamp' has been created to assist with log-tracking and the prosecution of illegal logging.
- Forest-sector reforms have been developed but are yet to be implemented effectively; the enforcement of existing policies, laws and regulations remains weak.
- The Government of Cambodia has been an active participant in the development of REDD+, and two pilot projects are under way in the country.

Endnotes

a Government of Cambodia (2009b).

b ITTO estimate.

References and other sources

Centre on Housing Rights and Evictions (2008). *Respect for Housing, Land and Properties Rights in Cambodia.* Occasional Paper No 1. Centre on Housing Rights and Evictions, Geneva, Switzerland.

Eggleston, H., Buendia, L., Miwa, K., Ngara, T. & Tanabe, T. (eds) (2006). *IPCC Guidelines for National Greenhouse Gas Inventories.* Prepared by the National Greenhouse Gas Inventories Programme. Institute for Global Environmental Strategies, Kamakura, Japan.

FAO (2010). Global forest resources assessment 2010 country report: Cambodia (available at http://www.fao.org/forestry/fra/67090/en/).

Forest Administration (2009). Regional workshop on forest and climate change: REDD consultation support to ASEAN senior officers on forestry and UNFCCC focal points, conclusions and recommendations of the ASEAN workshop on forest and climate change. Forest Administration, Phnom Penh, Cambodia.

Forest Administration (2010). *Cambodia Forestry Outlook Study.* Prepared by the Forest Administration, Cambodia. Asia-Pacific Forestry Sector Outlook Study II. Working Paper No. APFSOS II/WP/2010/32. FAO, Bangkok, Thailand.

Fraser Thomas Limited (2009). Joint appraisal of the national forest programme, Cambodia, 4–14 August, 2009 conducted at the request of the Danish Ministry of Foreign Affairs. Fraser Thomas Limited, Auckland, New Zealand.

FSC (2010, website accessed November 2010). FSC certification database (searchable database available at http://info.fsc.org/PublicCertificateSearch).

Fuels and Fire Behaviour Research Capacity Building Project (2008). Milestone 4 (final) report. Fuels and fire behaviour workshop, Hanoi, Vietnam, December 2008. Department of Agriculture, Fisheries and Forestry, Canberra, Australia.

Gibbs, H., Brown, S., Niles, J. & Foley, J. (2007). Monitoring and estimating tropical forest carbon stocks: making REDD a reality. *Environmental Research Letters* 2 (available at http://iopscience.iop.org/1748-9326/2/4/045023/fulltext).

Global Witness (2007). *Cambodia's Family Trees: Illegal Logging and the Stripping of Public Assets by Cambodia's Elite.* Global Witness, London, UK.

Government of Cambodia (2007). *National Adaptation Programme of Action to Climate Change (NAPA).* Government of Cambodia, Phnom Penh, Cambodia (available at http://unfccc.int/resource/docs/napa/khm01.pdf).

Government of Cambodia (2009a). Readiness plan idea note. Submitted to the Forest Carbon Partnership Facility. Forestry Administration, Phnom Penh, Cambodia.

Government of Cambodia (2009b). Report of progress toward achieving sustainable forest management in Cambodia. Submission to ITTO by the Forestry Administration, Phnom Penh, Cambodia.

Government of Cambodia (2011). Readiness preparation proposal. Prepared for the Forest Carbon Partnership Facility. Forestry Administration, Phnom Penh, Cambodia.

Guttal, S. (2006). *Land and Natural Resource Alienation in Cambodia*. Rights and Resources Initiative, Washington, DC, United States (available at www.rightsandresources.org/documents/files/doc_414.pdf).

Hansen, K. (2006). Importance of NTFPs in national policies and strategies. In: Community Forestry International (ed.) *Proceedings of the Non-timber Forest Products (NTFP) Workshop and Seminar. 7–6 December 2006, Phnom Penh, Cambodia.*

International Federation for Human Rights (2007, website accessed August 2010). The human rights situation in Cambodia (available at www.fidh.org/The-human-rights-situation-in-Cambodia).

ITTO (2004). Achieving the ITTO Objective 2000 and sustainable forest management in the Kingdom of Cambodia. Report of the Diagnostic Mission. Presented at the 37th session of the International Tropical Timber Council, December 2004. ITTO, Yokohama, Japan.

ITTO (2006). *Status of Tropical Forest Management 2005*. ITTO, Yokohama, Japan (available at http://www.itto.int/en/sfm/).

ITTO (2011, website accessed March 2011). Annual Review statistics database (available at http://www.itto.int/annual_review_output/?mode=searchdata).

IUCN (2011, website accessed March 2011). IUCN red list of threatened species (searchable database available at www.redlist.org).

Lund, B. (2006). Keynote speech. In: Community Forestry International (ed.) *Proceedings of the Non-timber Forest Products (NTFP) Workshop and Seminar. 7–6 December 2006, Phnom Penh, Cambodia.*

McSweeney, C., New, M. & Lizcano, G. (undated, website accessed March 2011). UNDP climate change country profiles: Cambodia (available at http://country-profiles.geog.ox.ac.uk/).

SGS (2007). Forest crime monitoring and reporting in Cambodia: SGS' response to the "Cambodia's Family Trees" report by Global Witness, June 2007. SGS (available at http://www.illegal-logging.info/uploads/SGS_response_to_GW.pdf).

Spalding, M., Kainumu, M. & Collins, L. (2010). *World Atlas of Mangroves.* Earthscan, London, UK.

Gurung, J., Hou, K., Long, K. & Maginnis, S. (2011). Communities must see the plus in REDD+: REDD+ demonstration projects are providing important lessons for a REDD+ framework in Cambodia that works for communities. Co-chairs' summary of an international REDD+ readiness dialogue held in Cambodia in November 2010. The Forests Dialogue, New Haven, United States.

UNDP (2009). *Human Development Report 2009*. United Nations Development Programme, New York, United States.

UNEP-WCMC (2010). Spatial analysis of forests within protected areas in ITTO countries. UNEP–WCMC, Cambridge, UK. Data prepared for ITTO, 2010.

UNEP-WCMC (2011, website accessed March 2011). UNEP-WCMC species database: CITES-listed species (searchable database at available at www.cites.org/eng/resources/species.html).

United Nations Population Division (2010, website accessed January 2010). World population prospects: the 2008 revision (searchable database available at http://esa.un.org/unpp/p2k0data.asp).

World Bank (2000). Cambodia forest sector. Internal assessment report.

FIJI

Forest resources

In 2010 Fiji had an estimated population of about 854 000 people (United Nations Population Division 2010). The country is ranked 108th out of 182 in UNDP's Human Development Index (UNDP 2009). Located in the South Pacific it comprises more than 300 islands, of which about 100 are inhabited, with a total land area of 1.83 million hectares. The two largest islands, Viti Levu (1.02 million hectares) and Vanua Levu (556 000 hectares), make up 86% of the total land area; they are mountainous and volcanic in origin. The eastern sides of Viti Levu and Vanua Levu receive an annual rainfall of over 2500 mm, while the western portions receive less than 1700 mm annually. The estimated forest area (including planted forests) in 2010 was 1.014 million hectares (FAO 2010a).

Forest types. The predominant forest type is tropical rainforest, which occurs mainly on the eastern sides of Viti Levu and Vanua Levu. Small areas of remnant rainforest also occur in the grasslands on the western slopes, which themselves are mainly the result of repeated burning of the drier parts of the rainforests, and there are remnants of the original forest type and a fringe of deteriorating shrubland at the interface of the forest and the grasslands (ITTO 2006). Fiji has an estimated 40 000 hectares of mangroves (Spalding et al. 2010).

Permanent forest estate. There is no formally designated PFE in Fiji. A national forest inventory conducted in 2006–08 classified forest as multiple-use, protection, preserved or plantation. The estimate of PFE contained in Table 1 comprises protection forests (as classified by FAO 2010a) and planted forests, as these are deemed committed to permanent forest use. At present there is no natural-forest production PFE in Fiji, although 656 000 hectares are designated as 'multiple use' (FAO 2010a). The Government of Fiji is consulting with communities on the possible establishment of a PFE involving communally owned land.[a]

Forest ecosystem health

Deforestation and forest degradation. Most of the remaining natural forest in Fiji is on steep and broken mountainous country and is difficult to access. Overall there was no net change in forest cover between the areas reported by FAO (2010a) for 2005 and 2010: a reduction in closed forest from 602 000 hectares to 566 000 hectares was offset by an increase in open forest from 344 000 hectares to 388 000 hectares and in the area of planted forest. The estimated area of primary forest in 2010 (Table 2) was little different from that estimated for 2005 (FAO 2010a). Forests are subject to periodic wind damage of varying intensity, including cyclonic.

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*	0.82–0.93	747	0	113	241	354
2010	**1.014**	**566**	**0**	**176**	**43a**	**219**

* *As reported in ITTO (2006).*

Source: ITTO (2006), FAO (2010a), unless otherwise stated.

Table 2 Forest condition

	PFE	Non-PFE	Total
	'000 ha		
Area of primary forest	-	-	449
Area of degraded primary forest	-	-	-
Area of secondary forest	-	-	388*
Area of degraded forest land	-	-	-

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

In its submission for this report, the Government of Fiji estimated that there were 588 000 hectares of closed natural forest (which it defined as natural forest with crown cover by trees and/or ferns of 40–100% and ground cover of palms and/or bamboo of over 20%) and 362 000 hectares of open natural forest (which it defined as natural forest with crown cover by trees and/or ferns of 10–40% and ground cover of palms and/or bamboo of 50–80%).[a]

Vulnerability of forests to climate change. The rate of increase in temperature in the Pacific during the 20th century exceeded the global average, with data showing a global mean temperature increase of around 0.6 °C. The annual number of hot days and warm nights increased in the South Pacific in the period 1961–2000 (Griffiths et al. 2003). Recent studies also indicate that the frequency and intensity of tropical cyclones originating in the Pacific have increased in the last few decades (Fan & Li 2005, cited in FAO 2010b). By the end of the 21st century the temperature is projected to be at least 2.5 °C higher in the South Pacific compared with 1990. Sea-level rise is expected to exacerbate inundation, storm surges, erosion and other coastal hazards, threatening infrastructure, settlements and natural resources. In 2010 Fiji created a Climate Change Unit within the Department of Environment to coordinate a multi-sectoral team to address climate-change adaptation. Fiji is committed to implementing climate-change adaptation measures at the community level.

SFM policy framework

Forest tenure. There are three types of land tenure in Fiji: freehold, stateland and native land. The freeholder exclusively and privately owns the freehold title and may dispose of it as he or she pleases. Stateland comprises Schedule A, Schedule B, State Freehold, State Foreshore and Stateland without Title. Schedule A and Schedule B land is held by the state in trust for Indigenous landowners. Fijian communal units, commonly referred to as 'landowning units', own native land. These may be in the form of a *yavusa* (tribe), *mataqali* (clan), *tokatoka* (family unit), the chief in his titular position or descendants of a chief or lady (Native Land Trust Board – NLTB – 2010). Such units own 89% of unexploited forests and 84% of all Fijian forests, including planted forests (ITTO 2006). For the latter, companies (mostly government-owned) lease the land from its Indigenous owners but own the trees.

The NLTB, which was set up in 1940, deals with local resource management and administers all customary land with the consent of landowning units. FAO (2010a) reported a general trend in the reversion of land ownership from private individuals – mostly 'foreigners' – to Indigenous owners. Nevertheless, land tenure is in a state of flux and the ownership of some forest areas is unclear; the total area classified by tenure in Table 3, therefore, is less than Fiji's total forest area.

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

Forest policy and legislation. The forest policy of Fiji was enacted in 1950 by the then Legislative Council. The sawmilling policy, formulated in the 1960s, was amended in 1995 to support the modernization of the industry. The 1992 Forest Decree updated and simplified the 1953 Forest Act.

A new national forest policy was issued in 2007 after three years of multi-stakeholder consultation. The policy provides a new direction for the development of the forest sector and was agreed to by all stakeholder groups. It addresses SFM and the meaningful participation of forest resource owners and value adding, and it outlines an implementation strategy and a strategy to finance implementation.[a]

Table 3 Forest area, by tenure

Ownership category	Total area	Of which PFE
	'000 ha	
State ownership (national, state or provincial government)	53	-
Other public entities (e.g. municipalities, villages)	0	-
Total public	**53**	**-**
Owned by local communities and/or Indigenous groups	885	-
Privately owned by individuals, firms, other corporate	59	-

Source: FAO (2010a).

Under the new policy the overall goal of the forest sector is the "sustainable management of Fiji's forest to maintain their natural potential and to achieve greater social, economic and environmental benefits for current and future generations". The policy has the following five objectives (Anon. 2007):

- Ensured ecosystem stability through the conservation of forest biodiversity, water catchments and soil fertility.
- Ensured sustainable supply of forest products and services by maintaining a sufficiently large permanent forest area under efficient and effective management.
- Increased engagement by landowners and communities in SFM and an equitable distribution of benefits from forest products and processes, including ensured protection of intellectual property rights.
- Increased employment in the forest sector, sufficient supply of domestic markets and increased foreign exchange earnings through sustainable forest-based industry development and trade.
- Enhanced national capacity to manage and develop the forest sector in a collaborative approach with the involvement of all stakeholders.

The Fiji Rural Land Use Policy addresses the management of land use in Fiji. On the basis of the policy the Government of Fiji is developing a national land-use plan and a legal framework for the environmentally sustainable use of Fiji's land resources. The ultimate goal of the policy is the allocation of land use according to land capability and good land-use practice. It will also address the need to identify areas to be kept or managed as a PFE and to create a protected-area system for the conservation of representative sites of Fiji's indigenous forest types. The Ministry of Agriculture is responsible for the implementation of the policy.[a]

The 2004 Native Land Forest Policy was developed by the NLTB to address issues that the NLTB feels is important to forest owners but is not particularly covered by the forest policy (which covers all lands, including state and freehold land).[a]

The Environment Management Act (2005) requires that all logging operations undergo an environmental impact assessment before approval. The Forestry Department and the Department of Environment (which is responsible for the implementation of the Act) are still working on ways to ensure that this requirement is dealt with effectively.[a]

Fiji developed its Biodiversity Strategy and Action Plan in 2007 as part of its national implementation plan under the CBD. The Forestry Department is responsible for implementing its forest biodiversity component.

The Mahogany Industry Development Decree (2010) and the Fiji Pine Decree (1990) address legal issues related to the development of industries based on mahogany and pine, respectively. The Endangered and Protected Species Act (2002) requires that all businesses trading in threatened timber species are registered with the Director of Environment. Timber exporters must pay a fee to obtain a CITES certificate for the export of CITES-listed species. The commercial use of endangered species (even if not listed in CITES) require special approval from the Department of Environment.[a]

To address the gap that was created in 2007 between the requirement of the new forest policy and the prevailing forest decree, a review process has been undertaken to align the decree with the new direction of the forest policy. The review was due to be completed by the end of 2010.[a]

The 1990 National Code of Logging Practice has also been reviewed to ensure that it accommodates the new requirements of the forest decree, and

Fiji has drafted a REDD+ policy to guide the development of any REDD+ activity that may occur in Fiji's forests. Both documents are now awaiting government endorsement.[a]

Institutions involved in forests. There are several governmental/quasi-governmental institutions responsible for or otherwise involved in forest management. These are the NLTB, for the leasing of native land for forestry purposes; the Forestry Department (under the Ministry of Fisheries and Forestry), for the licensing of timber harvesting, transport and export, policy and planning, and research, training and overall forest management, including extension plantations and timber production statistics; the Department of Environment, for the formulation and implementation of Fiji's environmental laws; Fiji Pine Limited (FPL), a public company wholly owned by government and landowners, incorporated in 1991, which is responsible for pine plantation establishment, management, utilization and marketing; the Fiji Hardwood Corporation Limited (FHCL), a government-owned subsidiary incorporated in 1999 under the purview of the Ministry for State-owned Enterprises, responsible for the hardwood plantations and in the process of becoming a government–landowner company similar to FPL; the Fiji Mahogany Trust and the Fiji Pine Trust, for the management of landowner involvement in the development of the mahogany and pine plantations; and the Fiji National Trust, for the conservation and management of sites with cultural, national and natural significance. The potentially high value of the mahogany resource and disputes over ownership and control of the FHCL were contributing factors in a military coup that took place in Fiji in 2000 (ITTO 2006).

About 110 people are involved in forest management across the public and private sectors. In the public sector there are six professionals and 56 technical staff and in the private sector there are 13 professionals and 35 technical staff.[a] According to FAO (2010a), the Forestry Department employs about 118 people (including six women), of whom ten have university degrees or an equivalent qualification.

A number of NGOs are active in Fiji, including Nature Fiji, IUCN, Conservation International and Wetlands International. The University of the South Pacific and the Fiji National University provide training and other capacity-building. The Secretariat of the Pacific Community/GTZ provides some technical support.[a]

The highest forum in the forest sector is the Forestry Council, which is chaired by the minister responsible for forests. The Council meets every two months and is attended by representatives of a wide range of stakeholder groups.[a]

Status of forest management

Forest for production

Logging on native land is allowed only with the consent of both the *mataqali* and the NLTB. Timber-cutting rights are negotiated between concessionaires or licensees and the NLTB, which authorizes the Forestry Department to issue logging licences and to administer concession agreements (ITTO 2006).

ITTO (2006) reported that about 0.29 million hectares of forest were allocated to concessions and long-term licences, but updated information was not available for this report. Royalties are collected by the Forestry Department and passed on in full to landowners, except for an administration levy deducted by the NLTB. The National Code of Logging Practice (currently under revision, with the revised version expected to come into force in 2011[a]) gives practical guidance to those involved in logging, prescribing operational, safety and environmental standards. The Forestry Department monitors and evaluates adherence to this code but lacks independence, and the results of such monitoring and evaluation are not available publicly (Wilkinson & Prescott 2009).

To harvest timber on any land, 'forestry right licences' are required. These are of four kinds: timber concessions (10–30 years); long-term licences (ten years); annual licences; and other licences and prepayment licences (usually for land-clearing). One important government initiative was the development of a natural forest management pilot project to assess the effect of different intensities of logging on the regenerative capacity of the forests. It was aimed at maintaining the composition and structure of the natural forest and stimulating growth and natural regeneration while ensuring the active participation of landowners. The results will now be applied in a much bigger forest area to test the initiative's

commercial applicability. The Forestry Department organizes training in logging to improve skills and techniques, reduce environmental damage and improve efficiency. However, the forest-sector workforce is currently too small and lacks the necessary skills and support to implement SFM (ITTO 2006).

In 2011 under the revised National Code of Harvesting Practice, tree-marking will be introduced for trees that may be removed according to diameter limits. Monitoring and verifying this new requirement will be a major challenge for the Forestry Department. Given that it is likely to slow down harvesting operations, resistance to the measure in the industry is expected. Internal and external awareness and capacity-building will be required.[a]

Fiji has begun to establish permanent sample plots in all forest types. Information is collected for all plant species with the aim of providing information on biodiversity, regeneration, tree growth and carbon storage. Over time, it is intended that forest-owning communities will become increasingly involved in data collection and the management of the permanent sample plots.[a]

Silviculture and species selection. Logging in natural forests is based in most cases on a selection system. The normal diameter limit for felling is 35 cm at dbh. Twenty-two species are included in an 'obligatory list' and these must be felled irrespective of market demand. Despite provisions in the licence agreements, pre- and post-harvest silvicultural prescriptions do not receive adequate attention (ITTO 2006). Also often neglected are enrichment and rehabilitation planting in logged-over forests and compensatory afforestation to make up for land transfers. Most of the larger sawmills have their own logging areas and logging operations, but they carry out almost no planting.

More species than the obligatory 22 are used in production and trade. The most readily available and commercially valuable indigenous timbers are retailed directly under their own local names or in mixtures called 'Fiji hardwood' or 'mixed hardwood'. The main commercial species from natural forests are *Agathis vitiensis* (kauri or dakua makadre), *Myristica* spp (kaudamu), *Endospermum macrophyllum* (kauvula), *Calophyllum* spp (damanu), *Palaquium* spp (sacau) and *Intsia bijuga* (vesi). No recent information was available on the most commonly harvested species; Table 4, therefore, shows the species listed in ITTO (2006).

Planted forest and trees outside the forest. The large-scale planting of pine and hardwoods by government began in the 1960s. According to FAO (2010a) there are about 68 000 hectares of hardwood plantation (up from the 61 000 hectares reported for 2005) and 108 000 hectares of softwood plantation (up from the 93 000 hectares reported for 2005). There are also about 28 000 hectares of coconut plantations.

The main softwood plantation species is *Pinus caribaea var. hondurensis* (Caribbean pine); it is mostly under the management of FPL and located mainly in the drier zones of Viti Levu and Vanua Levu. Forestry Department plantings of Caribbean pine began on a small scale around 1950 and, by 1972 (when the expanded 'pine scheme' began), had grown to about 12 000 hectares. The ownership of what are now the FPL plantations has had a chequered history. Cyclone damage was almost the only one of the many problems that plagued the scheme that did not originate in disputes over land tenure (ITTO 2004a).

According to the Government of Fiji, the biggest threat to pine plantations is careless burning by surrounding communities.[a] Long-term awareness programs have been conducted to foster a sense of ownership of the pine resource among these communities, since they are the landowners and also shareholders in FPL. Additional fire towers have been installed to assist in early fire detection.[a]

Table 4 Commonly harvested species for industrial roundwood

Species	Notes
Swietenia macrophylla (mahogany)	From planted forests.
Pinus caribaea (Caribbean pine)	From planted forests.
Myristica spp (kaudamu)	Natural-forest species used in sawmilling.
Endospermum macrophyllum (kauvula)	Natural-forest species used in construction and joinery.
Agathis vitiensis (dakua makadre)	Natural-forest species used for decorative purposes.

Source: ITTO (2006).

The main planted hardwood species, *Swietenia macrophylla* (mahogany), is managed by FHCL. Mahogany plantations also began in the early 1950s and the expansion of establishment had grown to around 1000 hectares a year by the mid 1960s. The program virtually stopped in 1971 because of widespread attack by the ambrosia stem borer but resumed after a few years with the development of successful containment measures (ITTO 2006). The annual sustainable production of mahogany is estimated at about 100 000 m^3. FHCL has had recurring financial difficulties, with the Fiji government needing to provide guarantees to enable the company to source capital from the domestic financial market. Stringent monitoring of the financial performance by government is necessary to raise the level of returns on the government's equity in FHCL and to ensure the financial viability of the company (Government of Fiji 2006).

Originally the Government of Fiji held 100% shareholding interests in FHCL but, in December 2005, 10% of the existing issued share capital was gifted to the mahogany landowners via the establishment of the Fiji Mahogany Trust. This trust is the vehicle that government intends to oversee the landowners' participation at all levels of the mahogany industry (Department of Public Enterprises 2010).

The involvement of landowners in the pine and mahogany plantations is much more advanced than in natural forests, facilitated by a government budget of close to US$250 000 annually to ensure landowner involvement. Landowners in the pine and mahogany industries are usually involved in contracts for logging operations, including felling and haulage; the government assists in the initial capital investment at the community and individual levels through the Fiji Pine Trust and the Fiji Mahogany Trust. Moreover, in the 2007 national forest policy the government endorsed the establishment of forest landowner associations.[a]

Mangrove forest, Fiji. © *S. Baba*

Forest certification. A Fiji Forest Certification Standard that is aligned with FSC requirements was completed in 2008 with the aim of setting a recognized national standard for certifying Fijian forest products. In mid 2009 the Department of Forestry was awaiting approval of the standard by the FSC (Ministry of Fisheries and Forestry 2009). No forest has been certified in Fiji.

Estimate of the area of forest sustainably managed for production. No natural forest is contained in the nominal production PFE, and there is little evidence of sustainable management in the forest concessions. An exception is the Drawa model area for community-based SFM, located in the centre of Vanua Levu, where primary and secondary native forest is being managed according to a management plan by eleven *mataqali* in the area (Secretariat of the South Pacific 2010; Table 5). FAO (2010a) reported this area as sustainably managed on the basis of information supplied by the Government of Fiji. No other natural forests have integrated forest management plans, although these are required under the new national forest policy.[a]

The national forest policy also requires commercial plantations of both pine and mahogany to submit integrated forest management plans to the Forestry Department. A management plan

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*	0	-	-	-	-	113	90	0
2010	**0**	**-**	**6.3****	**0**	**6.3****	**176**	**68‡**	**0**

* *As reported in ITTO (2006).*

** *This forest has not been designated as part of the PFE but is counted here because of its model-forest status.*

‡ *Mahogany plantation.*

has been submitted for the mahogany plantation, and a management plan for the pine plantation is under development. The Forestry Department has insufficient capacity to monitor or verify the implementation of management plans in forest plantations; significant capacity-building and re-organization is needed for the department to implement this requirement.[a]

Timber production and trade. In 2004 there were 26 licensed sawmills, 18 of which were operating (only one of which was large); there were also two small veneer and plywood mills and one woodchip plant integrated with the large sawmill. Conversion efficiency was thought to be around 50% (ITTO 2006).

In 1995 the government directed that all circular mills in Fiji should convert to band saws. In 2005, portable sawmills were introduced to communities for the sawing of small logs that are left behind by loggers. These measures were introduced to improve conversion efficiency, but there is still considerable inefficiency in the conversion process. The government is working to improve its training centre for timber-processing with the aim of improving conversion efficiency in the sawmilling industry.[a]

The estimated industrial roundwood production in 2009 was 466 000 m^3, of which 300 000 m^3 was softwood from pine plantations (ITTO 2011); this was similar to the estimated 470 000 m^3 of total industrial roundwood production in 1999 (ibid.). In 2009 Fiji produced 90 000 m^3 of sawnwood (down from 96 000 m^3 in 2004 but up from 64 000 m^3 in 1999), 9000 m^3 of veneer and 11 000 m^3 of plywood, and it exported 10 000 m^3 of sawnwood and 2200 m^3 of plywood (ibid.).

Mangroves are harvested for fuelwood, charcoal and timber. There is significant and apparently sustainable commercial fuelwood production in the Rewa Delta (Spalding et al. 2010).

Non-timber forest products. NTFPs are of great importance, especially to rural communities. Many plants are used as foods, medicines, construction and roofing materials, artisanal products and dyes, and in ceremonials and rituals. Wildlife, especially pigs, is a valuable source of food. Mud crabs, lobster and shellfish are harvested in mangrove forests. Stems of tree ferns are collected from forest areas and made into ornamental posts, which are widely used. Some plants, such as *Piper methisticum* (yaqona), from which the mild narcotic beverage kava is made, are now largely cultivated, but others are still collected from the wild. A few are marketed, such as *Morinda citrifolia* (nono), which is widely and increasingly used as a medicinal plant with huge potential in international markets. *Santalum yasi* (sandalwood) is another forest product with a large potential market: prices of 40 Fiji dollars or more per kilogram have reportedly encouraged its illegal harvest (Fiji Times Online 2009).

Along with tuber crops, *Artocarpus utilissimus* (bread fruit) is a staple food. Another item of ceremonial and niche-market significance is cloth made from the bark of *Broussonetia papyrifera* using natural dyes such as those from *Elaeocarpus pyriformis* and *Aleurites triloba.*

Forest carbon. There are no estimates of forest carbon in Fiji in the literature. Based on the extent of forests and forest plantations, however, the biomass carbon stock could be in the range 80–100 MtC. There are no reported activities for protecting or expanding forest carbon stock or pursuing REDD+, although Fiji joined the REDD+ Partnership in 2010. Table 6 summarizes Fiji's potential for forest carbon capture and storage.

Forest for protection

Soil and water. Land-use practices pay attention to the need for soil and water conservation. About 304 000 hectares of forest are classified as protection forests. These are located mainly on steep land with slopes over 30° and have shallow, unstable soils.

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
80–100	No data	+	+	-	+	+	-

+++ high; ++ medium; + low; - no activity/capacity.

Biological diversity. Four mammals, seven birds, one amphibian and one plant found in forests are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species (IUCN 2011). Twenty-six plants are listed in CITES Appendix II and one is listed in Appendix III (UNEP-WCMC 2011). The Government of Fiji (2010) identified 127 plant species, 4 mammals, 45 land birds, twelve sea birds, ten reptiles, one amphibian, 17 fish and two butterflies as endangered.[a]

Protective measures in production forests. The prevention of soil erosion has long been a national priority because of the risk of flooding, siltation and damage to coastal ecosystems. Nevertheless, present forest extraction techniques damage the soil. The National Code of Logging Practice is the only guideline protecting endangered species, although it provides only very general guidance.[a]

Extent of protected areas. The total estimated extent of the protection PFE is 92 000 hectares. According to UNEP-WCMC (2010), about 117 000 hectares of forest are in protected areas that conform to IUCN protected-area categories I–IV. However, the Government of Fiji (2010) reported 42 700 hectares of forest in 22 protected areas.[a] This smaller figure is used in Table 7.

Little political attention has so far been paid to the protection of forests for their biological diversity. According to FAO (2010a), however, the protected-area estate in Fiji is set to increase dramatically as conservation activities expand in the country. Issues affecting new conservation sites include conflicts of interest among landowning units and the payment of adequate financial compensation to landowners.

Estimate of the area of forest sustainably managed for protection. No data were available for an assessment of the extent of protection PFE under SFM (Table 7).

Socioeconomic aspects

Economic aspects. In 2005 the Government of Fiji generated 3.82 million Fiji dollars in revenue from the domestic production and trade of forest products and services, and the sector provided employment for about 1400 people (FAO 2010a). In 2008 the forest sector contributed 1.4% of Fiji's GDP (US$15.9 million), which was less than the 1.6% (US$20.7 million) contributed in 2005.[a] In 2005 the sector generated 45.1 million Fiji dollars in export earnings (Government of Fiji 2006). In the period 2003–07 the average value of the industrial roundwood harvest was 71 million Fiji dollars (FAO 2010a). The royalties paid to customary owners for the timber harvest on their lands provide a significant proportion of rural income (ITTO 2006).

In 2008 the export of sawnwood, plywood and veneer was worth an estimated US$15.1 million, more than US$12 million of which was coniferous (ITTO 2010); Fiji also exports woodchips and plywood.[a] In an attempt to increase its log-processing capacity, FHCL purchased the Waivunu sawmill in Galoa, Serua and remanufacturing assets in Navutu, Lautoka, in 2005 (Department of Public Enterprises 2010).

The timber sector employs about 3000 people, which is 8% of the Fijian workforce.[a] There are 15 forest recreation sites in Fiji which, combined, might receive about 150 000 visits per year, although data are not collected on forest recreational use.[a]

Livelihood values. The culture and livelihoods of traditional landowning communities are closely linked to their forest resources. It is difficult to quantify this value.

Social relations. The system of land tenure in Fiji was introduced in colonial times, based on a local traditional system, and continues to be fraught with difficulty. For example, in developing leasehold arrangements with potential forest developers, a majority of individual members of a *mataqali*

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*	241	3	18	37	55
2010	**43**	**43**	**304**	**-**	**-**

* *As reported in ITTO (2006).*

must agree to the proposal to the satisfaction of the NLTB (ITTO 2006). There have been tensions over control of the mahogany resource (ibid.). Forest-owners are involved in whatever development takes place and can stop an operation if dissatisfied with it. The land on which the country's pine and mahogany plantations grow are leased from the Indigenous landowners, who are shareholders in FPL and FHCL.[a]

In 2010 the Forestry Department challenged the country to plant a million trees between March 2010 and March 2011, thus bridging the International Year of Biodiversity and the International Year of the Forests. Methods for disseminating this challenge included the use of billboards and radio talkback shows. A local NGO translated the national forest policy into the Fijian language – an important step given that more than 90% of forests are owned by Indigenous communities. The same NGO is currently carrying out awareness-raising activities among forest-owning communities with the aim of creating an environment conducive to the creation of a PFE.[a]

Summary

Most of Fiji's remaining natural forest is on steep and broken mountainous country and difficult to access. There is a general trend for land ownership to revert from private individuals – mostly 'foreigners' – to Indigenous owners, but the ownership of some forest areas is unclear. A national forest policy was issued in 2007 after three years of multi-stakeholder consultations; it aims to ensure ecosystem stability and a sustainable supply of forest products and services, increase the engagement of landowners in SFM and employment in the forest sector, and encourage collaborative management approaches. Under the revised National Code of Logging Practice, due to come into force in 2011, tree-marking will be introduced for trees that may be removed according to diameter limits. Permanent sample plots are being established. Despite Fiji's vulnerability to climate change, there have been no official moves to pursue REDD+.

Key points

- Although Fiji has no formal PFE, some forests have equivalent status. The PFE, therefore, is estimated at 219 000 hectares (compared with 354 000 hectares in 2005), comprising 176 000 hectares of planted production PFE (compared with 113 000 hectares in 2005) and 43 000 hectares of protection PFE (compared with 241 000 hectares in 2005).
- About 6300 hectares of the natural production forest (although not part of the PFE) is considered to be sustainably managed. No estimate was possible of the area of protection PFE so managed.
- Fiji has about 176 000 hectares of planted forests, mostly comprising the high-value species *Swietenia macrophylla* (mahogany) and *Pinus caribaea*; an estimated 100 000 m^3 of mahogany is harvested annually.
- The timber industry is inefficient, but the government is working to improve wood-processing skills. Portable sawmills have been introduced to communities to enable them to saw small logs. The timber sector employs about 8% of the Fijian workforce.

Endnote

a Government of Fiji (2010).

References and other sources

Anon. (2007). Fiji forest policy statement: summary. November 2007 (available at http://groups.google.com.fj/group/fiji-forest-policy-2007?hl=en).

Department of Public Enterprises (2010, website accessed April 2010). Government commercial company: Fiji Hardwood Corporation Limited (available at http://www.publicenterprises.gov.fj/index.cfm?si=main.enterprises&cmd=fhcl).

Fan, D.D. & Li, C.X. (2005). Complexities of Chinese coast in response to climate change. *Advances in Research on Climate Change* 1: 111–114 (in Chinese with an English abstract), as seen in FAO (2010b).

FAO (2010a). Global forest resources assessment 2010 country report: Fiji (available at http://www.fao.org/forestry/fra/67090/en/).

FAO (2010b). *Forests and Climate Change in the Asia-Pacific Region.* Forests and Climate Change Working Paper 7. FAO, Rome, Italy.

Fiji Times Online (2009, website accessed December 2010). Police uncover timber scam (available at http://www.fijitimes.com/story.aspx?id=133748).

FSC (2010, website accessed April 2010). fsc certification database (searchable database available at http://info.fsc.org/PublicCertificateSearch).

Government of Fiji (2006). *Strategic Development Plan 2007–2011.* Parliamentary Paper No 92 of 2006. Ministry of Finance and Planning, Suva, Fiji.

Government of Fiji (2010). Report of progress toward achieving sustainable forest management in Fiji. Submission to ITTO. Fiji Forestry Department, Suva, Fiji.

Griffiths, G.M., Salinger, M.J. & Leleu, I. (2003). Trends in extreme daily rainfall across the South Pacific and relationship to the South Pacific Convergence Zone. *Journal of Climatolology* 23: 847–86.

ITTO (2006). *Status of Tropical Forest Management 2005*. ITTO, Yokohama, Japan (available at http://www.itto.int/en/sfm/).

ITTO (2011, website accessed March 2011). Annual Review statistics database (available at http://www.itto.int/annual_review_output/?mode=searchdata).

IUCN (2011, website accessed March 2011). IUCN red list of threatened species (searchable database available at www.redlist.org).

Ministry of Fisheries and Forestry (2009). Investing in Fiji's forestry industry. Fiji Forestry Policy Brief. Ministry of Fisheries and Forestry, Suva, Fiji.

NLTB (2010, website accessed April 2010). Native Land Trust Board (available at http://www.nltb.com.fj).

Secretariat of the South Pacific (2010, website accessed April 2010). Planning workshop for the Drawa model area for community-based forest management (available at http://www.spc.int/lrd/Highlights_Archive/highlights_Drawa_model.htm).

Spalding, M., Kainumu, M. & Collins, L. (2010). *World Atlas of Mangroves.* Earthscan, London, UK.

UNDP (2009). *Human Development Report 2009*. United Nations Development Programme, New York, United States.

UNEP-WCMC (2010). Spatial analysis of forests within protected areas in ITTO countries. UNEP-WCMC, Cambridge, UK. Data prepared for ITTO, 2010.

UNEP-WCMC (2011, website accessed March 2011). UNEP-WCMC species database: CITES-listed species (searchable database available at www.cites.org/eng/resources/species.html).

United Nations Population Division (2010, website accessed April 2010). World population prospects: the 2008 revision (searchable database available at http://esa.un.org/unpp/p2k0data.asp).

Wilkinson, G. & Prescott, M. (2009). Report on the proceedings of the regional workshop on strengthening the implementation of codes of practice for forest harvesting through effective systems of monitoring and evaluation, Beijing/Yanji, People's Republic of China, 22–24 June 2009. Asia Pacific Forestry Skills and Capacity Building Programme, FAO.

INDIA

Forest resources

India has the world's second-largest population – an estimated 1.21 billion people in 2010 (United Nations Population Division 2010) – and a land area of 316 million hectares. In 2005 about 25% of the population was living below the poverty line, as officially defined by the Government of India (Ghosh 2010). India is ranked 134th out of 182 countries in UNDP's Human Development Index (UNDP 2009).

Systematic, consistent and accurate information on the extent and especially the condition and management of the country's tropical forests is difficult to obtain. According to FAO (2010), the total area under effective forest cover in India is 68.4 million hectares, including substantial areas of forest north of the Tropic of Cancer.

The Forest Survey of India (FSI) has assessed forest cover every two years since 1987; since 2001 the assessment has been conducted digitally on the basis of satellite imagery at a scale of 1:50 000 (FAO 2010). In its 2009 state of the forests report, FSI (2009) estimated the total forest area in India at 69.1 million hectares using data generally collected in 2006 and 2007. Although they differ, the estimates of both FAO (2010) and FSI (2009) are used in this report.

FSI (2009) also contains information on forest area by state and territory; the total tropical forest area can therefore be estimated by summing the forest areas of all states and territories that lie in the tropics (i.e. south of the Tropic of Cancer).[1] Thus, India's total tropical forest area is estimated at 37.8 million hectares, comprising 4.13 million hectares of 'very dense' forest (i.e. forest with canopy cover greater than 70%), 19.0 million hectares of 'moderately dense' forest (i.e. forest with canopy cover between 40% and 70%), and 14.6 million hectares of 'open' forest (i.e. forest with canopy cover between 10% and 40%).

Legally proclaimed and gazetted forest is classified as:

- *Reserved forest* – a forest area notified under the provisions of the Indian Forest Act or other state forest acts, having a full degree of protection and where all activities are prohibited unless explicitly permitted.
- *Protected forest* – a forest area notified under the provisions of the Indian Forest Act or other state forest acts, having a limited degree of protection and where all activities are permitted unless explicitly prohibited.
- *Unclassed forest* – a forest area recorded as forest in government land records but not notified as reserved or protected forest under the Indian Forest Act or other state forest acts.[a]

In the tropical states and territories, the total area of reserved and protected forest is 25.0 million hectares, and the remainder is unclassed forest. In some states and territories, however, the area officially designated as reserved and protected forest is greater than the actual total area of forest; in Andhra Pradesh, for example, the official area of reserved and protected forest is 6.32 million hectares but the total actual forest area is 4.52 million hectares (FSI 2009).

Forest types. India's forests range from tropical rainforests in the south and northeast to dry alpine forests in the northwest Himalaya. They have been classified into 16 types – including tropical wet evergreen, tropical semi-evergreen, tropical

1 Andaman Islands, Andhra Pradesh, Chhattisgarh, Dadra-Nagar-Haveli, Daman, Diu, Goa, Gujarat, Karaikal, Karnataka, Kerala, Laccadive Islands, Madhya Pradesh, Maharashtra, Nicobar Islands, Orissa, Pondicherry, Tamil Nadu and West Bengal.

moist deciduous, littoral and swamp, tropical dry deciduous, tropical thorn, tropical dry evergreen, and others – and 221 subtypes on the basis of climatic and edaphic conditions and dominant species (Champion & Seth 1968).

Tropical wet evergreen forests occur in the south and northeast and in the Andaman and Nicobar islands. The most widely distributed genera are *Dipterocarpus, Hopea*, *Callophyllum* and *Syzgium*, and the families Lauraceae and Myrthaceae are also well-represented. Tropical moist deciduous forests occur in areas with monsoonal rainfall; some of these are characterized by *Tectona grandis* (teak) and others by *Shorea robusta* (sal). FSI (2009) estimated the total area of mangrove forest at 464 000 hectares; Spalding et al. (2010) estimated it at 433 000 hectares, about 23% of which occur on the west coast, 59% on the east coast and much of the remainder on the Andaman and Nicobar islands.

Permanent forest estate. In India, the entire forest area, whether owned by government or communities or privately, is considered to be PFE.[b] FAO (2010), however, estimated the PFE (for India's entire forest estate) at 65.9 million hectares, which is 2.5 million hectares less than the estimated total forest area. In FAO (2010) the PFE was calculated by "taking a proportion of forested area within recorded forest area as obtained from the NFI [national forest inventory] to the area under reserved and protected forest". This estimate was extrapolated to 2010 on the basis of "the average annual growth rate" (presumably of total forest area) during 2000–05. In total, the estimated production PFE in 2010 for all India was the same as that in 2005 (46.1 million hectares), but the protection PFE was nearly 6 million hectares smaller (19.8 million hectares).

In this report, the total PFE has been reduced on a pro rata basis to estimate the tropical PFE. The tropical forest area (37.8 million hectares) is 55% of the total forest estate (69.1 million hectares, using the estimates of FSI 2009); therefore, the tropical PFE is estimated at 36.3 million hectares (Table 1). The total area of protected areas south of the Tropic of Cancer is estimated at 4.54 million hectares on the basis of an estimate by UNEP-WCMC (2010); therefore, the production PFE is taken to be 36.3 million hectares less this amount (i.e. 31.8 million hectares). The methodology for reaching these estimates is admittedly flawed; ideally, each tropical state would provide estimates of its production and protection PFEs, which, combined with estimates for any PFE on federal lands, could then be collated to obtain an estimate for the total tropical PFE. The proportion of the tropical PFE comprising planted forests is assumed to constitute the same percentage (i.e. 55%) of the total plantation estate.

Forest ecosystem health

Deforestation and forest degradation. India's annual rate of deforestation in the 1970s was an estimated 1.3 million hectares. By the 1990s, however, the situation had changed to one of net forest gain (estimated at about 25 000 hectares per year since 2000), due mainly to the extensive planting of trees and woodlots outside forests. Nevertheless, natural forest was still being lost at a rate of 30 000–40 000 hectares per year due to conversion to non-forest uses (ITTO 2006b).

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* (all India)	64.1–76.8	22 500	13 500	32 600	25 600	71 700
2010 ** **(tropical)**	**37.8**	**23 100**‡	**26 160**	**5600**†	**4540**§	**36 300**

* *As reported in ITTO (2006a); estimates are for all India.*

** *As estimated by ITTO on the basis of data provided by FSI (2009) and FAO (2010); estimates are for tropical forest only.*

‡ *Comprises forest with a density of greater than 40% canopy cover, as estimated by FSI (2009) for tropical states.*

† *55% of the total plantation estate, as estimated by FAO (2010).*

§ *In 2005 the protection PFE was estimated at 25.6 million hectares for all India. The estimate for 2010 is for actual forest area in protected areas south of the Tropic of Cancer.*

The Forest (Conservation) Act 1980 makes it difficult for 'notified'[2] forest to be formally excised through de-reservation. However, some state forest departments have authorized what are effectively permanent changes in land use (known as 'diversions') without de-reservation (ibid.).

Irrespective of the apparent reduction in net deforestation, a number of commentaries on forest quality indicate an ongoing process of forest degradation in India. Afforestation through the establishment of agroforestry crops and woodlots raised by farmers and other private-sector enterprises does not necessarily offset the loss of natural forests and their ecosystem functions, including biodiversity conservation. Continuing deforestation through encroachment in notified forest areas, in particular protected forests and unclassed forests, and through the excision of reserved forests, has rendered the security of the PFE tenuous. The situation has been exacerbated by the excessive harvesting of fuelwood, NTFPs, poles and timber, including through illegal logging (ibid.). In the five years to 2005, an average 1.6 million hectares of forest per year were reportedly subject to wildfire (FAO 2010).

FAO (2010) estimated the total area of primary forest in India at 15.7 million hectares, with the remainder classified as 'other naturally regenerated forest' (Table 2). FSI (2009) reported the following forest areas (for all India), by canopy density:

- canopy density >70%: 8 351 000 hectares
- canopy density 40–70%: 31 901 200 hectares
- canopy density 10–40%: 28 837 700 hectares.

Major invasive plant species in India include *Lantana camara* (lantana), *Eupatorium odoratum, E. adenophorum, Parthenium hysterophorus* (carrot grass), *Ageratum conyzoides, Mikania micrantha*, *Prosopis juliflora* and *Cytisus scoparius*. Alien aquatic weeds such as *Eichornia* spp (water hyacinth) are increasingly choking waterways and degrading freshwater ecosystems. Lantana and carrot grass cause major economic losses in many parts of India. Highly invasive climbers such as *Chromolaena* and *Mikania* species have over-run native vegetation in the northeast Himalayan region and Western Ghats. Illegally introduced catfishes (such as the African magur) and also the big-head carp are known to have had an adverse impact on native fish diversity.[b]

The tsunami of 26 December 2004 affected approximately 2260 km of India's coastline and caused extensive damage to life and property in the Andaman and Nicobar Islands, Pondicherry and the coastal districts of the states of Andhra Pradesh, Kerala and Tamil Nadu. A total of 12 600 hectares of forest were lost, including 43 hectares of mangrove forest in the affected states (Indian Institute of Forest Management 2009).

Vulnerability of forests to climate change. The mean annual temperature in India showed a significant warming trend during the period 1901–2007, increasing by 0.51 °C (INCCA 2010); accelerated warming was observed in the period 1971–2007. The increase in mean annual temperature is contributed mainly by the two post-monsoon seasons, which have increased by 0.80 °C and 0.82° C, respectively, over the last hundred years. Mitchell and Hulme (2000) predicted an increase of temperature of 3.7–5.7 °C over the course of the 21st century. Forests in semi-arid regions of India are expected to be sensitive to greater climate variability such as changes in temperature, rainfall and seasonality.

Long-term observations are not available by which changes in biodiversity due to observed changes in climate might be detected (INCCA 2010). However, a study on the projected impacts of climate change on forests in 2050 and 2080 indicates shifts in forest boundaries, changes in the species composition of forest types, changes in net primary productivity, and potential losses of biodiversity. It is projected that, by 2050, most of the forest biomes in India will be highly vulnerable to climate change and 70% of the vegetation will be less than optimally adapted to its existing location (ibid.).

SFM policy framework

Forest tenure. Most forests are under the ownership and control of state governments, although some forests are administered by communities or owned privately. According to FAO (2010), about 86% of forests are under the management of forest departments and 14% are administered by communities or are under private ownership; communities hold the management rights to an estimated 21.6 million hectares of

2 'Notified' forest is forest for which a state government has issued a notification in the Official Gazette declaring that the land has been constituted as forest.

Table 2 Forest condition

	PFE	Non-PFE	Total
	'000 ha		
Area of primary forest	-	-	15 700
Area of degraded primary forest	-	-	-
Area of secondary forest	-	-	42 500*
Area of degraded forest land	-	-	-

Note: *Data are for all India.*
* *'Other naturally regenerated forest'.*
Source: *FAO (2010).*

publicly owned forest. RRI (2009) estimated that 49.5 million hectares of publicly owned forests were administered by government and 17.0 million hectares were reserved for communities and Indigenous people, and there were also about 1.07 million hectares of privately owned forest. The forests administered by communities are counted as state-owned in Table 3. The legal transfer of ownership to Indigenous communities may increase under the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, although the implementation of this Act has so far proved problematic (see below). Reserved and protected forests are government-owned and the ownership status and level of protected of unclassed forest varies from state to state.

Despite debates extending over decades, there is no effective national land capability mapping or integrated land-use planning. A central-government unit for the coordination of land capability survey and land-use planning, together with state inter-departmental land-use boards, existed until the late 1980s. Since then, demographic pressures have risen and demands on natural resources have increased as India continues to develop. Conflicts over priorities in land use – such as between agriculture, forestry, housing, industry, infrastructure, livestock, mining, tourism, water structures and reservoirs – cannot be resolved by appeal to Central or Union policies or legislation (ITTO 2006b).

This lack of coordination in land-use planning is compounded by complexities in land tenure. The lack of systems to avoid or resolve land-use conflicts is evident in the frequent reporting of corruption in land dealings, especially in peri-urban areas as cities expand and formerly arable and forest lands are converted to housing lots and industrial plots. The regulation of de-reservation and the excision of notified forests under the Forest (Conservation) Act, 1980 makes ad hoc diversion into other land uses almost inevitable in areas where there is strong competition for land. These diversions in land use are covered by state forest department *pattas* (land-use leases of defined periods such as five or ten years), similar to the agricultural leases granted by the Revenue Department. The state forest departments are hampered in defending the boundaries of notified forests by outdated ways of valuing forest resources (according to out-of-date royalty values, not by total economic value) which prevail at both the state and central levels (ibid.).

Table 3 Forest area, by tenure

Ownership category	Total area	Of which PFE
	'000 ha	
State ownership (national, state or provincial government)	66 500	-
Other public entities (e.g. municipalities, villages)	0	-
Total public	**66 500**	**-**
Owned by local communities and/or Indigenous groups	0	-
Privately owned by individuals, firms, other corporate	1070	-

Note: *Data are for all India.*
Source: *RRI (2009). FAO (2010) reported 58.0 million hectares of forest in public ownership and 9.70 milion hectares in private ownership.*

Criteria and indicators. A set of C&I for the sustainable management of the dry-zone forests of India was developed under the Bhopal-India Process initiated by the Indian Institute of Forest Management in 1998, and a similar process is under way for tropical forests under an ITTO project. Recognizing the importance of C&I, the Government of India constituted a taskforce in 1999, which endorsed the C&I developed by the Bhopal-India process. C&I were identified as a thrust area for the forest sector during the eleventh

five-year plan, and funds were made available for the incorporation of the C&I monitoring approach in 50 forest working plans nationwide over the period of the five-year plan. In 2008 the Conference of Forest Secretaries endorsed eight criteria and 37 indicators as the national set of C&I. An SFM 'cell' was created in the Ministry of Environment and Forests, and similar cells have been created in many state forest departments. The national government has created committees for the inclusion of the C&I in the National Working Code; in the future, working plans will therefore involve the use of C&I as the basis for monitoring the sustainability of forests.[a]

Teams for pilot-testing the national set of C&I were established in twelve states: testing has been completed in Madhya Pradesh, Chhattisgarh, Gujarat, Orissa, Kerala and Sikkim and is under way in Himachal Pradesh, Uttar Pradesh, Assam, Jharkhand, Karnataka and Tamil Nadu.[a]

A team has also been formed to develop C&I for the sustainable management of forest plantations, and work – including field-testing – is now in progress. C&I for the sustainable management of NTFPs have also been developed. The submission by the Government of India for this report was not in the ITTO C&I reporting format.[a]

Forest policy and legislation. India is a federal union of states. At independence in 1947, forestry was assigned to the States List but in 1976 (42nd amendment of the Constitution) it was included in the Concurrent List, meaning that the states have responsibility for forest management subject to certain controls by the central government (ITTO 2006b). The national forest policy dates from 1988 and there has been no major change since then. The guiding legislation is the Indian Forest Act, 1927 (amended in 1951). While policies have undergone changes, the legislation has not changed correspondingly, continuing to focus on the prevention of offences. Other national legislation relevant to forestry includes the Mines Act, 1952; the Wildlife (Protection) Act, 1972 (amended in 2003); the Forest Conservation Act, 2003; the Environmental Protection Act, 1986; and the Biological Diversity Act, 2002.

State governments generally have the freedom to manage forest resources on the basis of forest management plans. Under the Forest Conservation Act, 2003, however, state governments must obtain prior approval from the national government for any forest clearance for non-forestry purposes (ITTO 2006a).

The 1988 national forest policy embodies most elements of SFM. It focuses on the maintenance of environmental stability and the restoration of ecological balance; the conservation of the country's natural heritage and biological diversity; improved soil and water conservation; increasing forest cover (to the target, set in 1952, of 33% of the country's total land area) through massive afforestation and social forestry programs; providing the basic needs of the rural and tribal populations; increasing forest productivity; improving the efficiency of forest product utilization; and minimizing pressure on existing forests. The policy stipulates that requirements for industrial wood should be met increasingly from trees outside forests. It is noteworthy, however, that the reiterated target of 33% forest cover is backed neither by an in-depth assessment of the need for this level of forest cover or the type or location of the forest to be established, nor by the institutions and resources needed to achieve the target (ITTO 2006b).

The national forest policy pays little or no attention to a range of what are now recognized globally as important forest services, such as the supply of clean water, biodiversity conservation, carbon sequestration, and aesthetic, cultural and recreation services. The National Forestry Action Programme was conceived in 1999 by the Ministry of Environment and Forests but its implementation has had little effect on shaping policy and the legal framework. Nor has the underlying forest legislation been amended to reflect new developments.[b]

A 2006 amendment to the Wildlife (Protection) Act, 1972 provides for the creation of conservation foundations in the country's tiger reserves with a mandate to support protected-area management through independent revenue generation (Government of India 2009). In 2002 India enacted the Biological Diversity Act following a wide-ranging, eight-year consultative process. The Act gives effect to the provisions of the CBD, addressing, for example, access to biological resources and associated traditional knowledge to ensure the equitable sharing of benefits arising from the use of those resources. The Act is to be

implemented through a three-tiered institutional structure:

- the National Biodiversity Authority
- state biodiversity boards
- biodiversity management committees.

The National Biodiversity Authority was established in 2003. Twenty states have established biodiversity boards, and biodiversity management committees are being set up in some states (Government of India 2009).

The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act was passed by the national Parliament in 2006 and the Rules to the Act – which provide its operational details – were gazetted into force on 1 January 2008. According to its preamble, the Recognition of Forest Rights Act is designed "to recognise and vest the forest rights and occupation in forest land in forest dwelling Scheduled Tribes and other traditional forest dwellers who have been residing in such forests for generations but whose rights could not be recorded; to provide for a framework for recording the forest rights so vested and the nature of evidence required for such recognition and vesting in respect of forest land".

Certain provisions in the Recognition of Forest Rights Act are unclear and appear to be in conflict with existing legislation related to forest and wildlife.[b] In November 2009, the Campaign for Survival and Dignity[3] (2010a) made the following statement regarding the Act: "Passed in December 2006, the … Act was hailed as a historic step towards recognising the rights of forest dwellers and correcting a gross injustice. Almost three years later, it is clear that the government has no intention of allowing it to be implemented." Overall, it seems that the Act is proving difficult to implement (Dash 2010).

The National Green Tribunal Bill, 2009 was passed in both houses of Parliament in 2010 and is now awaiting Presidential assent. The aim of the Bill is to set up specialized environmental courts – 'green tribunals' – comprising judicial and expert members to adjudicate substantial questions of the environment and to award civil penalties (Ministry of Environment and Forests 2010).

3 A federation of tribal and forest dwellers' organizations from eleven states.

Institutions involved in forests. At the national level, forestry falls under the purview of the Ministry of Environment and Forests and its Indian Forest Service; there are also forest departments at the state level with defined functions and responsibilities. Within the Ministry of Environment and Forests are divisions of forest conservation, forest policy, forest protection, forest services, research and training (forestry) and climate change, as well as the National Afforestation and Eco-development Board and the Combating Desertification Cell. While at the national level the Forest Service focuses mainly on the provision of advice and guidance, the state forest departments are custodians of the public forest resource and act as the forest authorities. Often they also perform an enterprise function, becoming involved in production, processing and trade. All India's forested states have set up forest development corporations, which are responsible for production within the public forest estate. These corporations are meant to operate as autonomous business entities but, in reality, most function as extensions of the forest departments and enjoy hidden subsidies (ITTO 2006b). Not all forest development corporations are still active.

A number of specialized institutions are linked directly to the Ministry of Environment and Forests. These include the Indian Council of Forestry Research and Education, the Indian Institute of Forest Management, the Indira Gandhi National Forest Academy, the Wildlife Institute of India and the FSI. In 2008, 565 students (55% of them women) graduated with forest-related masters degrees, 808 students (50% women) graduated with forest-related bachelor degrees, and 3000 students (2% women) graduated with forest technician certificates or diplomas (FAO 2010).

The National Afforestation Programme (NAP), initiated in 2000, amalgamates all the previous centrally sponsored forest programs except those on parks and wildlife conservation. The NAP is implemented in a decentralized manner through forest development agencies (FDAs). FDAs, which are different to the forest development corporations referred to above, are autonomous entities at the level of forest divisions in which all the village forest committees (VFCs) within the respective forest division are represented. The central government transfers funds directly to the FDAs. FDAs are thus an institutional arrangement to implement the

NAP on the basis of micro-plans developed for that purpose. The NAP has been taken up in all states of India since 2002.

Joint forest management (JFM), which was introduced formally in the 1988 national forest policy, is implemented with the involvement of local communities at the village level and through FDAs at the district level. JFM, known by various labels in different states, is a forest management strategy by which a state forest department and a village community enter into an agreement to jointly protect and manage forest land adjoining villages and to share responsibilities and benefits through JFM committees (JFMCs). There has been gradual progress in the creation of JFMCs, from 36 130 in 1999 to 106 479 in 2007. In 2007, 22 million people were involved in the management of 22 million hectares under JFM.[b]

The rapid expansion in the number of JFMCs is said to be partly a function of donor target-setting. The capacity-building needed if the JFMCs are to become fully effective is a major challenge, as state forest department budgets are not directed towards it and some resources of the Rural Development Department are also unavailable. Rights of access to forest resources, such as fuelwood and fodder, is perhaps the greatest common benefit afforded to JFMCs (ITTO 2006b). Constitutional Amendment No 73 provides for the transfer of ownership of NTFPs to *Gram Sabhas*/ *Panchayats* (village assemblies) in states with sizeable tribal populations.

A criticism of JFM was that it covered only the protection and maintenance of degraded forests. To correct this, the Government of India issued, in January 2000, a circular concerning the extension of JFM to better-stocked forests. It also provided for the mandatory (50%) involvement of women in JFM activities.

Another criticism is that JFM has become a way for state forest departments to extend their control over land. According to Campaign for Survival and Dignity (2010b), "the 'participatory' plans for forest protection have to fit entirely within existing Forest Department plans. [The JFMCs] are not given any rights but instead promised a share in timber and other revenues in exchange for free labour; and the share is often never paid". Many JFM schemes are inadequate in the demonstrative sharing of rights, responsibilities and benefits, although there are some good exceptions (ITTO 2006b).

India has many national- and state-level NGOs involved in forestry, wildlife conservation, environmental protection and community development. These organizations play a crucial role in capacity-building and in the implementation of JFM. A number of forest-related international NGOs are also active in India.

Status of forest management

Forest for production

India follows a system of preparation and periodical revision of working plans or management plans for established forest divisions or FMUs. Working plans are tactical documents but lack a strategic framework; moreover, they do not seem to include model-based yield calculations and predictions. An estimated 75% of notified forests were under working plan prescriptions in 2005, but it is unclear what area of forest was involved (ibid.). According to FAO (2010), 30.6 million hectares of forest nationwide are subject to management plans. ITTO (2006a) reported that "nearly 10 million hectares of the production PFE" were thought to be under working plans, almost half of which had been so managed for more than 30 years. The management of government forest land is the direct responsibility of state forest departments. In some cases, industrial units are allowed to extract trees marked under a selection system. There are no long-term timber concessions of the kind practised in Southeast Asian countries. In recent years, logging in natural forests has been discouraged and, in several cases, locally banned. The resulting wood scarcity has provided impetus for the development of farm forestry, homestead forestry and agroforestry.

Some states, such as Andhra Pradesh, are developing joint management schemes in closed-canopy areas of natural forest. The silvicultural harvesting of teak, sal and other natural forests is allowed in states such as Chhattisgarh, Gujarat, Madhya Pradesh, Maharashtra and Orissa on the basis of working plan prescriptions. In others, only salvage fellings of dead, damaged and diseased trees are allowed. Harvesting operations are mostly done using simple hand tools such as axes and crosscut saws, which are associated with high wastage of valuable butt logs. There seems to be no application of reduced impact logging. Trees tend to be bucked into much shorter lengths than in other tropical countries, possibly

reflecting the low power and small size of extraction equipment (ITTO 2006b).

Although there may be empirical knowledge of the factors leading to forest degradation, the monitoring mechanisms and limited resources of state forest departments do not enable coordinated or effective measures to reduce the progressive reduction of natural forest assets (ibid.).

Forest governance in India faces several serious problems. Corruption is prevalent in the sector, affecting efficiency.[b] There is inconsistency in the recruitment of foresters at all levels. The forest sector must plan and manage forests on a long-term basis (e.g. the rotation period for teak and sal is 40–60 years), but recruitment policies are short-sighted and the distribution of staff by age and experience is uneven. Although forestry is a field-oriented job, few foresters spend significant time in the forest, preferring white-collar jobs in towns with modern amenities. The general level of commitment for forestry and professional field knowledge has declined, although some officers are very good. Often, the commitment to forestry is stronger in communities than among the forestry profession.[b]

The existing structure and functioning of state forest departments are inadequate to deal effectively with the problems facing the sector. Although good policies and legal instruments exist, these are often not fully complied with and the gap between the intended situation and actual condition is widening.[b]

Silviculture and species selection. Several silvicultural systems are prescribed in the working plans for Indian natural forests, varying according to the ecological potential of the dominant timber species. They include a selection system in the wet evergreen and semi-evergreen forests; a shelterwood system in coniferous forests and certain types of moist deciduous forests; and gap felling and coppice management in dry deciduous forests. Table 4 lists some commonly harvested species of natural-forest tropical hardwoods. Others include *Adina cordifolia*, *Albizzia lebbek* (kokko), *Cedrela toona*, *Gmelina arborea* (gamari, yemane), *Grewia* spp, *Pterocarpus* spp and *Xylia xylocarpa*.

Planted forest and trees outside the forest. The total area of planted forests India-wide in 2010 has been estimated at 38.6 million hectares; based on survival rate and stock density, however, the effective area is thought to be about 50% of the recorded total – i.e. 19 million hectares.[b] FAO (2010) estimated that the actual area of planted forest was even lower, at 10.2 million hectares. The wide range of estimates may also be explained partly by differing definitions of 'planted forest', with higher estimates including some 'natural' forests that have been subject to enrichment planting with local species, especially teak (sometimes called 'semi-natural' forest).

New planted forests are being established at an estimated rate of 1.48 million hectares per year (FAO 2010), of which public planting (mainly by forest development corporations) accounts for two-thirds and private planting for one-third (ITTO 2006b). India also has an estimated 2.15 million hectares of agro-industrial coconut plantations and at least 1 million hectares of rubber plantations (ibid.).

Planted species include fast-growing (and short-rotation) species of *Eucalyptus* (*E. grandis*, *E. tereticornis*) and *Acacia* (*A. auriculiformis*, *A. mearnsii*, *A. nilitica*), and other common hardwood species such as *Albizia* spp, *Azadirachta indica, Casuarina equisetifolia, Dalbergia sissoo* and *Gmelina arborea*. Teak (*Tectona grandis*) is the most widely planted timber species in India, covering nearly 2.6 million hectares in 2005 (STCP Engenharia de Projetos Ltda 2009).

Table 4 Commonly harvested species for industrial roundwood

Species	Notes
Tectona grandis (teak)*	Most of the teak is harvested in planted forests; the total potential sustainable yield has been estimated at 12.8 million m^3 per year (STCP Engenharia de Projetos Ltda 2009).
Shorea robusta (sal)*	
Dalbergia spp*	
*Acacia catechu**	
Eucalypt* and poplar	From planted forests.

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

Source: P. Kotwal, pers. comm., 2010 – see endnote b.

A woman collects seeds from *Madhuca* trees in an Indian dry teak forest.

While impressive in area, the performance of India's forest plantations in terms of survival, growth and yield has often been poor due to inadequacies in site selection and site–species matching, poor planting stock and a lack of maintenance and protection (Saigal et al. 2002). Fifty per cent of all plantations raised since 1980 are in an agroforestry (or at least a non-notified forest) environment, with varying intensities of management (ITTO 2006b).

Forest certification. The Ministry of Environment and Forests has constituted a national forest certification committee to develop certification standards and processes and their accreditation. It also envisages the establishment of an independent National Certification Council.[b] As of August 2010 the FSC had issued 125 chain-of-custody certificates to the timber industry in India and one forest-management certificate for a small area (676 hectares) of rubber plantation in Tamil Nadu (FSC 2010).

Estimate of the area of forest sustainably managed for production. Under the national forest policy, no forest is permitted to be worked without an approved management plan, which should be in a prescribed format. Nevertheless, data on the area of production forest currently being managed under approved management plans were unavailable for this report.

ITTO (2006a) estimated that 9.72 million hectares of the production PFE (all India) were being managed under regular working plans, of which at least 4.8 million hectares were considered to be sustainably managed. This area comprises forest reserves that have been managed according to working plans for more than 30 years. No information has been received for the current report to indicate a change in this situation; therefore, the 2005 estimate is assumed to apply in 2010 (Table 5).

Timber production and trade. About 50% of India's wood supply is provided by non-forest sources and the rest is accounted for by imports and the supply from public forests, mainly planted forests. India's official total roundwood production in 2005 was 307 million m^3, of which 261 million m^3 (85%) was fuelwood (FAO 2010), although only about 55.1 million m^3 was from forests. India produced 20.3 million m^3 of non-coniferous tropical hardwood logs in 2009, unchanged from 2004 but considerably more than the 14.0 million m^3 produced in 1999 (ITTO 2011). Non-coniferous tropical sawnwood production was estimated at 4.89 million m^3 in 2009, non-coniferous tropical veneer production was estimated at 270 000 m^3 and tropical plywood production was estimated at 2.13 million m^3 (ibid.).

In 2009 India imported about 3.0 million m^3 of non-coniferous tropical logs (ibid.), mainly from Malaysia, Myanmar and, increasingly, Africa. The total value of imports of primary timber products (industrial roundwood, sawnwood, plywood and veneer) in 2009 was US$1.47 billion (ibid.). According to ITTO (2004), the Indian timber market is not well organized, reducing timber's competitiveness against substitute products.

Non-timber forest products. NTFPs such as bamboo (e.g. *Melocanna baccifera* – muli), thatching materials and medicinal plants are essential components of the livelihoods of many local communities. Some NTFPs, such as latex, bamboo, gums, sandalwood, resins and aroma chemicals, support value-added processing, niche marketing and an export trade. FAO (2010) reported that the total value of removals of nine groupings of NTFPs (tendu leaves, gums, bamboo, resin, fodder, drugs, cane and rattan, lac, and sal seeds) in 2005 was 5.85 billion rupees (about US$120 million at 2010 exchange rates). This is likely to be a significant underestimate because it excludes NTFPs collected by forest-dwellers.[b]

Forest carbon. A report on India's GHG emissions released in May 2010 indicates that India is now ranked fifth in global GHG emissions behind the United States, China, the European Union and the Russian Federation, with net annual emissions of

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* (all India)	13 500	13 500	9720	0	4800	32 600	8150	0
2010	**26 160** ** **(tropical)**	**16 800 (tropical)**	**16 800** ‡ **(tropical)**	**0**	**4800** †	**5600** §	**-**	**0.68**

* *As reported in ITTO (2006a).*

** *Natural and planted forest.*

‡ *FAO (2010) reported that 30.6 million hectares of forest (tropical and non-tropical) were under management plans in 2010. The estimate given here assumes that these management plans are applied on a proportional basis between tropical and non-tropical forest.*

† *All India.*

§ *The estimated area of planted forests for all India in 2010 was 10.2 million hectares (FAO 2010). The large difference between the 2005 and 2010 estimates for all India is most likely due to different interpretations of planted and semi-natural forest, and also to revisions made on the basis that some previously established planted forests had failed.*

Table 6 Forest carbon potential

Biomass forest carbon (MtC)	% tropical 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
5085–8560	13	+	+++	+++	+++	++	+

+++ 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).

around 1.7 billion tonnes of CO_2e (Government of India 2010a). On the other hand, India's forests sequestered 67.8 million tonnes of CO_2 in 2007 (ibid.). Gibbs et al. (2007) estimated the national-level forest biomass carbon stock at 5085–8560 MtC, but FAO (2010) estimated it at only 2800 MtC.

India's National Action Plan on Climate Change contains a 'National Green India Mission', which aims to double the area of afforestation and forest restoration in the next ten years to 20 million hectares, which would result in an increased sequestration rate of 43 million tCO_2e annually (Government of India 2010b).

India currently has two afforestation/reforestation CDM projects, one in Andhra Pradesh and the other in Haryana. In order to develop methodologies and procedures for assessing and monitoring REDD+ activities, a technical group and a REDD coordinating committee have been set up under the Ministry of Environment and Forests. India is a member of the REDD+ Partnership. Table 6 indicates India's potential for forest-based carbon capture and storage.

Forest for protection

Soil and water. The Government of India emphasizes the environmental protection and conservation roles of forest in preference to their economic role; measures are being taken to protect upland watersheds through forest conservation and afforestation (ITTO 2006a). According to FAO (2010), protection of soil and water is the primary designated function of 10.7 million hectares of forest nationwide.

Biological diversity. India is one of the twelve megadiverse countries, hosting 7% of the world's biodiversity and supporting 16% of its major forest types. Twenty-three mammals, four reptiles, two amphibians, 20 fish, 16 arthropods and 209 plants found in India's tropical forests[4] are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species (IUCN 2010). Twelve plants are listed

4 Only Indian states located south of the Tropic of Cancer were included in the search of the IUCN Red List database: Andaman Islands, Andhra Pradesh, Chhattisgarh, Dadra-Nagar-Haveli, Daman, Diu, Goa, Gujarat, Karaikal, Karnataka, Kerala, Laccadive Islands, Madhya Pradesh, Maharashtra, Nicobar Islands, Orissa, Pondicherry, Tamil Nadu and West Bengal.

in CITES Appendix I, 401 in Appendix II and three in Appendix III (UNEP-WCMC 2011). Threats to biodiversity stem mainly from habitat fragmentation; degradation and loss; shrinking genetic diversity; invasive alien species; a declining forest resource; climate change and desertification; the overexploitation of resources; and the impacts of development projects and pollution.[a]

Protective measures in production forests. India's national forest policy requires that production forests are managed in ways that are consistent with environmental conservation, and this stipulation must be reflected in the prescriptions and practice of working and management plans. In 2007 India established the National Wildlife Crime Control Bureau to combat illegal trade in wildlife and its derivatives (Government of India 2009).

Extent of protected areas. Protected areas in India cover about 4.8% of the country's geographical area (15.9 million hectares), comprising 99 national parks, 515 wildlife sanctuaries, 43 conservation reserves and four community reserves; there are also 37 tiger reserves and 26 elephant reserves (Government of India 2009). Of these, 61 national parks with a total area of 1.57 million hectares and 334 wildlife sanctuaries with a total area of 8.22 million hectares are south of the Tropic of Cancer, although the total area of forest within these protected areas is unclear.[b] According to UNEP-WCMC (2010), 4.54 million hectares of tropical forests are in protected areas that conform to IUCN protected-area categories I–IV; this equates to about 46% of the total tropical protected area.

Estimate of the area of forest sustainably managed for protection. Most of India's national parks – which are subject to the provisions of the Wildlife (Protection) Act – have management plans that are generally well-implemented.[b] An area of 722 000 hectares (which is 46% of the total area of national parks in the tropics) is assumed, therefore, to be under SFM (Table 7).

Socioeconomic aspects

Economic aspects. The contribution of forestry to GDP fell from about 2.9% in 1981 to 1.7% in 1991, 1.1% in 2005 and 0.9% in 2006 (CSO 2006). These figures exclude the contributions of forest-based industries (which are counted under manufacturing), as well as the vast amount of products such as fuelwood and fodder, the use of which is unrecorded, and the contribution of ecosystem services such as water and soil conservation. According to one estimate, about 7.5 million people, mostly in rural and tribal settings, are in forest-related employment.[b] According to FAO (2010), about 6.19 million people are employed in the primary production of forest goods, mostly related to plantations, 5.68 million of whom are in paid employment. A further 24 600 people are employed in the management of protected areas.

Livelihood values. Some 740 million people (68% of the total population) live in rural areas, of whom well over 200 million are considered to be forest-dependent, particularly the 90 million Scheduled Tribal People**.** Small-scale agriculture remains the mainstay of livelihoods, especially for 600 million farmers, and forest-based activities are highly significant in providing fuel, housing materials and employment. More than 300 million people subsist on less than US$1 per day, most of them in forest-fringe areas (ITTO 2006b).

Social relations. Local rights govern the use of forest resources by rural and tribal communities living in and near forests. The plight of most of these communities is one of great hardship and requires the settling of tenure issues and the rationalization of the system of people's participation in forestry. JFM is India's flagship program enabling participation and it has the support of the national forest policy, but it has several constraints. The introduction of the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act could

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*	25 600 (all India)	3060 (tropical)	-	-	-
2010 (tropical)	**4540**	**4540**	**4540[b]**	**722**	**722**

* *As reported in ITTO (2006a).*

have far-reaching effects for millions of tribal people and their relations with government, including the federal and state forest departments, but to date its implementation appears to have been inadequate.

Summary

In India, state forest departments are custodians of the public forest resource and act as the forest authorities. Increasingly, some responsibilities for and benefits from the forests are being shared with local communities; for example, joint forest management approaches are now being applied to at least 22 million hectares, including in some closed-canopy tropical forests. Moreover, farmers are becoming more involved in tree-growing, the private sector is participating more in forest management, and partnerships between forest-product manufacturing companies and local farmers are developing. A new national law should enable the transfer of ownership of certain forest lands to Indigenous communities, although it is yet to be fully implemented. While India appears to be expanding its forest area (including through a large-scale expansion of the planted forest estate), its natural forests remain under threat from unauthorized (and sometimes authorized) land-use change and various agents of degradation, including illegal forest activities.

Key points

- The estimated 36.3 million hectares of India's tropical PFE comprises 31.8 million hectares of production forest and 4.54 million hectares of protection forest.
- While India appears to be adding forest cover, natural forest continues to be lost or degraded.
- An estimated 4.8 million hectares of India's production PFE and an estimated 722 000 hectares of India's tropical protection PFE is under SFM.
- In many states, forest departments lack the capacity to deal effectively with the problems facing the sector, and forest law enforcement is often inadequate.
- Information on the extent and management of forests is fragmentary and often unreliable.
- Forest management is becoming increasingly decentralized and community-based approaches are becoming more common.
- A national afforestation program was initiated in 2000 and operates at the level of forest divisions within states through forest development agencies and village forest committees.
- India's wood-based industries face a serious scarcity of raw materials and are increasingly dependent on non-forest and external sources. The country has become a major importer of tropical timber, particularly logs.
- A very large number of people (up to 7.5 million people) are in forest-related employment, and over 200 million people are considered to be forest-dependent.
- Tenure reforms pose a serious challenge. The Recognition of Forests Rights Act, which was enacted in 2006, is designed to recognize and vest forest rights to forest-dwelling tribes and other traditional owners; however, the implementation of this law has been slow.
- India is highly exposed to the negative effects of climate change. The forest sector has been identified as a priority sector for climate-change adaptation. A national REDD+ program is being developed with the aim of greatly increasing forest carbon stocks.

Endnotes

a Government of India (2010c).

b Personal communications with P.C. Kotwal, consultant, 2010.

References and other sources

Campaign for Survival and Dignity (2010a, website accessed December 2010). Chargesheet on government's violations of forest rights (available at http://www.forestrightsact.com/current-situation/75-chargesheet-on-governments-violations-of-forest-rights-act).

Campaign for Survival and Dignity (2010b, website accessed December 2010). Land grabbing on the quiet (available at http://www.forestrightsact.com/statements-and-news/89-land-grabbing-on-the-quiet).

Champion, H. & Seth, S. (1968). Forest Types of India. Manager Publications, Government of India, New Delhi, India.

CSO (2006). Report of the Central Statistical Organisation. Central Statistical Organisation, Government of India, New Delhi, India.

Dash, T. (2010). The ineffective Forest Rights Act. India Times, 24 April 2010.

FAO (2010). Global forest resources assessment 2010 country report: India (available at http://www.fao.org/forestry/fra/67090/en/).

FSC (2010, website accessed August 2010). FSC certification database (searchable database available at http://info.fsc.org/PublicCertificateSearch).

FSI (2009). State of Forest Report 2009. Forest Survey of India, Dehra Dun, India (available at http://www.fsi.nic.in/sfr_2009.htm).

Ghosh, J. (2010). Poverty Reduction in China and India: Policy Implications of Recent Trends. DESA Working Paper No. 92, Department of Economic and Social Affairs, United Nations, New York, United States.

Gibbs, H., Brown, S., Niles, J. & Foley, J. (2007). Monitoring and estimating tropical forest carbon stocks: making REDD a reality. *Environmental Research Letters* 2 (available at http://iopscience.iop.org/1748-9326/2/4/045023/fulltext).

Government of India (2009). Non-legally Binding Instrument on All Types of Forests: Voluntary sharing of information on progress. Suggested format. Report submitted by the Government of India to the United Nations Forum on Forests.

Government of India (2010a). Taking on Climate Change. Post-Copenhagen Domestic Actions. Ministry of Environment and Forests, New Delhi, India.

Government of India (2010b). National mission for a green India. Draft mission document, version 1.0 (available at http://envfor.nic.in 2010)

Government of India (2010c). India's progress towards SFM. Country report to ITTO. Prepared by P.C. Kotwal, Bhopal, India.

INCCA (2010). Climate Change and India: a 4x4 Assessment. A Sectoral and Regional Analysis for 2030s. INCCA Report #2. Indian Network for Climate Change Assessment, Ministry of Environment and Forests (available at http://envfor.nic.in).

Indian Institute of Forest Management (2009). Country report based on national set of criteria and indicators for sustainable forest management. Indian Institute of Forest Management, Bhopal, India.

ITTO (2004). Annual Review and Assessment of the World Timber Situation 2003. ITTO, Yokohama, Japan.

ITTO (2006a). *Status of Tropical Forest Management 2005*. ITTO, Yokohama, Japan (available at http://www.itto.int/en/sfm/).

ITTO (2006b). Achieving the ITTO Objective 2000 and sustainable forest management in India: report of the diagnostic mission. ITTC(XLI)/7. ITTO, Yokohama, Japan.

ITTO (2011, website accessed March 2011). Annual Review statistics database (available at http://www.itto.int/annual_review_output/?mode=searchdata).

IUCN (2010, website accessed April 2010). IUCN red list of threatened species (searchable database available at www.redlist.org).

Ministry of Environment and Forests (2010, website accessed August 2010). Available at http://moef.nic.in/index.php.

Mitchell, T. & Hulme M. (2000). A Country-by-country Analysis of Past and Future Warming Rates. Tyndall Centre for Climate Change Research Working Paper 1. University of East Anglia, Norwich, UK.

RRI (2009). Who Owns the Forests of Asia? An Introduction to the Forest Tenure Transition in Asia, 2002–2008. Rights and Resources Initiative, Washington, DC, United States.

Saigal, S., Arora, H. & Rizvi, S. (2002). The New Foresters: The Role of Private Enterprise in the Indian Forestry Sector. International Institute of Environment and Development, London, UK.

Spalding, M., Kainumu, M. & Collins, L. (2010). *World Atlas of Mangroves.* Earthscan, London, UK.

STCP Engenharia de Projetos Ltda (2009). Encouraging Industrial Forest Plantations in the Tropics: Report of a Global Study. ITTO Technical Series 33. ITTO, Yokohama, Japan.

UNDP (2009). *Human Development Report 2009*. United Nations Development Programme, New York, United States.

UNEP-WCMC (2010). Spatial analysis of forests within protected areas in ITTO countries. Data prepared for ITTO. UNEP-WCMC, Cambridge, UK.

UNEP-WCMC (2011, website accessed March 2011). UNEP-WCMC species database: CITES-listed species (searchable database at available at www.cites.org/eng/resources/species.html).

United Nations Population Division (2010, website accessed April 2010). World population prospects: the 2008 revision (searchable database available at http://esa.un.org/unpp/p2k0data.asp).

INDONESIA

Forest resources

Indonesia is a 5200-km-long chain of about 17 000 islands. Its population (in 2010) of 233 million people (United Nations Population Division 2010) lives on a land area of about 190 million hectares. The country is ranked 111th out of 182 countries in UNDP's Human Development Index (UNDP 2009). It has a considerable range of climates, including equatorial regimes in Kalimantan, Sumatra and West Irian and those with a pronounced dry season, such as in Java and the Moluccas. Soils vary from the rich volcanic soils of Java and Madura to the leached lateritic soils of Kalimantan. Estimates of forest area, including plantation forests, range from 94.4 million hectares (FAO 2010a) to 98.5 million hectares.[a]

Forest types. For the purposes of management, six forest types are distinguished by government: mixed hill forests; submontane/montane and alpine forests; savanna/bamboo/deciduous/monsoon forests; peat swamp forests; freshwater swamp forests; and tidal forests (mangroves). Mixed hill forests account for about 65% of the natural forests and are the most important for timber production.[a]

Indonesia has an estimated 3.19 million hectares of mangrove forest, which is 21% of the global total (Spalding et al. 2010). In many locations, Indonesia's mangroves are closely linked to adjacent ecosystems ranging from peat swamp and lowland forests inland to wide seagrass beds and coral reef communities offshore (Spalding et al. 2010).

Permanent forest estate. Land-use planning, including on the location and extent of 'permanent forest', is ongoing in Indonesia under processes such as Forest Land Use by Consensus and Provincial Spatial Planning. In its submission for this report, the Government of Indonesia estimated the PFE at 114.1 million hectares and the area of convertible forest FPE at 22.8 million hectares, according to the following categorization[a]:

- conservation forest (23.3 million hectares)
- protected forest (31.6 million hectares)
- limited production forest (22.5 million hectares)
- permanent production forest (36.6 million hectares)
- convertible forest for non-forestry use (22.8 million hectares)
- game hunting parks (234 000 hectares).[1]

Given that these figures suggest a PFE that is significantly larger than the total forest estate, the estimate in Table 1 of the area of forest in the PFE has been made on the basis of other data in the Government of Indonesia's submission.

Forest ecosystem health

Deforestation and forest degradation. There has been a rapid loss of forest cover in the last 40 years; FAO (2010a) estimated that forest cover declined by 3.42 million hectares between 2005 and 2010 and by 24.1 million hectares between 1990 and 2010. Moreover, periodic serious fires have affected large areas of forest, especially in Kalimantan and parts of Sumatra, partly influenced by the El Niño/Southern Oscillation phenomenon and aggravated by land clearance, the accumulation of combustible matter after logging, disputes over land tenure, and the presence of burning coal seams in the surface strata. Wildfire was particularly prevalent in the

1 More recent data put the official PFE at 114.2 million hectares (and the area of convertible forest at 22.7 million hectares), comprising 23.4 million hectares of conservation forest, 31.6 million hectares of protected forest, 22.3 million hectares of limited production forest, 36.7 million hectares of permanent production forest, 22.7 million hectares of convertible forest, and 168 000 hectares of game hunting parks (T. Yanuariadi, pers. comm., 2011).

Table 1 Permanent forest estate

Reporting year	Estimated total forest area, range (million ha)	Total closed natural forest ('000 ha)	PFE ('000 ha)			
			Production		Protection	Total
			Natural	Planted		
2005*	105–120	100 382	46 000	2500	22 500	71 000
2010	**94.4–98.5**	**69 230****	**38 600[a,‡]**	**2500[a]**	**27 300**	**68 400[†]**

* *As reported in ITTO (2006).*

** *Calculated using the ratio of forest with greater than 60% forest cover estimated by UNEP-WCMC (2010) (69.1%) and the total natural forest area as estimated by FAO (2010a).*

‡ *Includes game hunting parks. FAO (2010a) reported a production forest area of 49.7 million hectares, including forest outside the PFE.*

† *FAO (2010a) reported a PFE of 77.1 million hectares.*

period 1998–2002, but less so since. Table 2 shows the estimated area of primary forest and secondary forest.

In 2008, 30 'technical recommendations' were issued for the conversion of forest to non-forest uses (such as mining, transmigration or industrial agriculture) in 30 'location units'; ten such recommendations were expected to be issued in 2009.[a] The area involved is unclear, however, and a recent agreement between the Government of Indonesia and the Government of Norway to suspend, for two years starting in 2011, all new concessions for the conversion of peat and natural forest may have changed the situation (Governments of Norway and Indonesia 2010).

Vulnerability of forests to climate change. The mean annual temperature in Indonesia has increased by around 0.3 °C since 1990; the 1990s were Indonesia's warmest decade of the 20th century and an increase of almost 1 °C in 1998 made that year the country's warmest of the century (Intergovernmental Panel on Climate Change 2007). Climate change is projected to result in a 2–3% increase in annual rainfall per year in the main islands (Sari et al. 2007).

Indonesia is highly vulnerable to the impacts of climate change, such as an increased frequency of extreme weather events, heavy rainfall leading to flooding, and prolonged droughts, all of which could have harmful effects on agriculture, fisheries and forestry and threaten food security and livelihoods. Ten of the biggest natural disasters in Indonesia in the period 1907–2007 occurred after the 1990s – they were largely climate-related disasters, especially floods, droughts and forest fire (Government of Indonesia 2007).

The National Strategy on Climate Change Adaptation acknowledges that forest conservation would help Indonesia adapt to climate change because forests provide communities and the nation with a wide range of ecosystem services, resources and products that enhance livelihoods and resilience. The National Action Plan for Addressing Climate Change (Government of Indonesia 2007), which was drafted by the Ministry of Environment and other agencies and presented to Cabinet in November 2007, guides various institutions in carrying out coordinated and integrated efforts to tackle climate change (Hayes 2010). In 2010 it was incorporated in the National Mid-Term Development Plan 2010–2014.

SFM policy framework

Forest tenure. Article 5 of the Forestry Law (Law 41/1999, see below) sets out two types of forest tenure: state and titled. A titled forest is a forest

Table 2 Forest condition

	PFE	Non-PFE	Total
	'000 ha		
Area of primary forest	-	-	47 200
Area of degraded primary forest	-	-	-
Area of secondary forest	-	-	43 600*
Area of degraded forest land	-	-	-

* *'Other naturally regenerated forest'.*

Source: FAO (2010a).

located on land on which the land title is registered. Traditional community rights (*adat*) to forest resources are also widely recognized based on the Customary Act (1999). Most of Indonesia's forest is owned by the state (Table 3). The state also holds the management rights to about 38.2 million hectares of forest, while private corporations and institutions directly manage 51.2 million hectares, individuals about 32 000 hectares and communities only 3300 hectares (FAO 2010a).

Table 3 Forest area, by tenure

Ownership category	Total area	Of which PFE
	'000 ha	
State ownership (national, state or provincial government)	89 500	-
Other public entities (e.g. municipalities, villages)	0	-
Total public	**89 500**	**-**
Owned by local communities and/or Indigenous groups	0	-
Privately owned by individuals, firms, other corporate	8410	-

* *Data are for 2005; total forest area, therefore, is higher than estimated for 2010.*

Source: FAO (2010a).

Criteria and indicators. Indonesia demonstrates a commitment to SFM through its membership of a range of international organizations and its adherence to all relevant major international conventions. It has established its own C&I, developed national standards for forest certification and introduced the mandatory verification of SFM (ITTO 2006). The country's revised C&I (2009) for SFM consist of four criteria (enabling conditions, production, ecology, and social aspects) and 24 indicators; these are being used in the mandatory certification of SFM, which was imposed by the national government through Ministerial Forestry Regulation No. 4795/Kpts-II/2002, issued on 3 June 2002. Indonesia's submission to ITTO for this report was not in the ITTO C&I reporting format.

Forest policy and legislation. For many years the legal and policy framework for forests was provided by the Basic Forestry Law of 1967 (5/1967). This was replaced by Forestry Law 41 (1999), which is now the primary source of authority and guidance on forest stewardship, forest ownership and forest management. Other relevant policy and legal instruments include Law 5 (1990) on the conservation of natural living resources and their ecosystems; Law 24 (1992) on spatial planning; Law 23 (1997) on environmental management; Law 25 (2002) on anti-money laundering; and Law 7 (2004) on water resources.

There are also hundreds of other laws, government regulations and presidential decrees relevant to forest governance, resulting in an often conflicting policy and legal environment. For example, there are conflicts between forest and mining laws in which large areas of forested land are licensed for opencast mining despite being nominally protected from clearing under forestry regulations. There are also conflicts between forestry and agriculture regulations, particularly in relation to oil-palm plantation development. Regulatory inconsistency in Indonesia has been compounded by conflicts between central, provincial and district-level regulations (Lawson & MacFaul 2010).

The Ministry of Forestry has formulated five priority policies – to be implemented progressively – to halt deforestation and forest degradation and to support efforts towards SFM. These are the elimination of illegal logging; overcoming forest fires through preventive measures; restructuring the forest sector by increasing the efficiency and effectiveness of forest resource management; the conservation of forest resources through the rehabilitation of degraded forests and land; and the decentralization of the forest sector. The Government of Indonesia recently concluded negotiations with the European Union to establish a VPA for timber exports to the European Union.

Institutions involved in forests. Before decentralization, the Ministry of Forestry was responsible for the management and control of forests and the conservation of natural resources. At the provincial level there were two different forestry offices: regional forestry offices (*kanwil kehutanan*), and provincial forestry offices (*dinas kehutanan propinsi*). The former, as an extension of the Ministry of Forestry, coordinated all technical aspects of forestry in the provinces. This dual control system came to an end in 1999 with the enactment of Law 22 (amended by Law 32 of 2004 on regional administration) and Law 25 (amended by Law 33 of 2004 on the fiscal balance between the central government and regional governments); the field role of the Ministry of Forestry was

reduced and authority over forest management was vested in the provinces and particularly the districts (*kabupaten*) (there were also 'special autonomy' provisions applicable to Papua and Aceh).

All forest land except national parks and nature reserves are to be managed by the *kabupaten* governments. Under Law 22 (1999), there is no hierarchical relationship between the central departments, the provincial forest services and the district forest services.

This decentralization has created confusion in the field and widened the scope of corruption at the provincial and district levels. Moreover, laws prohibiting the harvest of trees within protected areas, of small size classes, on steep slopes, or near streams are routinely ignored, causing widespread environmental damage. Such problems eventually forced the re-centralization of some aspects of forest control, such as land-conversion permits for the establishment of plantations, although local governments continue to issue their own permits, adding to confusion about the legality or otherwise of a range of forest activities (Human Rights Watch 2009).

The national-level Ministry of Forestry is responsible for developing forest policy and economic incentives and the provinces and districts are responsible for implementing those policies, including by approving annual harvesting quotas. The annex of Government Regulation 38/2007 states that:

- Provincial governments will perform forest inventories of production forest, protection forest, conservation forest and watershed areas across the regency areas. The central government will create the norms, standards, procedures and criteria of forest inventories.
- Provincial governments will devise forestry plans at the provincial level, set up information systems, issues permits for timber and non-timber harvesting from the production forest, issues permits for the use of forests and the production of ecosystem services, issue permits for forest industry with a production capacity of less than 6000 m^3 per year, and publish technical advice for the establishment of forest industries with a production capacity greater than 6000 m^3 per year.
- Provincial governments will design, form and propose management areas for protection and production forests.
- Provincial governments will approve short-term management plans for production areas.
- Provincial governments will manage forest parks.
- Provincial governments will undertake and maintain forest rehabilitation in production forest, protected forest and forest parks.

In 2009 and 2010 the Minister of Forestry stipulated the following regulations and guidance[a]:

- The Periodical Entire Forest Inventory at Management Unit (Minister of Forestry Decree P33/Menhut-II/2009).
- The Application of Multiple Silviculture at Concession Area (Minister of Forestry Decree P.11/ Menhut-II/2009).
- The Standard and Guidance for Valuation of Sustainable Production Forest Performance and Verification of Log Legality for Concession Holder or Titled Forest (Minister of Forestry Decree P38/Menhut-II/2009).
- The Designation of Permanent Forest (Minister of Forestry Decree P50/Menhut-II/2009).
- The Working Plan of Concession of Timber Utilization of Natural Forest and Ecosystems Restoration (Minister of Forestry Decree P56/ Menhut-II/2009).
- The Valuation of Competent and Certified Technical Personnel (Professional) for Achieving SFM (Minister of Forestry Decree P58/Menhut-II/2009).
- The Costing Standard in SFM Achievement (Minister of Forestry Decree P.69/Menhut-II/2009).
- The Manual for Changing of Forest Purpose and Function (Government Regulation 10 Tahun 2010).
- The Use of Forest Area (Government Regulation 24 Tahun 2010).

An estimated 16 800 people are employed in public forest-related institutions at the national and sub-national levels, nearly one-third of whom have university degrees or equivalent and about 18% of whom are women (FAO 2010a).

For many years, international NGOs have pressed for forest policy reform; this role has largely been assumed and greatly expanded by Indonesian NGOs. Networks link many hundreds of NGOs; prominent are WAHLI (Indonesian Forum of Environmental NGOs), KPSHK (Community Forest System Development Group), JKPP (Participatory Mapping Network) and WWF Indonesia. There are also a number of timber industry organizations, such as the Association of Indonesian Forest Concessionaires, the Indonesian Wood Panel Producers Association and the Indonesian Sawmill and Woodworking Association. The Forest Industry Revitalization Board (BRIK) was set up by the Ministry of Forestry to help in the restructuring of the forest sector.

In February 2007, prompted by a number of NGOs led by WWF, the governments of Indonesia, Malaysia and Brunei Darussalam signed the Heart of Borneo Declaration, which sets out commitments for the three countries to sustainably manage up to about 24 million hectares of forest in Borneo designated as protected areas, production areas and sustainable land-use areas.

Status of forest management

Forest for production

In order to open up the huge and valuable forest resource outside Java, Indonesia enacted legislation in 1967 to encourage the participation of private investors. The large-scale exploitation of forests began in 1969 with the issuance of Government Statute 5/1967, followed by Government Regulation 21 (1971) on forest concessionaires.

Under the concession system, state-owned companies (central-government or local-government), domestic private companies, cooperatives and foreign private companies with Indonesian legality may apply to manage and use available forest resources. HTIs were permits for the establishment, management and harvesting of plantation forests. There were two categories of concession for logging in natural forests: forest concession rights (*hak pengusahaan hutan* – HPHs), and forest products collection rights *(hak pemungutan hasil hutan* – HPHHs). HPHs were non-transferable long-term rights and required concession-holders to follow the principles of SFM, as prescribed by the Indonesian Selective Cutting and Replanting System.

HPHHs ceased to be issued after July 1989 but were revived after decentralization in the form of log exploitation permits (*izin pemanfaatan kayu* – IPKs), which are awarded to companies by the provincial forest service for the conversion of forests to enable the harvesting of logs. Conversion forests are defined as those with a standing volume of less than 20 m^3 per hectare which are proposed to be cleared for agriculture, plantation, transmigration or industrial forest plantations.

By the early 1990s the number of HPHs had reached 584, with a total area of about 68 million hectares. The recorded production of industrial wood increased from 5 million m^3 in 1965 to about 47 million m^3 in 1990, a trend which led to the development of forest industries on the basis of 'supply-push'. In 2001, there were 354 HPHs and 102 HTIs covering 39.3 million hectares (ITTO 2006).

HPHs and HTIs were replaced under Government Regulation 34 (2002), which created licences to commercially use timber in natural forests (IUPHHK HAs) and plantation forests (IUPHHK HTs). By December 2008, 308 IUPHHK HA permits had been issued over a total area of 26.2 million hectares, a reduction of 2.1 million hectares compared with the area of forest under concessions in 2007.[a]

Another permit type is the *Hak pengusahaan hutan* (HPHTI), an industrial forest plantation permit that allows concessionaires to plant and harvest plantation timber on unproductive areas of permanent production forest.

The Ministry of Forestry also created a restoration ecosystem policy for natural production forest via Decree of Forestry Minister P61/2008: The Issuance of Timber Utilization Permit in Natural Production Forest through Ecosystem Restoration. By March 2010, timber utilization permits had been issued for twelve units covering a total area of 1.17 million hectares.

Regulation 6/2007 and its amendment, 3/2008, establish a system for the allocation of conservation forests, protected forests and production forests into FMUs called forest management totalities (KPHs). National parks, for example, are being allocated to conservation KPHs. By 2008, KPHs had been designed for 23 provinces, reservation directives for KPHs had been issued for 15 provinces, governors

in four provinces had made requests to the Minister of Forestry for the establishment of KPHs, and the Minister had established KPHs in one province. It was expected that, by the end of 2009, KPH design would have been completed for 27 provinces, reservation directives issued for 27 provinces, KPH establishment requests made by 28 provinces, and KPHs established by the Minister of Forestry in 28 provinces.

In the field, a pilot KPH serves as a model for the preparation of an operational KPH. It was envisaged that, in the period 2005–09, one pilot KPH would be established in each of 22 provinces (South Kalimantan would have two such pilots), comprising two conservation KPHs, six protected-forest KPHs (known as KPHLs – 'sustainable management units of protection forest') and 15 production KPHs (known as KPHPs – 'sustainable management units of production forest'). In 2009 the aim was to established five pilot KPHs in five provinces, comprising one KPHL and four KPHPs.[a]

At a policy level, the national AAC was reduced from 22 million m^3 in the 1990s to 4.8 million m^3 in 2006. Given that aspects of forest management have been decentralized, however, the extent to which a national AAC can be enforced is unclear; in any case, much timber is still harvested illegally, reducing the significance of an AAC (ITTO 2006, Human Rights Watch 2009). In general, Indonesian forest management needs urgent improvement. Many of the concessions do not have clearly demarcated boundaries, and forest fires, illegal land clearance and shifting cultivation are widespread.

Population growth, land-based national development and decentralization are all major challenges for achieving sustainability in Indonesia's forests. Greater coordination between the levels of government is needed to overcome problems in, for example, land-use allocation, forest conversion, illegal logging, illegal timber trade and industrial inefficiency.[a]

The eradication of illegal logging is one of the top priorities of the Forestry Department in the planning periods 2005–09 and 2010–14. A number of policy measures have been put in place, including:

- Presidential Instruction *Inpres* 4/2005: Eradication of Illegal Logging and Its Distribution at the Entire Indonesian Territory.
- The development of a draft regulation on illegal logging eradication.
- Improving the forest-product distribution system and the system of log legality verification.
- Capacity-building measures, including the establishment of national park and natural resource conservation offices, and province/city forest offices and human resource development through the establishment of the Quick Response Forest Police Unit (SPORC) and the training of investigating civil officers.
- Improvements in forest protection infrastructure and facilities.
- Increased national and international cooperation (with China, Malaysia, the United States, Europe and Australia).

The number of investigations of illegal logging decreased dramatically in the five years to 2009, from 7201 in 2005 to 107 in 2009. The extent to which this reflects a decline in illegal activities is unclear, although the Environmental Investigation Agency (EIA), an NGO, acknowledged that "By 2009 the rate of illegal logging in Indonesia was estimated to have halved to 40 per cent. EIA/Telapak field investigations found a significant decline in the volumes of illicit Indonesian timber reaching China and Malaysia, with traders in those counties [sic] bemoaning the improved enforcement in Indonesia". Nevertheless, on the basis of a recent undercover investigation, EIA alleged that "significant amounts of illegal merbau, in the form of square logs and rough sawn timber, continue to be smuggled out of Indonesia, with the bulk bound for China" (EIA 2010).

Human Rights Watch (2009) suggested that operations to crack down on illegal logging had done little to bring legal accountability to the sector. Moreover, it is "low-level laborers, often local residents desperate to make a living, who are most often snared in these crackdowns".

Silviculture and species selection. Indonesia's forests contain about 4000 tree species, 267 of which are traded; the most important are trees of the Dipterocarpaceae family (ITTO 2006). No recent information was available on the most commonly harvested species. Table 4, therefore, shows the species listed in ITTO (2006). *Gonystylus bancanus* (ramin), a valuable timber tree which

was logged heavily in the past, is now listed in CITES Appendix II. The silvicultural system originally prescribed for logging in concession areas was the Indonesian Selective Cutting System (*Tebang Pilih Indonesia* – TPI). Only mature and overmature trees conforming to prescribed conditions were to be removed. It was later realized that the concessionaires were only complying with the minimum felling diameter limit and ignoring the other requirements of the system (e.g. residual stand inventory, post-harvest tending and enrichment planting) (ITTO 2001). In 1989 the Ministry of Forestry introduced the Indonesian Selective Cutting and Replanting System (*Tebang Pilih Tanam Indonesia* – TPTI), based on a 35-year cutting cycle, which placed greater importance on natural regeneration and enrichment planting. Under the TPTI, the minimum cutting limit prescribed for production forest is 50 cm, for limited production forest it is 60 cm and for swamp forest it is 40 cm, and, in each forest type, at least 25 commercially valuable trees per hectare must be retained. The diameter of these residual trees should be in the range of 20–50 cm in production forest, 20–60 cm in limited production forest, and 20–40 cm in swamp forest. A further modification, the Selective Cutting and Strip Planting System (*Tebang Pilih Tanam Jalur* – TPTJ), was introduced in the 1990s.

In 2005 the Ministry of Forestry's Directorate General of Forestry Production Development introduced a new approach, 'intensified silviculture' (SILIN), with the aim of increasing stand productivity and planting intensity in logged-over areas as well as to facilitate supervision by government agencies, alongside the TPTI. By December 2008 SILIN had been applied in 29 IUPHHK-HAs over an area of 55 000 hectares and to 29 plantation units covering 66 600 hectares. Enrichment planting was carried out on a further 16 900 hectares of logged-over forest.

The Directorate General of Forestry Production Development has also overseen a project for the model development of a management unit of meranti (*Shorea* spp) forest, which commenced in 2003. As of 15 November 2008 the project had been implemented in just over 12 000 hectares.[a]

Planted forest and trees outside the forest. According to FAO (2010a), 404 000 hectares of plantation were established, on average, each year in the period 2003–2007 through afforestation and reforestation, compared to an annual average of about 119 000 hectares in 1998–2002. Afforestation comprised community forests (*Hutan Rakyat*), *terras* rehabilitation, city forests, mangrove rehabilitation, the development of community forest outside forestland and Ministry of Forestry rehabilitation plantings along rivers and roads, but excluded oil-palm plantations. Reforestation included activities such as re-greening, social forestry and community forest on forestland.

Despite the high rate of annual planting, the area of productive industrial timber plantations does not appear to have increased above the 2.5 million hectares cited in ITTO (2006).[a] Estimates vary: FAO (2010a), for example, estimated the planted forest estate at 3.55 million hectares in 2010, down from 3.70 million hectares in 2005. Important planted species are teak (1.47 million hectares), *Pinus merkusii* and other pines (0.77 million hectares), *Acacia* spp (0.64 million hectares), *Eucalyptus* spp (0.13 million hectares), and other broadleaved species (3.39 million hectares), including *Gmelina arborea*, *Albizia* and *Melaleuca* (ITTO 2006). The sum of these areas is much larger than both estimates of total planted-forest area given above, implying that large areas have become unproductive.

As part of Indonesia's commitment to achieving the Millennium Development Goal of 'ensuring environmental sustainability' it has developed an ambitious program to expand the area of forest

Table 4 Commonly harvested species for industrial roundwood

Species	Notes
Shorea spp (meranti)	Used for sawnwood and plywood.
Dipterocarpus spp (keruing)	Used for sawnwood and plywood.
Dryobalanops spp (kapur)	Used for sawnwood and plywood.
Anisoptera spp (mersawa)	Used for sawnwood and plywood.
Tectona grandis (teak)	From planted forests.

Source: ITTO (2006).

Box 1 Target of planting plan, 2010–2020

Year	Area to be established ('000 hectares)					
	Community and village forest	Watershed rehabilitation	Plantation forest	Logged-over area restoration	Supported community forest	Total
2010	500	300	450	300	50	1600
2011	500	300	550	350	50	1750
2012	500	300	500	450	50	1800
2013	500	350	600	650	50	2150
2014	500	350	550	750	50	2200
2015	500	300	450	300	50	1600
2016	500	300	550	350	50	1750
2017	500	300	500	450	50	1800
2018	500	350	600	650	50	2150
2019	500	350	550	750	50	2200
2020	500	350	500	750	50	2150
Total	**5500**	**3550**	**5800**	**5750**	**550**	**21 150**

Source: Government of Indonesia (2010).

plantations and to restore degraded forests. Box 1 shows that the aim is to establish or improve forests on a total area of more than 21 million hectares by 2020.

Forest certification. A system of timber certification has been developed through the Indonesian Ecolabelling Institute (*Lembaga Ekolobel Indonesia* – LEI). Established in 1993 and assisted by an ITTO project, LEI has devised C&I for the auditing of forest management in logging concessions, the ecolabelling of products from these concessions, chain-of-custody certification and a log audit system. It has also developed C&I for planted forests, community-based forest management and 'legal origin verification'. In addition, LEI has developed a joint certification program with the FSC.

Since 2002/03 the Government of Indonesia has adopted a mandatory certification approach (*Lembaga Penilai Independen* – LPI) for concession-holders based on an independent assessment against C&I for SFM set by government. These C&I, in turn, are based on those of ITTO, FSC and LEI. Independent auditors are engaged through a selection process and are accredited by LEI; the selection process has been criticized as non-transparent, however. By 2009, 153 of the 308 existing IUPHHK-HAs had been assessed for mandatory certification over a total area of 13.7 million hectares (Box 2).

The data provided by the mandatory certification system suggest that the performance of IUPHHK-HAs has improved. In 2005 and 2006, none was assessed as 'good' against the C&I, but in the period 2007–2009, 13 IUPHHK-HAs covering a total of 2.10 million hectares received a 'good' rating. Government is developing incentives designed to reward good management performance (ratings of 'good' and 'fair'). Following the audit the licence-holder and the Ministry of Forestry agree on an action plan to address the areas where improvement is required. Regulation 39 prescribes penalties for non-compliance with certification, the most severe of which is non-renewal of the concession licence, but this is rare. Generally, there has been a positive response from industry to the evaluation process. The mandatory certification rating is referred to in requests from IUPHHK-HA holders for extensions to their concessions.

A number of organizations in addition to ITTO, including the Tropical Forest Foundation, The Forest Trust and the Borneo Initiative Foundation, are assisting Indonesian companies to improve forest management at the concession level. The Nature Conservancy has assisted several management units to identify and manage high-conservation-value forest and has also introduced mono-cable skidding to reduce soil compaction and erosion on steep sites.[a]

There has been a significant increase in the extent of voluntary certification since 2005. In June 2010, the

Box 2 Mandatory certification of IUPHHK-HAs

Year	Number of IUPHHK-HAs assessed	Size (ha)	Evaluation			
			Good	Fair	Bad	Very bad
			Number of IUPHHK-HAs rated			
2005	43	5 010 266	0	17	26	0
2006	21	2 116 200	0	12	6	3
2007	31	2 451 353	5	8	14	4
2008	44	3 351 590	6	21	14	3
2009	14	797 259	2	5	5	2
Total	**153**	**13 726 668**	**13**	**63**	**65**	**12**

Source: Government of Indonesia (2010).

FSC had certified 618 000 hectares of natural forest and about 195 000 hectares of plantation forest (FSC 2010). Most of the FSC-certified certified area was also certified by LEI, and LEI had also certified another 486 000 hectares of industrial-scale operations in natural forest. In addition, LEI had certified just under 21 000 hectares of community-managed forests. The figure for certified forest shown in Table 5 includes only those forests certified under voluntary schemes (FSC and LEI).

Estimate of the area of forest sustainably managed for production. The Government of Indonesia (2010) considered those KPHs assessed as under 'fair' management through the LPI to be under sustainable management, but only those rated as 'good', a total of 2.10 million hectares, are considered here. In addition, 1.125 million hectares have been certified under voluntary schemes. According to the Government of Indonesia (2010), 1.06 million hectares of the area certified by the FSC or LEI are not counted in the LPI assessment and therefore can be added to the LPI total. Thus, the total area of forest considered to be under sustainable management is at least 3.16 million hectares (Table 5).

Timber production and trade. Average annual wood production in the period 2003–2007 was estimated at about 101 million m^3, consisting of 14.4 million m^3 of industrial wood and 86.4 million m^3 of fuelwood. Overall this was a reduction of about 17 million m^3 per year on the average total wood production in the period 1998–2002 (FAO 2010a). ITTO (2011) estimated total industrial log production in 2009 at 36.0 million m^3, up from 24.8 million m^3 in 2004; however, the volume of illegal logging has been estimated to be about equal to the official harvest (Human Rights Watch 2009). The Government of Indonesia (2010) estimated that total log production in 2008 was 32 million m^3, more than double official production in 2004. Most of the reported increase was from plantation forests, where wood production increased from 8.25 million m^3 in 2004 to 22.4 million m^3 in 2008. These data have been criticized as unreliable (Human Rights Watch 2009).

The production of tropical hardwood plywood in 2009 was estimated at 3.20 million m^3, down from 4.51 million m^3 in 2004 and 7.50 million m^3 in 1999 (ITTO 2010). The recent decline has been attributed to reductions in logging quotas and crackdowns on illegal log flows that have

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*	46 000	43 200	18 400	275	2940	2500	2500	0.152
2010	**38 600**	**26 200**	**13 700**	**1125**	**3160****	**2500**	**2500**	**195**

* *As reported in ITTO (2006).*

** *Comprises 2.10 million hectares of forest where management is rated as 'good' under the LPI, and 1.125 million hectares of forest certified by the FSC or LEI.*

restricted log availability for plywood production (ITTO 2009). The estimated volume of tropical hardwood sawnwood produced in 2009 was 4.17 million m^3, compared with 4.33 million m^3 in 2004 and 6.5 million m^3 in 1999 (ITTO 2011). In 1999 Indonesia produced 50 000 m^3 of tropical hardwood veneer; this grew to 220 000 m^3 in 2009 (ibid.).

In 2009 Indonesia exported an estimated 2.15 million m^3 of tropical hardwood plywood, 698 000 m^3 of tropical hardwood sawnwood, 11 000 m^3 of tropical hardwood veneer and 67 000 m^3 of tropical hardwood logs. The total export value of primary wood products (including coniferous wood) was about US$2.15 billion, down from US$2.89 billion in 1999 (ITTO 2011).

In 2008 there were 227 production units with an installed capacity of more than 6000 m^3 per year. Total processing capacity was 23.4 million m^3 per year[a], but in 2005 the installed capacity utilization rate was less than 50% in both the plywood/veneer and sawmilling sectors. On the other hand, the pulp industry has been expanding, based mainly on the plantation resource, and in 2005 was operating at over 80% capacity (Forest Industry Revitalization In-house Experts Working Group 2007).

In 2007 the Ministry of Forestry issued a 'road map' for revitalizing the forest industry. The vision of this road map was "A high quality and competitive Indonesian timber industry supported by sustainable and growing sources of raw materials". The road map sets out objectives, targets, strategy recommendations and follow-up steps, and describes the enabling conditions that are necessary for the road map to work (ibid.).

Non-timber forest products. A wide range of NTFPs are produced in Indonesia – rattan, bamboo, *Nipa* fronds, *Metroxylon* spp (sago starch), resin from *Pinus merkusii*, *Shorea javanica* (damar mata kucing), copal, *Melaleuca* (kaya putih oil), *Santalum album* (cendana), *Aquilaria malaccensis* (agarwood), medicinal plants, fibres, and fruits such as *Durio zibethinus* (durian). Wood-carving for souvenirs is important, using woods such as *Hibiscus tiliaccus, Manilkara kauki* (sawo kecik), *Artocarpus heterophyllus* (jackfruit), teak, sandalwood and ebony.

Forestry Minister Regulation P35/Menhut-II/2007 identified nine potential and prospective groups of NTFPs, consisting, in total, of 557 species plant and animals. Five species groups – rattan, bamboo, bees, silk and sandalwood – have been afforded development priority.

FAO (2010a) reported the following removals for 2005:

- resin (damar), 689 tonnes
- rattan, 563 tonnes
- cajuput oil, 88.8 tonnes
- sap (getah-getahan), 44.4 tonnes
- gum resin (gondorukem), 18.3 tonnes
- turpentine, 12.6 tonnes
- honey (madu), 2.19 tonnes
- agarwood (gaharu), 2.36 tonnes.

No data were available for other NTFPs, such as birds' nests, grass, medical herbs, fruits, fish and live animals, which are commonly traded by local communities.[a]

As of 2009, 316 registered companies were involved in the breeding of wild plant and animals (not all forest-based), comprising 124 units of *Arwana* fish breeding, 31 units of crocodile breeding, 30 units of bird breeding, 53 units of decorative coral breeding/transplants, three units of *molusca* breeding, 17 units of plant breeding, 31 units of reptile breeding, 20 units of mammal breeding and nine units of insect breeding. Exports of wild plants and animals earned a total non-tax state income of 2.26 billion Indonesian rupiah in 2008.[a]

Forest carbon. Gibbs et al. (2007) estimated national-level forest biomass carbon stock in the range 13 143–25 547 MtC and FAO (2010b) estimated it at 13 017 MtC. Deforestation, peatland degradation and forest fires have put Indonesia among the world's top three emitters of GHGs; emissions resulting from deforestation and forest fires are five times those of non-forestry emissions. Carbon emissions from Indonesia's deforestation and forest degradation are estimated at 55 $MtCO_2e$ per year.

Indonesia has significant potential for carbon capture and storage and is well-advanced in its planning (Table 6). Following the 13th Conference of the Parties to the UNFCCC, which was held in Bali in 2007, the Ministry of Forestry prepared a national REDD+ policy and strategy

A typical forest/rotational agriculture landscape in an ITTO project area, Malinau, East Kalimantan.

and established a climate-change working group. The REDD+ strategy includes reducing forest conversion and forest access that causes permanent change; forest management; improving fire management; tackling illegal logging; rehabilitating degraded lands; and restoring forest ecosystems. The Government of Indonesia also works to conserve the forest carbon pool through forest conservation. Various Forest Minister decrees (e.g. P68/Menhut-II/2009, P30/Menhut-II/2009, P30/Menhut-II/2009 and P36/Menhut-II/2009) regulate REDD+ approaches and REDD+ demonstration activities.

REDD+ is being carried out in three steps. The first step (2007–2010) is preparation by identifying the state of science and related policy. The second step (2009–2012) is 'readiness', which is to set the method and policy used. The third step is full implementation (Ministry of Forestry 2010). Indonesia participates in all major international REDD+ initiatives, including the REDD+ Partnership, the Forest Carbon Partnership Facility, UN-REDD and the Forest Investment Program. A considerable number of regionally based foreign-supported REDD+ pilots are being implemented throughout the country. As part of the climate-change partnership established between the Government of Indonesia and the Government of Norway, the latter has stated its intention to contribute funds to Indonesia's REDD+ efforts in the order of US$1 billion. In December 2010 the Government of Australia also announced it would join the partnership and pledged to contribute US$45 million to it.

Table 6 Forest carbon potential

Biomass forest carbon (MtC)	% forest 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
13 143–25 547	69	+++	+++	++	++	+++	+++

+++ 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 2010, while announcing a voluntary target to reduce the country's GHG emissions, Indonesia took steps toward a coordinated approach for both managing climate-change activities and ensuring that related finances received externally are harmonized with the country's priorities. The government established the Indonesian Climate Change Trust Fund, which seeks to co-finance investments in adaptation and mitigation activities, including those involving forests.

Forest for protection

Soil and water. Indonesia pursues integrated watershed management. Some 28% of the total forest area is managed primarily for the protection of soil and water.[a] Forest concession agreements have conditions covering the establishment of buffer strips along streams and protective belts along roads.

Biological diversity. Indonesia is a megadiverse country. With about 1.3% of the earth's land surface, it contains an estimated 10% of the world's plants, 12% of mammals, 16% of reptiles and amphibians, and 17% of birds. One hundred and seventy-four mammals, 90 birds, 30 amphibians, three reptiles, eleven arthropods, one fish and 21 plants found in forests are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species (IUCN 2011). Twenty-seven plants are listed in CITES Appendix I and 880 in Appendix II (UNEP-WCMC 2011). Under Government Regulation 7 (1999) on the Preservation of Plant and Animal Species, 58 plant species and 236 animals are threatened by extinction and must be preserved.[a]

Protective measures in production forests. In addition to stipulations for conservation measures contained in forest concession agreements, elaborate guidelines are set out in various forest regulations, such as the Forestry Law (1999) and Decree 32 (1990) concerning the management of protected areas. Regulations include specifications for road construction, protective belts along the margins of streams/rivers and roads, the alignment of skid trails, directional felling, and enrichment and protective planting.

Extent of protected areas. Indonesia has allocated over 10% of its land area as protected areas (Yeager 2008). As of 2009 there were 50 national parks (16.3 million hectares), 248 strict nature reserves (4.8 million hectares), 75 wildlife sanctuaries (5.1 million hectares), 118 nature recreation parks (750 000 hectares), 14 game-hunting parks (225 000 hectares) and 22 grand forest parks (344 000 hectares).

The establishment of conservation forest management units is in progress under Government Regulation 6 (2007) for the following ten national parks: Berbak, Ujung Kulon, Gunung Halimun Salak, Tanjung Putting, Kutai, Meru Betiri, Alas Purwo, Bali Barat, Gunung Rinjani and Bunaken.

Many of the protected areas are thought to be degraded, due largely to illegal activities (ITTO 2001). According to UNEP-WCMC (2010), 14.1 million hectares of forest are in protected areas that conform to IUCN protected-area categories I–IV.

Estimate of the area of forest sustainably managed for protection. Management plans have been prepared for the Betung Kerihun and Kayan Mentarang national parks in Borneo, which together cover about 2.18 million hectares of forest, and their management is being strengthened under two projects implemented by WWF Indonesia and the Ministry of Forestry's Directorate General of Forest Protection and Nature Conservation (previously with ITTO funding). WWF Indonesia has had a presence in the Kayan Mentarang National Park since the 1990s, developing a 25-year management plan that is now under implementation. In general, however, there is little information on the management status of the protection PFE. Therefore, the estimate given in Table 7 comprises only the Kayan Mentarang National Park.

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*	22 500	14 400	16 000	5000	1360
2010	**27 300**	**14 100****	**26 400**[b]**	**2180**	**1360**

* *As reported in ITTO (2006).*

** *UNEP-WCMC (2010).*

Socioeconomic aspects

Economic aspects. Forests and forest industries make a substantial contribution to Indonesia's socioeconomic development. The wood-products sector, for example, employed 205 000 people in 2008.[a] In 2005 the forest sector generated about 3.25 trillion rupiah in revenue for the state (FAO 2010a). Nevertheless, Human Rights Watch (2009) estimated that the Indonesian government lost US$2 billion in 2006 due to:

- Forest taxes and royalties never collected on illegally harvested timber.
- Shortfalls due to massive unacknowledged subsidies to the forestry industry (including basing taxes on artificially low market price and exchange rates).
- Losses from tax evasion by exporters through transfer pricing.

It is estimated that between 500 000 and 600 000 people are directly employed in the forest industry. This figure would be much higher if all those employed in agroforestry activities and in woodworking and the small-scale production of sawnwood, particleboard, fibreboard and wooden handicrafts were taken into account (Thang, H.C., pers. comm., 2011).

Livelihood values. There are about 32 000 forest-related villages in Indonesia, 1305 of which are in forest (including 208 in Central Kalimantan), 7943 are adjacent to forest, and 22 709 are in the vicinity of forest. In Central Java there are 1581 adjacent-to-forest villages and 6795 villages in the vicinity of forest.[a] About 50 million people live in these villages, about 10 million of whom have been categorized as poor or left-behind.[a]

The Indonesian government has introduced the Forest Village Community Development and Empowerment Program (PMDH) to assist such people. Concession-holders in Java are also developing communal joint forest management (PHBM), and there are other social forestry, community forest and village forest programs. The PMDH started in 2003 and has been extended to 267 villages in 169 IUPHHK HAs in 16 provinces involving 20 542 families. The PHBM involves about 16 000 families in IUPHHK-HAs and 30 600 families in IUPHHK-HTs. As of December 2008, another program (Rural Development, or *Bina Desa*) has involved 19 810 families in forest communities. The social forestry program covers 8614 hectares and involves 540 families.

Social relations. In many cases forest concessionaires have neglected or rejected the traditional rights of local communities; in some areas this has prompted communities to collaborate with illegal loggers and/or to take revenge by damaging the forest (ITTO 2001). Some concessionaires are working towards repairing relations with local communities in an effort to improve acceptance of their activities. Decentralization has often complicated disputes over land and usufruct rights but in the long run could provide mechanisms for resolving them.

Disputes related to tribal rights need to be resolved if there is to be tenure security and business certainty. Decentralization still needs better coordination and synchronization to achieve good governance; nevertheless, it offers promise that the fair economic distribution of benefits from forest management can be realized through community empowerment.[a] The other important aspect that urgently needs to be strengthened is land reform, for example with respect to land-use change.[a]

While corruption remains a problem in the forest sector, there have been improvements in forest management under the administration of President Susilo Bambang Yudhoyono (who has been president since 2004), and successes in anti-corruption efforts have resulted in significant gains in Indonesia's score on World Bank measures of control of corruption (Human Rights Watch 2009). There remains a lack of transparency at the national, provincial and district levels of government, however, and accurate information about the forest sector is difficult to obtain (ibid.).

Summary

Indonesia's forests face many threats, including illegal logging, fire, encroachment, poor logging practices, inefficient timber-processing, unsettled land claims and regulatory inconsistency and confusion. A process to decentralize forestry administration has been partially reversed, and greater coordination between the levels of government is needed to overcome problems in, for example, land-use allocation, forest conversion, illegal logging, illegal timber trade and industrial inefficiency. Efforts are under way at the national

level to combat illegal logging and it appears that some progress has been made. A two-year suspension of new forest-clearing concessions was announced in 2010 as part of a climate-change partnership between the Government of Indonesia and the Government of Norway that aims to reduce GHG emissions from Indonesian forests. A compulsory certification scheme for concession-holders imposes a certain degree of oversight on forest operations.

Key points

- Indonesia has an estimated PFE of 68.4 million hectares (compared with 71.0 million hectares in 2005), comprising 38.6 million hectares of natural production forest (compared with 46.0 million hectares in 2005), 27.3 million hectares of protection forest (compared with 22.5 million hectares in 2005) and 2.5 million hectares of planted forest (no change since 2005).
- As of 2009, 153 of the 308 existing commercial logging licences (IUPHHK-HAs) had been assessed for mandatory certification over a total area of 13.7 million hectares. The performance was assessed as 'good' over about 2.10 million hectares.
- The area of independently certified natural production forest is 1.125 million hectares, up from 275 000 hectares in 2005. An estimated 3.16 million hectares of the production PFE are under SFM. An area of 1.36 million hectares of protection PFE, in one national park, is considered to be under SFM.
- The Indonesian timber sector has been undergoing massive change. For example, the volume of tropical hardwood plywood produced in 2009 was one-third the volume produced in 1995.
- A program to restore degraded forests and especially to establish new planted forests has been announced, with the aim of covering more than 21 million hectares.
- Climate-change concerns are being integrated into Indonesia's forest-related institutions and a national strategy for REDD+ is being implemented in stages, including through the large-scale funding of REDD+ pilot projects.

Endnotes

a Government of Indonesia (2010).

b ITTO estimate.

References and other sources

EIA (2010). *Rogue Traders: the Murky Business of Merbau Timber Smuggling in Indonesia*. Environmental Investigation Agency, London, UK, and Telepak, Bogor, Indonesia.

FAO (2010a). Global forest resources assessment 2010 country report: Indonesia (available at http://www.fao.org/forestry/fra/67090/en/).

FAO (2010b). *Forests and Climate Change in the Asia-Pacific Region.* Forests and Climate Change Working Paper 7. FAO, Rome,Italy.

Forest Industry Revitalization In-house Experts Working Group (2007). A road map for the revitalization of Indonesia's forest industry. Ministry of Forestry, Jakarta, Indonesia.

FSC (2010, website accessed June 2010). FSC certification database (searchable database available at http://info.fsc.org/PublicCertificateSearch).

Gibbs, H., Brown, S., Niles, J. & Foley, J. (2007). Monitoring and estimating tropical forest carbon stocks: making REDD a reality. *Environmental Research Letters* 2 (available at http://iopscience.iop.org/1748-9326/2/4/045023/fulltext).

Government of Indonesia (2007). *Rancana Aksi Nasional Dalam Menghadapi Perubahan Iklim* (National Action Plan Addressing Climate Change). Government of Indonesia, Jakarta.

Government of Indonesia (2010). Report of progress toward achieving sustainable forest management in Indonesia. Submission to ITTO by the Government of Indonesia, Jakarta, Indonesia. Unpublished.

Governments of Norway and Indonesia (2010). Letter of intent on cooperation on reducing greenhouse gas emissions from deforestation and forest degradation. 26 May 2010.

Hayes, A. (2010). The governance of national climate change adaptation strategies: an Indonesian case study. Paper prepared for the Conference on Democratizing Climate Governance, held 15–16 July 2010, Australian National University, Canberra, Australia.

Human Rights Watch (2009). *Wild Money: The Human Rights Consequences of Corruption and Illegal Logging in Indonesia's Forestry Sector.* Human Rights Watch, New York, United States.

Intergovernmental Panel on Climate Change (2007). Summary for policymakers. In: Parry, M., Canziani, O., Palutikof, J., van der Linden, P. & Hanson, C. (eds) *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.* Cambridge University Press, Cambridge, UK.

ITTO (2001). Achieving sustainable forest management in Indonesia. Report of the diagnostic mission. Presented at the thirty-first session of the International Tropical Timber Council, November 2001. ITTO, Yokohama, Japan.

ITTO (2006). *Status of Tropical Forest Management 2005*. ITTO, Yokohama, Japan (available at http://www.itto.int/en/sfm/).

ITTO (2009). *Annual Review and Assessment of the World Timber Situation 2008*. ITTO, Yokohama, Japan.

ITTO (2011, website accessed March 2011). Annual Review statistics database (available at http://www.itto.int/annual_review_output/?mode=searchdata).

IUCN (2011, website accessed March 2011). IUCN red list of threatened species (searchable database available at www.redlist.org).

Lawson, S. & MacFaul, L. (2010). *Illegal Logging and Related Trade: Indicators of the Global Response.* Chatham House, London, UK.

Sari, A., Maulidya, M., Butarbutar, R., Sari, R. & Rusmantoro, W. (2007). Executive summary: Indonesia and climate change: working paper on current status and policies. PT Pelangi Energi Abadi Citra Enviro, Jakarta, Indonesia.

Spalding, M., Kainumu, M. & Collins, L. (2010). *World Atlas of Mangroves.* Earthscan, London, UK.

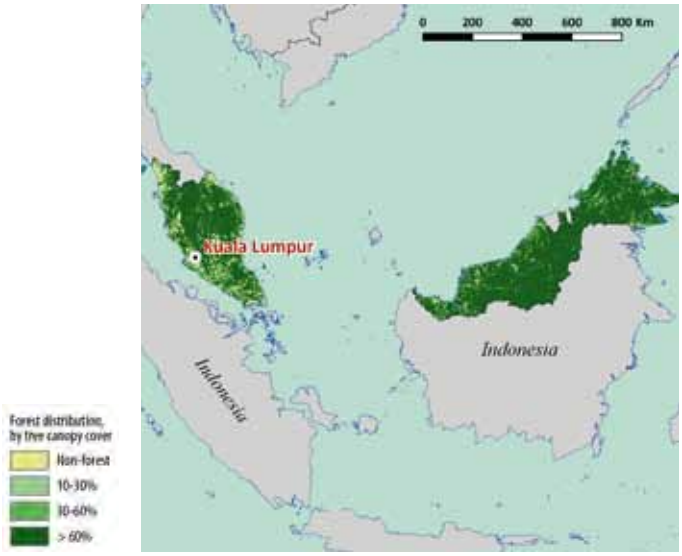
UNDP (2009). *Human Development Report 2009*. United Nations Development Programme, New York, United States.

UNEP-WCMC (2011, website accessed March 2011). UNEP-WCMC species database: CITES-listed Species (searchable database at available at www.cites.org/eng/resources/species.html).

United Nations Population Division (2010, website accessed March 2010). World population prospects: the 2008 revision (searchable database available at http://esa.un.org/unpp/p2k0data.asp).

Yeager, C. (2008). Conservation of tropical forests and biological diversity in Indonesia. Submitted in accordance with Foreign Assistance Act Sections 118/110 for the United States Agency International Development.

MALAYSIA



Forest resources

Malaysia is a federation of 13 states and three federal territories comprising two distinct regions – Peninsular Malaysia, with eleven states, and the states of Sarawak and Sabah (East Malaysia) in Borneo. In 2010 the country's estimated population was 27.9 million people (United Nations Population Division 2010), and it is ranked 66th out of 182 countries in UNDP's Human Development Index (UNDP 2009). Estimates of total natural forest area include 18.4 million hectares (excluding mangroves)[a] and 18.6 million hectares (FAO 2010a), which is 56% of the total land area (33.0 million hectares).

Forest types. Malaysia reports its forests according to three forest types: dry inland forest (synonymous with the dipterocarp forests reported in ITTO 2006, dominated by trees of *Dipterocarpaceae*); peat swamp forest; and mangrove forest. Common tree species found in the dry inland forests include *Anisoptera*, *Dipterocarpus*, *Dryobalanops*, *Hopea*, *Shorea* and *Parashorea.* Of the estimated 17.1 million hectares of dry inland forests, 5.48 million hectares are in Peninsular Malaysia, 7.83 million hectares are in Sarawak and 3.84 million hectares are in Sabah.[a] There are also 1.31 million hectares of peat swamp forest (down by about 230 000 hectares from the area reported in ITTO 2006), 890 000 hectares of which are in Sarawak. Major timber species found in this forest are *Gonystylus bancanus* (ramin), *Durio carinatus* and various species of *Shorea*. Mangrove forests cover an estimated 709 700 hectares, 59% of which are in Sabah (Spalding et al. 2010).

Permanent forest estate. In 2008 the area of natural-forest PFE was 13.9 million hectares (42% of the total land area), which was slightly less than the 14.4 million hectares reported in ITTO (2006). Of this, 13.3 million hectares were dry inland forests. The natural-forest PFE comprises 10.3 million hectares of production forest (74% of the natural-forest PFE) and 3.58 million hectares (26%) of protection forest (Table 1). These forests are gazetted in accordance with the National Forestry Act (1984) in Peninsular Malaysia and

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*	19.3–19.5	19 148	11 200	183	3210	14 593
2010	**18.4–18.6**	**14 700****	**10 298** Of which: 2738 in Peninsular Malaysia 2790 in Sabah 4770 in Sarawak	**539** Of which: 109 in Peninsular Malaysia 200 in Sabah 230 in Sarawak	**3579** Of which: 1969 in Peninsular Malaysia 610 in Sabah 1000 in Sarawak	**14 416**‡

* *As reported in ITTO (2006).*

** *Calculated using the ratio of forest with greater than 60% forest cover estimated by UNEP-WCMC (2010) (79%) and the total natural forest area as estimated by FAO (2010).*

‡ *FAO (2010a) reported a total PFE of 14.3 million hectares.*

Source: Government of Malaysia (2009).

the relevant state forest ordinance/enactment in Sabah and Sarawak. Peninsular Malaysia contains 4.71 million hectares (34%) of the total natural-forest PFE, Sabah 3.40 million hectares (25%) and Sarawak 5.77 million hectares (42%).[a] The increase in protection PFE from the value reported in ITTO (2006) is due mainly to an increase in the area of water catchment forest within the PFE.[b]

A significant proportion of the total PFE (i.e. natural forests and planted forests combined) has been demarcated on the ground. Licensed land surveyors mark the boundaries of the PFE by the placement of permanent boundary stones; the painting of trees with three rings of red paint at 10-metre intervals; and the erection of noticeboards at 800 m intervals and at all entrances to the forest. In Peninsular Malaysia, an estimated 65% of the production PFE has been demarcated in this way, 6% has been demarcated in Sabah and 72% has been demarcated in Sarawak. About 25% of the protection PFE has been demarcated in Peninsular Malaysia, 41% in Sabah and 80% in Sarawak.[a]

Forest ecosystem health

Deforestation and degradation. According to FAO (2010a), Malaysia's total forest area decreased by 434 000 hectares between 2005 and 2010 (an annual decline of 0.42%) and by 1.92 million hectares between 1990 and 2010. The Malaysian government reported that a total of 12 359 hectares of forest were formally converted to agriculture in the period 2004–07 (all in Peninsular Malaysia because data were unavailable for Sabah and Sarawak), while just over 53 000 hectares were formally added to the forest estate in the same period. An estimated 20 000 hectares were converted illegally in Sabah.[a] Human-induced forest fire was reported to be negligible, as was illegal harvesting.[a] FAO (2010a) estimated a total area of primary forest of 3.82 million hectares and Peninsular Malaysia reported 191 000 hectares of degraded primary forest in the PFE (Table 2). There were an estimated 2.70 million hectares of secondary forest in Sabah's PFE, the only region for which data on that parameter were available.[a]

Vulnerability of forests to climate change. In the past 100 years, mean surface temperatures have increased in the range of 0.3–0.8 °C across Southeast Asia (IPCC 2010). No long-term trend in mean annual rainfall has been discernible over that period. Similarly, no identifiable change in the number, frequency or intensity of tropical cyclones is observable; however, decadal-scale variations have occurred. From 2006 to 2009, Malaysia conducted a series of multi-stakeholder consultations to assist the drafting of a national climate-change policy. The aims of the policy are to mainstream climate-change measures, integrate balanced adaptation–mitigation responses, and strengthen institutional and implementation capacity, with an emphasis on maximizing adaptive capacity in the face of expected climate change.

SFM policy framework

Forest tenure. All forests in Malaysia are owned and managed by the state governments (Table 3). The federal government is responsible for trade policies on forest products and provides technical advice to the states.

Criteria and indicators. The Government of Malaysia used the ITTO C&I in its submission to ITTO for this report.[a] The Malaysian Criteria and Indicators for Forest Management Certification (MC&I 2002), which form the basis of the Malaysian Timber Certification Scheme (MTCS), draw on the principles, criteria and indicators of the FSC.

Table 2 Forest condition

	PFE	Non-PFE	Total
	'000 ha		
Area of primary forest	-	-	3820*
Area of degraded primary forest	191[a,**]	-	-
Area of secondary forest	2700[a,‡]	-	-
Area of degraded forest land	-	-	-

* *FAO (2010a).*

** *Data available for Peninsular Malaysia only.*

‡ *Data available for Sabah only.*

Table 3 Forest area, by tenure

Ownership category	Total area	Of which PFE*	Notes
	'000 ha		
State ownership (national, state or provincial government)	18 257	14 420	State governments.
Other public entities (e.g. municipalities, villages)	-	-	
Total public	**18 257**	**14 420**	
Owned by local communities and/or Indigenous groups	0	0	
Privately owned by individuals, firms, other corporate	0	0	

* *Includes only natural forest.*
Source: Government of Malaysia (2009).

Forest policy and legislation. A national forest policy (NFP) was adopted in 1978 as a framework for SFM. It was revised in 1992 in response to growing concern for the conservation of biological diversity, the sustainable use of genetic resources and the participation of local communities in forestry. The Malaysian C&I for SFM were developed in 2000 based on the ITTO C&I and revised in 2002. Malaysia is also negotiating a VPA with the European Union, under which it will institute a system to verify the legality of its logs, sawnwood, veneer and plywood exports to the European Union.

Under the Federal Constitution of Malaysia, land use falls within the jurisdiction of the states. Each state is empowered to enact laws, formulate forest policy and manage its forests. The legislative framework is defined in the federal National Forestry Act (1984) and the Wood-based Industries Act (1984). The National Forestry Act establishes the general laws on forestry and each state is empowered to enact state laws and regulations in line with the federal Act. The federal government also provides advice and technical assistance, maintains experimental stations and funds research and training.

The National Land Council, empowered under the Malaysian Constitution to formulate a national policy for the promotion and control of land use for mining, agriculture and forestry, serves as a forum for coordination between the federal and state governments in the discussion and resolution of problems and issues relating to forest policy, administration and management, including the determination of the annual timber harvest.

There is a commitment in the NFP that sufficient land strategically located throughout the country should be dedicated as PFE; the permanent forests should be managed in accordance with the principles of sound forest management; and the efficient harvesting and use of forest products and the development of forest industries should be promoted.

The National Forestry Act (1984) was amended in 1993 to provide more stringent penalties for certain forest offences, particularly illegal logging. Provision was also made for the police and armed forces to undertake surveillance of forest activities, especially in curbing illegal logging, the encroachment of forested areas, and timber theft. The National Forestry Act (1984) is adopted for implementation by all states in Peninsular Malaysia and is complemented by relevant laws dealing with land and water conservation, environmental quality, wildlife protection, the management of national

Log landing at Ravenscott in Sarawak.

parks, biodiversity conservation, and the rights of Indigenous communities. The International Trade in Endangered Species Act was enacted in 2008; among other things, this Act prohibits any person from trading scheduled species (which may include species found in forests) without a permit.

Incentives provided by the federal government to encourage forest-based development include:

- *Pioneer status for forest plantation projects*: pioneer status exempts companies from income tax for a period of ten years, starting from the date of first harvest of the first planted block.
- *Investment tax allowance for forest plantation projects*: this provides a 100% tax allowance for qualifying expenditure – including the cost of clearing and preparing land, and the construction of roads and bridges – incurred within five years of date of project approval.
- *Qualifying capital expenditure*: this provides private companies undertaking forest plantation projects to offset qualifying capital expenditures, such as in the clearing and preparation of land, the planting of timber seedlings, the provision of plant and machinery, the building of access roads and bridges and the construction or purchase of buildings against income from the company's other business sources. Expenditure may be for the preparation of a forest management plan and an environmental impact assessment; fees related to the procurement of timber certification; and enrichment planting, silviculture, pest and disease control and fire management.
- *Soft loans*: private companies may obtain loans to develop forest plantations, where upon harvesting the matured trees the companies must repay the government at 3.5% interest.
- *Infrastructure allowance*: logging companies located in the Eastern Corridor of Peninsular Malaysia and in Sabah and Sarawak can be considered for a 100% allowance for five years on expenditure incurred in the development of infrastructure such as bridges, jetties, power stations, ports, connecting roads and electricity cables.
- *Incentives for research and development*: forest concessionaires that undertake research and development activities to enhance SFM are eligible for incentives such as deductions on research and development expenditure and exemption from import duty and sales tax on machinery and equipment used in research and development.
- *Incentives for training*: forest concessionaires can claim deductions for the training of staff.

In addition to federal incentives and provisions under the National Forestry Act (1984), the state governments of Peninsular Malaysia set royalty rates for various timber species to encourage the greater use of lesser-used species and small-diameter logs. Each of the states also has a forest development fund that can be used:

- For the preparation of state forest management plans.
- For the preparation and implementation of forest restoration plans.
- For the preparation and implementation of programs related to amenity forests.
- To meet expenses incurred in the implementation of reforestation plans in the event of a licensee failing to do so.

In 2008, total government funding available for forest management, administration, research and human resource development at the national and sub-national (Peninsular Malaysia, Sabah and Sarawak) levels was about US$139 million.[a] This amount does not include grants or loans from international development partners and private sources.

The National Timber Industry Policy 2009–2020 was launched in February 2009 with the aim of changing the character of the industry from being a commodity producer to a manufacturer of globally sold high-value products. By 2020, the policy foresees that 60% of the value of exports will be derived from further-processed timber products (Malaysian Timber Council 2009).

Institutions involved in forests. The Forestry Department Headquarters, Peninsular Malaysia, is responsible for overall forest-sector planning, forest management, forest development and operational studies, the provision of technical advice and services, and staff training in Peninsular Malaysia. The individual state forestry departments in Peninsular Malaysia and Sabah are responsible for the administration, management and development of forest resources, the regulation of forest

harvesting, the collection of forest revenue, and the planning and coordination of the development of wood-based industries in their respective states. In Sarawak, these functions are carried out by the Sarawak Forestry Corporation, while the Forestry Department is vested with regulatory functions. Apart from the forestry departments there are a number of specialized institutions, including the Forest Research Institute of Malaysia, the Malaysian Timber Industry Board (MTIB), the Malaysian Timber Council, the Malaysian Timber Certification Council (MTCC), and university forestry faculties.

In total, about 8700 personnel work in government to support forest management. Of these, nearly 500 (170 in Peninsular Malaysia, 126 in Sabah and 200 in Sarawak) have a university or technical qualification.[a]

The implementation of the NFP, the 1998 National Policy on Biological Diversity and matters relating to the upstream activities of the forest sector are under the jurisdiction of the Ministry of Natural Resources and Environment. Timber and other downstream activities of the sector, including processing, manufacturing, marketing, trade, export and international cooperation are under the responsibility of the Ministry of Plantation Industries and Commodities, which replaced the Ministry of Primary Industries in 2004. Within each state, consultative committees at the village, *Mukim* and district levels enable public participation in forest management.

The forest industry is strongly involved at both the federal and state levels through, for example, the MTIB, the Malaysian Timber Council, the Sarawak Timber Industry Development Corporation, the Sabah Timber Association, the Sarawak Timber Association and other associations.

Status of forest management

Forest for production

Malaysian forest policy emphasizes the sustainable management of forests and the balance between protection and production. Regulations are set out in codes of forest practice, forest harvesting guidelines and standard road specifications for the country's three broad forest types (dry inland forest, peat swamp forest, and mangrove forest). These specify, in detail, the silvicultural and harvesting steps to be followed. Reduced impact logging and helicopter logging are being carried out with an emphasis on reducing environmental impact and (for the latter) on timber harvesting in terrain and conditions that preclude ground-based systems. The Logfisher winch system, a Malaysian-developed technology for extracting logs on level terrain with the minimal use of tractors, has been deployed in one FMU.[a]

In Peninsular Malaysia, a forest management plan is prepared for each FMU covering a ten-year period with a review in the fifth year; it is designed to act as a master plan for the long term and is credited with being instrumental in the achievement of SFM.[a] It serves as the basis for the preparation of five-year working plans at the forest district level and annual operating plans at both the district and FMU levels.

In Sarawak, each concession has its own forest management plan, which is a legal document and an integral part of the forest timber licence. It is revised periodically to take into account new information and requirements. The forest management plan sets out how harvesting should be conducted in the concession, including the species to be removed; the minimum diameter cutting limit; the annual harvest areas; and the volume of timber allowed. It also prescribes the penalties for damaging residual trees and includes a forest engineering plan.

As of 2009 there were eleven forest management plans in Peninsular Malaysia (one each for the eleven FMUs there), 24 in Sabah and 64 in Sarawak. In total, these 99 forest management plans accounted for 9.91 million hectares of the PFE.[a]

All timber harvesting and related management operations are carried out by contractors operating on the basis of either a long-term logging agreement (i.e. 100 years) or a short-term licence (i.e. 1–2 years for 0–1000 hectares). Large concessions are normally granted under legally binding agreements; these are often tied to wood-based industries and some cover periods of up to 30 years. Logging licences generally stipulate size limits, intensity of extraction, logging sequence, methods of treatment, transport routes, standards of road construction, etc.

The sustainable level of timber harvesting in natural forests is based on an AAC (calculated

on the basis of harvest area rather than volume extracted) approved by the government. In brief, the calculation of the AAC involves an estimate of the net productive area of the production PFE (i.e. the production PFE less forest plantations and unproductive areas such as rivers, roads and electricity transmission lines), which is then divided by 30 years, which is the length of the cutting cycle under the Selective Management System (SMS). The total AAC in the production PFE was 266 940 hectares for the period 2006–2010, comprising 36 940 hectares in Peninsular Malaysia, 60 000 hectares in Sabah, and 170 000 hectares in Sarawak. The average area harvested annually in the three-year period 2006–08 was 33 001 hectares in Peninsular Malaysia, 76 876 hectares in Sabah and 154 694 hectares in Sarawak.[a,b]

Silviculture and species selection. The silvicultural system used for managing Malaysian dry inland forests has changed over the years. Regeneration improvement felling was replaced by the Malayan Uniform System in the 1950s; these two mainly applied to lowland forest. The SMS was introduced in 1978 as logging moved into the hill dipterocarp forests and as advances in wood-processing technology rendered marketable many species that were previously not so.

In Peninsular Malaysia, the dry inland forests are managed under two management systems: the Modified Malayan Uniform System and the SMS. Under the Modified Malayan Uniform System, the mature crop may be removed in a single felling of all trees down to 45 cm dbh for all species. Under the SMS, the current cutting limit prescribed for dipterocarp species is 65 cm dbh, that prescribed for non-dipterocarps is 55 cm dbh, and the maximum permitted harvested volume is 85 m^3/hectare.

In Sabah, dry inland forests are harvested selectively based on a 50-year cutting cycle in which only trees greater than 60 cm dbh may be removed.

In Sarawak, the cutting cycle prescribed for dry inland forest is 25 years and the prescribed cutting limits for dipterocarp and non-dipterocarp species is 60 cm dbh and 45 cm dbh, respectively. An average of 7–9 trees are harvested per hectare, and the average volume removed per hectare is 54 m^3.

Peat swamp forest in Peninsular Malaysia is managed under a modified SMS in which higher cutting limits apply due to a lower stocking of natural regeneration in the stand. The minimum cutting limit prescribed for dipterocarp species is 60 cm dbh and that prescribed for non-dipterocarps, including ramin, is 50 cm dbh. In Sarawak the cutting cycle for peat swamp forest is 45 years. The prescribed cutting limit is 40 cm dbh for ramin and 50 cm dbh for other species.

Only merchantable trees (up to about ten trees per hectare) may be harvested. Post-harvest treatments concentrate on assessing the condition of the crop after logging and measures for the rehabilitation and enhancement of the crop determined according to its condition at the time. By the end of 2003, 2.1 million hectares of logged-over forests had been treated silviculturally and an additional 50 000 hectares had been enriched with native species (ITTO 2006).

More than 120 species are used for timber production. Table 4 shows the most important species or species groups harvested in Peninsular Malaysia, and their average harvested volumes. The most important harvested species in Sarawak are grouped by common name: dark red meranti,

Table 4 Commonly harvested species for industrial roundwood, Peninsular Malaysia

Species	Average annual harvest (average production 2006–08), PFE and non-PFE combined
Red meranti**,‡ (*Shorea parvifolia, S. macroptera* and other *Shorea* spp)	838 000 m^3.
Dark red meranti**,‡ (*Shorea pauciflora, S. curtusii* and other *Shorea* spp)	657 000 m^3.
Keruing‡ (*Dipterocarpus* spp)	562 000 m^3.
Kempas (*Koompassia malaccensis*)	385 000 m^3.
Balau† (*S. kunstleri, S. guiso, S. collina, S. ochrophloia* and other *Shorea* species)	218 000 m^3.

** *Red and dark red meranti are distinguished by their specific gravities: 0.38–0.58 for red meranti and >0.58 for dark red meranti.*
‡ *Also listed in ITTO (2006).*
† *Comprising red and yellow balau.*
Source: Government of Malaysia (2009).

selangan batu (also known as balau), yellow meranti, light red meranti, and kapur.[a]

Planted forest and trees outside the forest. In 2009, the total area of planted forest for marketable timber was 620 000 hectares, of which 539 000 hectares were inside the PFE (Thang, H.C., pers. comm., 2010). There were also about 5.86 million hectares of commercial agricultural tree plantations in 2009 – comprising oil palm (4.69 million hectares), rubber (1.06 million hectares) and coconut (114 000 hectares) (Government of Malaysia 2010). Many of these, especially rubber, are also used for wood production.

The main species planted in Peninsular Malaysia are *Acacia mangium*, *Tectona grandis*, *Azadirachta excels*, *Hevea braziliensis* (timber latex clones) and *Pinus carribaea.* The main species in Sabah are *Acacia* spp, *Albizia falcataria*, *Gmelina arborea*, *Eucalyptus grandis*, *Tectona grandis* and *Hevea braziliensis* (timber latex clones). In Sarawak the main species planted are *Acacia* spp, *Albizia falcataria*, *Eucalyptus* spp and *Anthocephalus cadamba*.

In Sarawak, 2.4 million hectares have been set aside since 1998 and 39 licences for planted forests have been awarded to the private sector for the development of forest plantations of exotic and native tree species (Thang, H.C., pers. comm., 2010).

Forest certification. In 2008 the MTCS began operating as part of a new institutional arrangement, whereby the MTCC continues to play the role of the national governing body for the national certification scheme and the independent assessors become certification bodies, which receive and process applications for certification, conduct assessments and make decisions on awarding certificates for forest management and/or chain of custody. The certification bodies are required to be accredited by the Department of Standards Malaysia, the national accreditation body in Malaysia (MTCC 2010). In May 2009 the MTCS was endorsed by the PEFC Council after meeting its requirements; the endorsement is valid for five years. The MTCS uses the PEFC International Chain of Custody standard for the purposes of chain-of-custody certification.

As of April 2010, ten Certificates for Forest Management (Natural Forest) had been issued by either the PEFC or the MTCS to FMUs covering 4.953 million hectares, which was 48% of the natural-forest production PFE. Eight of the certified FMUs (Kelantan, Kedah, Johor, Negeri Sembilan, Pahang, Perak, Selangor and Terengganu) are in Peninsular Malaysia, and the other two are the Anap-Muput FMU in Sarawak and the Segaliud Lokan FMU in Sabah (Thang, H.C., pers. comm., 2010). In addition, as of May 2010 the FSC had certified five FMUs totalling 203 842 hectares: the KPKKT concession at Dungun (108 900 hectares of natural forest), Asiaprima (4884 hectares of plantation), the Perak State Development Corporation (9000 hectares of natural forest), Sabah Softwoods (25 919 hectares of plantation), and the Sabah Forestry Department (55 139 hectares of natural forest at Deramakot) (FSC 2010). The first three of these are in Peninsular Malaysia and are already counted as certified under the MTCS/PEFC schemes. An additional 301 202 hectares in Sarawak are verified at the Verification of Origin stage of SGS's TLTV scheme, while 288 623 hectares in Sabah are verified under SmartWood's Verification of Legal Origin scheme and 188 520 hectares, also in Sabah, are verified under the SmartWood's Verification of Legal Compliance scheme (Thang, H.C., pers. comm., 2010).

Estimate of the area of forest sustainably managed for production. Data presented below (see 'timber production and trade') suggest that a sustainable harvest is still to be achieved in Sarawak: by 2020 the allowable cut is predicted to decline by 30% over 2006 levels, mostly as a result of a decrease in the timber harvest outside the PFE.

In Sabah, the cutting cycle is 50 years (twice the length of the cutting cycle in Sarawak) and the official AAC is not being exceeded. This is an encouraging sign for the sustainable management of Sabah's production PFE, although the overall harvest in that state is still expected to decline by 2020 as a more conservative harvesting regime takes effect. Most production PFE in Peninsular Malaysia has been certified and a high-quality monitoring regime is in place.

On the basis of an estimate provided by the Government of Malaysia, FAO (2010a) reported that 14.3 million hectares of natural forest were under SFM, which was the entire PFE identified in that report. Nevertheless, a lack of clear information on the status of forest management in parts of the country suggests that a degree of caution is warranted. The area of natural-forest

production PFE under SFM in 2010 is therefore estimated to be at least 5.95 million hectares, comprising the total area certified by the MTCS or the PEFC, the concession at Deramakot in Sabah, the 778 345 hectares of forest in Sabah and Sarawak with controlled-wood certification, and the 162 000-hectare Bintulu Model Forest in Sarawak (Table 5). More than 50% of the natural-forest production PFE is certified.

Timber production and trade. Total Malaysian industrial log production was 18.0 million m^3 (mostly from natural forests) in 2009, down from 24.7 million m^3 in 2004 (ITTO 2011); in 1990 the estimated total industrial log production was 39.1 million m^3 (ITTO 1995). In the period 2011–15, total annual log production is projected to be 29.2 million m^3. Production from natural forests will decline to 15.5 million m^3 but the harvest from forest plantations will grow to 11.8 million m^3, with most of the expansion occurring in Sarawak (and 1.90 million m^3 will also be harvested in rubber plantations). In the period 2016–2020, annual natural forest production will decline to 11.5 million m^3, while production from plantations will increase to 16.1 million m^3. Thus, annual log production from natural forests is expected to decline from 19.3 million m^3 per year in 2006 to 11.5 million m^3 in 2020, but total log production (i.e. from natural and planted forests combined) will increase. Over the period, the decline in annual log production in the PFE in Peninsular Malaysia, Sabah and Sarawak will be due mainly to the introduction of more conservative forest-harvesting practices and stringent enforcement.[a] Most of the projected decline in natural-forest production in Sarawak (from 11.5 million m^3 per year in 2006–10 to 8.0 million m^3 per year in 2016–2020) is due to a reduction in log production from non-PFE natural forests. There will be a slight reduction in the harvest in the PFE, from 8.5 million m^3 to 8.0 million m^3.[b]

Log exports fell from 6.73 million m^3 in 1999 to 4.37 million m^3 in 2009 (ITTO 2011), continuing a downward trend since 1990, when exports were estimated at 20.3 million m^3 (ITTO 1995). Sawnwood production fell from 5.24 million m^3 in 1999 to 4.49 million m^3 in 2009 (ITTO 2011).

The main wood-based industries are sawmilling, wood-based panel products, wood moulding and furniture manufacture. The contribution of wood-based products to export earnings is significant: in 2008, for example, the export of wooden furniture from Malaysia was valued at more than US$2 billion and the value of plywood exports was nearly US$1.9 billion.[a] The total value of all wood-based product exports in 2008 was US$6.6 billion.[b]

Non-timber forest products. The fourth national forest inventory, completed in 2007, contained data on some NTFPs in Peninsular Malaysia. However, the Government of Malaysia's submission for this report included little information on NTFPs.[a] In Peninsular Malaysia, about 35 000 m^3 of rattan and 300 000 m^3 of bamboo are harvested each year. The combined value of rattan furniture exports from Peninsular Malaysia and Sabah was just over US$10 million in 2008.[a] In 2005 the harvest of agarwood was valued at 92 million ringgit and the harvest of birds' nests was worth 22 million ringgit (FAO 2010a).

Forest carbon. Forest carbon loss is linked mainly to the planned conversion of non-PFE to commercial crops, in particular oil palm, and to intensive logging, particularly in Sarawak. An estimated 4036 MtC are stored in Malaysia's forests (PFE and non-PFE combined), comprising 2831 MtC in above-ground biomass, 679 million tonnes in below-ground biomass, and 526 MtC in dead wood.[a] Gibbs et al. (2007) estimated national-level forest biomass carbon stock in the range 2405–4625 MtC, and FAO (2010b) estimated it at 3212 MtC. Malaysia's potential to conserve

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*	11 200	6790	11 200	4620	4790	183	183	183
2010	**10 298**	**9910**	**9910**	**5228****	**5950**	**539**	**539**	**35**

* *As reported in ITTO (2006).*

** *Includes an area of 223 000 hectares with FSC controlled-wood certification.*

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
2405–4625	79	+	++	+++	+	+	

+++ 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).

the existing forest carbon stock is high (Table 6). Nonetheless, Malaysia is one of the few tropical forest countries not yet engaged in major REDD+ activity (as of November 2010).

Forest for protection

Soil and water. An estimated 5.197 million hectares of forest are managed primarily for the protection of soil and water (designated 'water catchment forest').[a] Of this, about 3.58 million hectares are in the protection PFE.

Biological diversity. Malaysia is one of the twelve megadiverse countries. It is estimated to have 12 500 species of flowering plants and more than 1100 species of ferns. In Peninsular Malaysia, 26% of tree species are endemic. Sabah and Sarawak are key areas of endemism. The fauna is considered even richer than the flora: it includes 300 mammals, 750 birds, 350 reptiles, 165 amphibians, more than 300 freshwater fish and 1040 butterflies. Of Malaysia's estimated 19 335 forest-dependent species, 72 mammals (including the orang utan, proboscis monkey, Sumatran rhinoceros, sun bear and clouded leopard), 542 birds, seven amphibians and 29 butterflies are considered endangered.[a]

Sixty-five mammals, 34 birds, 46 amphibians, two reptiles, six arthropods, 30 molluscs and 19 plants found in forests are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species (IUCN 2011). Twenty plant species that occur in Malaysia are listed in CITES Appendix I and 734 in Appendix II, including ramin (UNEP-WCMC 2011).

Protective measures in production forests. In the production PFE, no logging is allowed in areas higher than 1000 m above sea level or on slopes greater than 25 degrees. In Peninsular Malaysia, there are procedures designed to specifically reduce the impact of logging on soil and water values. Implementation is monitored by an internal auditing team and, in certified forests, by third-party assessors auditing for compliance with the Malaysian C&I or the FSC's PCI.[a]

Extent of protected areas. Of the total PFE, 3.58 million hectares can be classified as protection forest. According to UNEP-WCMC (2010) 1.98 million hectares of forest are in reserves classified in IUCN protected-area categories I–IV. One million hectares of protection PFE are located in Sarawak. The management of the Lanjak-Entimau Wildlife Sanctuary, which covers 187 000 hectares, benefited from a long-running ITTO-funded project, while the extended Pulong Tau National Park (covering 165 000 hectares) is also the subject of an ITTO-funded project. The 434 000-hectare Taman Negara National Park, which straddles the states of Pahang, Terengganu and Kelantan in Peninsular Malaysia, was established in 1939 and is managed by the Department of Wildlife and National Parks Peninsular Malaysia.

Estimate of the area of forest sustainably managed for protection. The area of protection PFE under sustainable management is estimated at 3.58 million hectares (Table 7), the total area

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*	3210	1400	3210	3210	3210
2010	**3579**	**1980**	**3579**	**3579**	**3579**

* *As reported in ITTO (2006).*

of protection PFE. Protected forest areas outside the PFE may also be so managed but data were unavailable for this report.

Socioeconomic aspects

Economic aspects. The forest sector in Malaysia directly contributed about US$2.88 billion to the Malaysian economy in 2008 (up from US$2.33 billion in 2003), which was about 1.3% of GDP (down from 1.9% in 2003).[a] In 2008 about 167 000 people were employed directly in timber harvesting and primary processing (the latter comprising sawmills and plywood and veneer mills), and another 19 400 were employed in other wood-processing factories.[a,b] In Peninsular Malaysia, the 31 750 people estimated to be employed in timber harvesting and primary processing comprised 26 865 males and 7255 females.[a] About 2000 people are employed in the management of protected areas (FAO 2010a). In 2005, government revenues from the forest sector were estimated at 1.6 billion ringgit and total public expenditure was estimated at 373 million ringgit (ibid.).

Livelihood values. The rights of Indigenous communities for the subsistence use of forest products are recognized officially. Timber concessionaires are required to designate community-use zones within licensed forest areas. Sabah's licensing agreements for concessionaires include local communities in the classification of forest areas. In Sarawak, the law allows community access rights to collect forest products for subsistence. Sago palm (*Eugeissona utilis* and *Metroxylon* spp), meat, fish, wild honey and mushrooms are collected, as are medicinal plants, dart poison, birds' nests, rattan and bamboo.

Social relations. As part of the requirements of certification under the Malaysian C&I (2002), consultations before, during and after logging on the impacts of logging are carried out with local communities via questionnaires. Several mechanisms exist for resolving disputes between forest stakeholders, including village development and security committees, *Mukim* coordination committees, district action committees, state working committees, state development/action committees, and state executive councils.

In Peninsular Malaysia and Sabah, about 76 600 hectares of forest are designated as community forests, in which local people may pursue traditional and subsistence uses. Peninsular Malaysia also has just over 17 000 hectares of forested 'Indigenous peoples reserves'.[a]

Logging in forest areas claimed by Indigenous communities has created conflicts between timber operators and local communities, particularly in Sarawak involving the Penan. In 2007, people living in Sarawak's Long Benalih community blockaded a logging track in the area. This dispute was investigated by the Human Rights Commission of Malaysia, Suhakam (Suhakam 2007), which concluded that "despite efforts by numerous organisations and continuous recommendations to the Government, the Community seems nowhere near to achieving its perceived rights to ancestral land, or to economic and social development. Urgent steps have to be taken to ensure that State laws do not deprive the Penan of inherent rights without adequate compensation and alternative resettlement areas". Suhakam (2007) further concluded that there was "a need for the Government to balance the country's economic development and exploitation of resources with the promotion and protection of basic human rights of its citizens, especially, those as vulnerable as the Penan".

Summary

Malaysia's forests are generally well managed, and there is a well-defined and demarcated PFE. Forests are managed by the states and there are differences in the approach to SFM between Sabah and Sarawak and states in Peninsular Malaysia. Generally the quality of information about the forest sector is high, although it varies by state, and relatively little information on Sarawak was available for this report. There has been little change in forest-related policies since 2005, although a national timber industry policy launched in 2009 aims to encourage further processing. More than 50% of the natural-forest production PFE has been certified, mainly under the Malaysian Timber Certification Scheme. The forest sector plays an important role in the Malaysian economy and is a significant employer. A large part of the furniture manufacturing sector is based on rubberwood, which is grown in plantations, while much of the harvest in natural forests is still exported as plywood, sawnwood and logs. Well-organized and resourced forest administrations at both federal

and state levels have the capacity to ensure that concessionaires adhere to prescribed practices and to oversee the long-term management of the resource.

Key points

- Malaysia has an estimated PFE of 14.4 million hectares (compared with 14.6 hectares in 2005), comprising 10.3 million hectares of natural production forest (down from 11.2 million hectares in 2005), 3.58 million hectares of protection forest (compared with 3.21 million hectares in 2005) and 539 000 hectares of planted forest (compared with 183 000 hectares in 2005).
- An estimated 5.95 million hectares of the production PFE is under SFM; 5.23 million hectares of the natural production PFE and 35 000 hectares of the planted-forest PFE are certified. Progress in certification is advanced in Peninsular Malaysia but less so in Sabah and Sarawak.
- The entire protection PFE is considered to be under management that is consistent with sustainability.
- The harvest in natural forests is declining and will continue to decline until at least 2020. The shortfall in production from natural forests is expected to be met by planted forests, especially in Sarawak. The forest sector in Malaysia contributed about US$2.88 billion to the Malaysian economy in 2008.
- There remains a need to better address the concerns and land claims of Indigenous communities, especially the Penan in Sarawak.

Endnotes

a Government of Malaysia (2009).

b Personal communications with officials in the Ministry of Plantation Industries and Commodities, Government of Malaysia, 2010.

References and other sources

FAO (2010a). Global forest resources assessment 2010 country report: Malaysia (available at http://www.fao.org/forestry/fra/67090/en/).

FAO (2010b). *Forests and Climate Change in the Asia-Pacific Region.* Forests and Climate Change Working Paper 7. FAO, Rome, Italy.

FSC (2010, website accessed April 2010). FSC certification database (searchable database available at http://info.fsc.org/PublicCertificateSearch).

Gibbs, H., Brown, S., Niles, J. & Foley, J. (2007). Monitoring and estimating tropical forest carbon stocks: making REDD a reality. *Environmental Research Letters No. 2* (available at http://iopscience.iop.org/1748-9326/2/4/045023/fulltext).

Government of Malaysia (2009). Report of progress toward achieving sustainable forest management in Malaysia. Submission to ITTO by the Ministry of Plantation Industries and Commodities, Kuala Lumpur, Malaysia. Unpublished.

Government of Malaysia (2010). *Yearbook of Statistics Malaysia 2009*. Department of Statistics, Malaysia. Kuala Lumpur, Malaysia.

IPCC (2010, website accessed December 2010).The regional impacts of climate change. Intergovernmental Panel on Climate Change (available at http://www.grida.no/publications/other/ipcc_sr/?src=/climate/ipcc/regional/281.htm).

ITTO (1999). *Annual Review and Assessment of the World Timber Situation 1998*. ITTO, Yokohama, Japan.

ITTO (2006). *Status of Tropical Forest Management 2005*. ITTO, Yokohama, Japan (available at http://www.itto.int/en/sfm/).

ITTO (2011, website accessed March 2011). Annual Review statistics database (available at http://www.itto.int/annual_review_output/?mode=searchdata).

IUCN (2011, website accessed March 2011). IUCN red list of threatened species (searchable database available at www.redlist.org).

Malaysian Timber Council (2009). Blueprint for growth: Malaysia's National Timber Industry Policy (NATIP) launched. *Timber Malaysia* 15:1, Jan–Feb 2009.

MTCC (2010, website accessed May 2010). Available at http://www.mtcc.com.my.

Spalding, M., Kainumu, M. & Collins, L. (2010). *World Atlas of Mangroves*. Earthscan, London, UK.

Suhakam (2007). Penan benalih blockade issue. Suhakam, Kuala Lumpur, Malaysia.

UNDP (2009). *Human Development Report 2009*. United Nations Development Programme, New York, United States.

UNEP-WCMC (2010). Spatial analysis of forests within protected areas in ITTO countries. UNEPWCMC, Cambridge, UK. Data prepared for ITTO.

UNEP-WCMC (2011, website accessed March 2011). UNEP-WCMC species database: CITES-listed species (searchable database at available at www.cites.org/eng/resources/species.html).

United Nations Population Division (2010, website accessed January 2010). World population prospects: the 2008 revision (searchable database available at http://esa.un.org/unpp/p2k0data.asp).

MYANMAR

Forest resources

Myanmar lies between India and Bangladesh to the west and Thailand, Laos and China to the east and stretches from a latitude of 9° north in the Kra Isthmus to about 27° north in the Himalayas. In 2010 it had an estimated population of 50.5 million people (United Nations Population Division 2010) and it is ranked 138th out of 182 countries in UNDP's Human Development Index (UNDP 2009). Rainfall varies from 500 to 5000 mm and there is a marked dry season. Topographically, the country varies from flat lands at sea level to snow-capped peaks of nearly 6000 m. The total natural forest area in Myanmar is estimated at 30.8 million hectares, which is 45% of the total land area (FAO 2010). The Government of Myanmar reported total natural forest areas of 35.4 million hectares (in 2006, including beach and tidal forests) [a] and 33.0 million hectares.[b] Not all Myanmar's forests are tropical, but tropical and non-tropical forests are not disaggregated in this report.

Forest types. Because of its wide geographical spread, Myanmar's forests are very varied. Important forest types are mixed deciduous forest (38% of the total forest area); hill evergreen forest (25%); evergreen (16%); dry forest (10%); deciduous dipterocarp forest (5%); and tidal, beach, dune and swamp forest (4%).[a] *Tectona grandis* (teak) is found in mixed deciduous forest and the economically most appreciated teak varieties mainly grow in moist upper mixed deciduous forest. Of the world's 19 million hectares of natural teak forests, more than 16 million hectares are in Myanmar. Mangroves cover about 0.5 million hectares along nearly the entire coast. However, they are disappearing faster in Myanmar than in any neighbouring country (Spalding et al. 2010).

Permanent forest estate. In ITTO (2006) the country's PFE was estimated at 13.7 million hectares (Table 1), comprising 10.4 million hectares of production forest (including 710 000 hectares of plantations) and 3.3 million hectares of protection forest. In 2010 the Government of Myanmar reported its PFE to comprise 15.8 million hectares of production forest and 5.33 million hectares of protection forest; this is the total area under the jurisdiction of the Forest Law (and "may include non-forest areas").[b] In this report the production PFE is assumed to be the total area of designated reserved and public protected forests and the total area of planted forests. The total area of forest

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*	34.4	32 700	9700	710	3300	13 710
2010	**30.8–35.4**	**17 500[a,**]**	**15 800[b,‡]**	**882[b,†]**	**5330[b,**]**	**22 012**

* *As reported in ITTO (2006).*

** *This estimate, which was provided by the Government of Myanmar (2010), is similar to the estimate calculated using the ratio of forest with greater than 60% forest cover estimated by UNEP-WCMC (2010) and the total natural forest area estimated by FAO (2010), which is 17.8 million hectares.*

‡ *Comprises the total area under the jurisdiction of the Forest Law and may include non-forest areas and also non-tropical forest.*

† *As of 2006.*

designated as the protection PFE comprises already announced and proposed protected areas. It was not possible to disaggregate tropical and non-tropical PFE.

Forest ecosystem health

Deforestation and forest degradation. The Government of Myanmar reported that no data were available on forest condition[b], although it was able to supply an estimate of the area of closed forest (see Table 1). The data shown in Table 2 are from FAO (2010).

Myanmar lost an estimated 1.55 million hectares (4.7%) of its forest between 2005 and 2010 and 7.44 million hectares (19%) between 1990 and 2010 (FAO 2010). Global Witness (2009) reported that, since 2006, deforestation to make way for sugar cane, tapioca, castor oil and rubber plantations has become one of the biggest threats to Myanmar's northern frontier forests.

According to the Government of Myanmar, about half the total forest estate (17.5 million hectares) comprised closed forest and the remainder (15.5 million hectares) consisted of open forest.[b]

Vulnerability of forests to climate change. Given its exposure to the monsoon, Myanmar is particularly vulnerable to the effects of climate variability, such as drought, inundation and tropical storms. A rise in sea-level would have a major impact on the well-populated coastal zone. Myanmar is preparing a NAPA with support from UNEP-WCMC; it will likely include the protection and restoration of mangrove forests as a priority. The National Commission for Environmental Affairs under the Ministry of Forestry is Myanmar's UNFCCC focal point and the Department of Meteorology and Hydrology under the Ministry of Transport is overseeing the preparation of the NAPA.

Table 2 Forest condition

	PFE	Non-PFE	Total
	'000		
Area of primary forest	-	-	3192
Area of degraded primary forest	-	-	0
Area of secondary forest	-	-	27 593*
Area of degraded forest land	-	-	**0**

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

SFM policy framework

Forest tenure. Almost all forests are owned by the state; they are designated as reserved forests and public or unclassified forests, and commercial timber and NTFPs may be extracted from both classes. Reserved and public forests constitute the PFE. Particular rights apply to teak: according to the 1992 Forest Law (Chapter III), "a standing teak tree wherever situated in the state is owned by the state". RRI (2009) reported that about 40 000 hectares of forest were designated for use by communities or Indigenous groups, an increase from zero in 2002. This area is shown in Table 3 as 'owned' by local communities and/or Indigenous groups, although its ownership status is unclear. The Government of Myanmar reported in 2010 that no detailed information on tenure classes was available.[b]

Table 3 Forest area, by tenure

Ownership category	Total area	Of which PFE
	'000 ha	
State ownership (national, state or provincial government)	33 300	-
Other public entities (e.g. municipalities, villages)	0	-
Total public	**33 300**	**-**
Owned by local communities and/or Indigenous groups	41	-
Privately owned by individuals, firms, other corporate	0	-

Source: FAO (2010).

Criteria and indicators. Identification of Myanmar's C&I for SFM at both national and FMU levels was completed in October 1999 and formally approved by the Ministry of Forestry. Myanmar's C&I, which are based on the 1998 version of ITTO's C&I, comprise seven criteria; there are 78 indicators and 257 required activities at the national level and 73 indicators and 217 activities at the FMU level, together with standards of performance for each activity. The Forest Department has been testing the adequacy and application of Myanmar's C&I at the FMU level.

Nevertheless, Myanmar's submission to ITTO for this report was not in the ITTO C&I reporting format.[a]

Forest policy and legislation. There has been no significant change in Myanmar's forest-related policies and laws since 2005.[a]

Myanmar was once a province of British India, and the 1894 Indian Forest Policy guided forest management until the Burma Forest Act was enacted in 1902; this, in turn, was replaced by the Forest Law (1992). Other regulations such as the Forest Rules and the National Code of Practice for Forest Harvesting (promulgated in 2000) also help guide forest management. The national forest policy, developed in 1995, focuses on the protection of soils, water, vegetation and wildlife; the sustainability of forest resources; satisfying the basic needs of the people; efficiency in harnessing the full economic potential of the forests; people's participation in forest management and biodiversity conservation; and raising the awareness of the people and decision-makers in forestry.[a] The Wildlife Protection Act (1936) was replaced by the Protection of Wildlife and Wild Plants and Conservation of Natural Areas Law (1994).

The Forest Rules, originally prescribed in 1902, were replaced by a new set in 1995, issued by the Ministry of Forestry, to facilitate implementation of the Forest Law (1992). The new set of rules emphasizes the increased formation and protection of reserved forests and protected public forests, the sharing of forest management responsibility with local communities, the establishment of fast-growing plantations on degraded forest lands to conserve soil, water and biodiversity, and the harvesting of timber and other forest products in an environmentally sound manner.[a]

Community forestry instructions were issued by the Forest Department in 1995 to grant tree and forest land tenurial rights to local communities for an initial 30-year period, which is extendable.[a]

Institutions involved in forests. The Ministry of Forestry has primary responsibility for implementing the forest policy, for the administration and management of the forest sector and, since January 2005, for environmental protection (Global Witness 2005). The Ministry of Forestry oversees forest management and provides guidance to the Forest Department, the Myanmar Timber Enterprise (MTE), the Dry Zone Greening Department, the Planning and Statistics Department, the Institute of Forestry and the National Commission for Environmental Affairs.

The Minister of Forestry may constitute the following categories of reserved forest by demarcation on land at the disposal of government: commercial extraction reserve forest; local supply reserved forest; watershed or catchment reserved forest; environment and biodiversity conservation reserved forest; and other categories of reserved forest. The minister may also declare specific areas as protected public forest.

The Forest Department is the main arm of government for forest-sector policy and program implementation. The Environmental Conservation Committee, which is headed by the Minister of Forestry, oversees the conservation of soil, water and biodiversity. There are also government-sponsored NGOs, such as the Forest Resource, Environment, Development and Conservation Association; the Forest Joint Venture Corporation Ltd; and the Timber Merchants' Association.

The Forest Research Institute (FRI), located in Yezin, is under the administrative control of the Director-General of the Forest Department. It has 77 researchers and 202 supporting staff. It has published over 230 research papers, and 19 research studies in diverse fields of forestry are on-going. The main clients for FRI research are the Forest Department and the Dry Zone Greening Department. However, it has little interaction with other user agencies and, as a result, the lab-to-land transfer of research findings is constrained.[a] Collaborative research, including with research institutes in other countries, is still being sought.

The University of Forestry has been relocated and upgraded at Yezin; it offers a Bachelor of Science in Forestry, post-graduate diplomas, Masters' degrees in forestry and, since 2003, doctorate degrees. There is also a technical training school at Pyin Oo Lwin. An in-service and public training centre supported by the Japan International Cooperation Agency has been established at Hmawbi.

The adoption of a market economy was first announced in September 1988, and many private timber companies became involved in timber industries. For teak, however, the MTE has a monopoly on harvesting, processing and export,

and the private sector is not permitted to export logs of any species. With a view to stepping up the manufacture of forest products and to promote internal and external distribution, the Forest Products Joint Venture Corporation Ltd was established by the MTE, the Forest Department and private enterprises.

The level of decentralization is low and confined to the delegation of powers to parallel and vertical institutions. Privatization and private-sector involvement are meagre.

Participation by civil society takes place through government-sponsored NGOs such as those listed above. ITTO (2006) reported that farmers' and women's income generation groups were being formed with the aims of raising off-farm incomes and helping advance SFM. No data were available on how many such groups are currently active.[b]

Status of forest management

Forest for production

There are 63 FMUs in Myanmar, of which 41 are dedicated to timber production. Thirty-four FMUs are actively managed for teak and other hardwoods, covering an area of about 470 000 hectares.[b] An estimated 19.6 million hectares of forest is allocated for production, and a further 8.7 million hectares is allocated for multiple-use (FAO 2010). In the natural teak forest, mature teak trees selected for harvesting are normally girdled and left standing for three years before felling and extraction. This is done to season the timber and make it buoyant, as logs are normally transported by floating them down rivers; in more accessible areas, mature teak trees are felled and extracted green. The Forest Department selects mature trees for harvesting while the MTE is responsible for the actual harvesting of both teak and other hardwoods. The MTE operates 38 extraction and rafting agencies throughout the country. Most log-skidding is done by elephant, which has been shown to do less damage to the forest than machines, and wastage is less.[b]

Mechanical extraction is not favoured as it is not considered economically feasible under the Myanmar Selection System and is only used in limited areas. So far, heavy equipment has been used mainly for road construction, the loading and unloading of logs, and for transportation.[b]

The area harvested annually has averaged about 411 000 hectares in the last five years; 52% of logging areas are under management plans or harvesting schemes.[b] Logging is guided by the National Code of Practice for Forest Harvesting, which includes detailed guidelines for work such as the alignment and construction of extraction roads, skid trails and stream crossings; the mapping of tree positions; climber cutting before felling; and the directional felling of selectively marked trees. Forest management in general and teak management in particular have various constraints and problems.

Timber extraction is concentrated on only a few economically important species. This 'creaming' of the forest, if unabated, will lead to the devaluation of the forests in the long run through a decrease of valuable species. Other problems are the illegal logging of trees for commercial use; the extension of pasture land and swidden agriculture; and over-harvesting for fuelwood and charcoal.[b] The political situation in remote areas creates an environment that allows wasteful and unplanned logging and possible illegal cross-border trade.

Since 2003/04 the annual allowable cut for teak has been 334 000 m^3, but the actual harvest in the period 2003/04–2006/07 averaged 588 000 m^3 per year. The allowable cut for other hardwoods in that period was 1.602 million m^3 but the actual cut averaged 2.113 million m^3 per year. Production exceeded the annual allowable cut because of an increase in production in areas where insurgency made production impossible in the past and where land-use change occurred for development programs (Zaw Win Myint 2009).

Illegal logging is a challenging issue in Myanmar. National efforts to control it are hampered by the fact that a considerable share of the timber trade occurs in areas under the control of minority ethnic groups and outside of the government's effective reach with respect to law enforcement and policy implementation (Global Witness 2009). Action against illegal logging taken by the Forest Department includes the formation of 'special task forces' for operations in specific areas, mostly along the country's northern and eastern borders, in close cooperation with military and police forces and local authorities. The Forest Department has also formulated a forest administrative unit called a beat in each township for the conservation and protection of forest. The beat officer is normally a deputy ranger. Nevertheless, forest law enforcement

is hampered by a lack of legal knowledge among Forest Department officers, a lack of cooperation with financial and police institutions in the prosecution of offenders, and a lack of software and hardware for the effective detection of illegal activities (Zaw Win Myint 2009).

In the period 2001–2009, 241 000 tonnes of illegal timber was seized by authorities. In the 2008/09 financial year, 7093 breaches were reported, 37 600 tonnes of timber, 389 vehicles and 69 boats were seized, and 6149 offenders were arrested (Zaw Win Myint 2009).

In the past, the Forest Department has lacked the resources to exercise control in remote areas (Global Witness 2003). Logging in Kachin state on the border with China (which is outside the tropics) has had serious environmental impacts (Global Witness 2005). Nevertheless, the Government of Myanmar[a] reported that illegal logging is "almost under control". It has implemented the following measures:

- Strict enforcement of the existing forest law, rules and regulations.
- The setting up of checkpoints along the main transport routes.
- The inspection of logging operations to ensure that they are carried out in accordance with the procedures and prescribed rules and regulations.
- The adoption of an incentive scheme for staff and those who are actively engaged in protecting illegal logging.
- The forming of a partnership with the institutions concerned and local communities in combating illegal logging.
- Cooperation and coordination with the neighbouring countries in fighting illegal logging along the borders.

Global Witness (2009) reported that "log imports, across the Burma-China land border, have fallen from 1 million cubic metres in 2005 to 270 000 m^3 in 2008 according to Chinese import data", due mainly to measures put in place by the Chinese authorities. Nevertheless, it was "probable" that 90% of that trade was still illegal (ibid.).

Silviculture and species selection. Forest management during the colonial period was based solely on teak. British foresters formulated and put into practice what was originally known as 'sustained yield management of teak in Myanmar'. The Brandis Selection System, modified into the Myanmar Selection System in 1920, is a selection and stand improvement system, the main feature of which is to protect immature stock and assist it to attain maturity. Forests are managed under working plans, which generally form working circles. The working circles consist of groups of reserves that are divided into felling series for the convenience of working according to drainage and other geographical features. The felling series is subdivided into 30 annual coupes, which can be further subdivided into compartments approximately 250 hectares in size (ITTO 2006).

Each year, trees are selected for felling in coupes and the whole felling series is therefore worked over in a felling cycle of 30 years. Traditionally, the yield capacity of the forest is determined from data obtained from the 10% enumeration of trees below the felling limit carried out along with girdling operations. Complete enumeration of teak is carried out down to 39 cm dbh. At the time of felling, all marketable trees that have attained the minimum harvestable dbh are selected for cutting. The prescribed girth size varies with the type of forest. The dbh limit is 73 cm in good (moist) teak forests and 63 cm in poor (dry) forests.[a]

Silvicultural tending is necessary to guarantee the sustainability of teak in Myanmar's multi-species and complex teak-bearing forests. In the absence of such tending, bamboo and light-demanding species will suppress teak regeneration. The extent to which tending is carried out was not reported by the Government of Myanmar.[a]

The Forest Department has been undertaking the following major activities[a]:

- Reservation of forest lands on up to 30% of the country's total land area, up from the present status of about 15%.
- Establishment of forest lands in a system of protected areas of up to 10% of the country's total land area, up from the present status of about 7%.
- Preparation and updating of ten-year management plans at the district level for the efficient conservation and development of the forest sector.

- An initiative to introduce a 'polluter pays' system for the protection of forest resources.
- The initiation and practice of establishing 'cess money' from the commercial trade of timber and other forest products.
- Introduction of the sharing of management responsibilities through the adoption of community participatory forestry to rehabilitate degraded forest lands.
- The continuation of a reforestation program at an annual rate of about 20 000 hectares.
- The periodical review of forest policy, legislation and institutional arrangements to keep pace with social preference and international priorities.
- A continued effort to formulate and adopt multi-sectoral national land-use policy respected by all parties concerned.
- A continued effort to promote the private sector in forestry development programs without compromising the carrying capacity of forest ecosystems and the well-being of future generations.
- A continued effort to promote wood-based industries for the increased production of value-added finished products.
- The encouragement and liberalization of trade and tariff policies to ensure the reasonable stability of the declared policies.
- A continued effort to strengthen research and development activities.
- A continued effort to promote human-resource development and institutional capacity-building.

Commonly used timber species include teak, *Xylia dolabriformia*, *X. kerri* (pyinkado), *Pterocarpus macrocarpus* (padauk), *Terminalia tomentosa* (htauk kyant), *Millettia pendula*, *Adina cordifolia, Anogeissus* spp, *Bridelia retusa, Dalbergia oliveri, Dipterocarpus* spp, *Homalium tomentosum* and *Lagerstroemia flos-reginae.* Table 4 shows the annual harvested volume of teak and other hardwoods.

Planted forest and trees outside the forest. The area of planted forests in 2006 was estimated at 882 000 hectares, about 373 000 hectares of which were teak, 62 000 hectares of which were *Xylia kerri* (pyinkado), and about 79 000 hectares of which were eucalypt species.[b]

Table 4 Annual harvested volume of teak and other hardwoods, 1996–97 to 2005–06 ('000 m^3)

Year	Teak	Other hardwood	Total
1996–97	415	1320	1735
1997–98	431	1490	1921
1998–99	454	1560	2010
1999–20	470	1530	2003
2000–01	451	1710	2164
2001–02	497	2050	2544
2002–03	537	1930	2470
2003–04	652	2030	2683
2004–05	541	2070	2612
2005–06	553	2120	2674

Note: *Totals might not tally due to rounding.*
Source: *Personal communications – see endnote b.*

Myanmar has a long tradition of forest plantations: teak plantations were introduced in 1856 under a *taungya* system. About 30 000 hectares of plantation are established per year, including about 12 000 hectares of teak. For example, 28 300 hectares of plantation were established in 2006, including 11 800 hectares of teak.[b] At this rate, the total planted forest area in 2010 was probably close to 1 million hectares (although the 2006 figure is used in Table 1 and Table 5).

The Forest Department establishes four types of plantation, of which local supply plantations and watershed plantations especially aim to satisfy the woodfuel demands of local communities and to rehabilitate degraded watershed areas. In 2006, 483 000 hectares of the plantation estate was designated for commercial production, 208 000 hectares for village supply, 72 000 hectares for industrial use, and 118 000 hectares for watershed rehabilitation. The entire plantation estate was being managed under approved management plans.[b]

A Special Teak Plantation Program was launched in 1998, structured as a series of eight consecutive phases. Each phase, to be implemented over a five-year period, consists of 20 plantation centres. Each centre establishes 405 hectares of teak plantation annually, which will be clearcut after 40 years. Over 40 years, therefore, the program will have established 324 000 hectares of teak plantation.[a]

A villager gathers bamboo and wood from a nearby forest, Myanmar.

Desertification is a major environmental threat in the dry zone of central Myanmar caused by the excessive cutting of trees and clearing of natural forests for farming under harsh climatic conditions. The Dry Zone Greening Department was therefore formed in 1997 with the task of restoring the environment, preventing desertification and mitigating climate change in the dry zone of central Myanmar. Since then, the Dry Zone Greening Department has been establishing forest plantations in order to meet these objectives. There are 1.72 million hectares of closed forest in the dry zone, which is about 20% of the total land area of the region. The policy is to increase this area to 35% by conserving and improving degraded forests and by artificially regenerating suitable sites. Therefore, approximately 730 000 hectares of the degraded forests will be conserved and restored by natural means, and 323 750 hectares will be planted by 2030. In addition, about 500 000 hectares of natural and planted forests will be converted to community forests.[a]

Forest certification. As of mid 2010, no forest in Myanmar had been certified (e.g. FSC 2010). The Timber Certification Committee (TCC) was formed in August 1998 by the Ministry of Forestry. Since then the TCC has been establishing links with other timber certification bodies on a bilateral basis, including the Malaysian Timber Certification Council and the Indonesian Eco-labeling Institute. The TCC is developing a timber certification scheme that reflects Myanmar's forest management system, using Myanmar's C&I as the basis of a timber certification checklist at the FMU level.[a]

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*	9700	-	9700	0	291	710	0	0
2010	**15 800**	-	**15 800**	**0**	**291****	**882**‡**	**882**	**0**

* *As reported in ITTO (2006).*

** *Semi-natural teak forest; assuming no change since 2005.*

‡ *As estimated in 2006.*[b]

Estimate of the area of forest sustainably managed for production. All the production PFE is covered by management plans formulated by the Forest Department in cooperation with the MTE (FAO 2010 and personal communications – see endnote b), and nearly half a million hectares of teak forest are under active management. In 2005 the area of forest under sustainable management was estimated at 291 000 hectares, comprising semi-natural planted teak forest (ITTO 2006). No information has been received for the current report to indicate a change in this situation; therefore, the 2005 estimate is assumed to apply in 2010 (Table 5).

Timber production and trade. Roundwood production in 2005 was estimated at 43.1 million m^3, of which 39.2 million m^3 (91%) was fuelwood (FAO 2010). The estimated production of industrial roundwood in 2009 was 4.24 million m^3, as it was in 2004 (although it was only about 3.35 million m^3 in 1999; ITTO 2011). Myanmar's estimated production of tropical hardwood sawnwood in 2009 was 897 000 m^3, down from 979 000 m^3 in 2004 and up from 298 000 m^3 in 1999. An estimated 1.38 million m^3 of tropical hardwood logs were exported in 2009, similar to the 1.37 million m^3 exported in 2004 (ibid.). Major export destinations are India (reported by the Government of India at 741 000 m^3 in 2008), China (reported by the Government of China at 462 000 m^3 in 2008) and Thailand (96 600 m^3 in 2008). The estimated value of Myanmar's exports of primary timber products amounted to US$859 million in 2008, of which logs contributed US$716 million (83%) (ITTO 2010).

Non-timber forest products. Many NTFPs are used locally and marketed, the most important being bamboo and rattan. Others, such as cutch (extracted from *Acacia catechu*), tannin, honey and beeswax, pine resin and birds' nests, are also widely used. Forest recreation and ecotourism are important: eleven areas are set apart as recreation forest (ITTO 2006).

Forest carbon. Gibbs et al. (2007) estimated the national-level forest biomass carbon stock in Myanmar at 2377–5182 MtC, Eggleston et al. (2006) estimated it at 4867 MtC and FAO (2010) estimated it at 1654 MtC. Climate change in general and REDD+ in particular have not been integrated into Myanmar's forest policies and laws, although the need to mainstream REDD+ in national forest management plans was raised by Myanmar at a meeting of the ASEAN Social Forestry Network in June 2010. Myanmar's initial national communication to the UNFCCC is being prepared. The Small-scale Reforestation Project in Mangrove Forests of Ayarwaddy Delta, a CDM project, was also under way in 2010 (Kyaw & San 2009). To date Myanmar has not become involved in any of the major ongoing REDD+ initiatives. Table 6 summarizes the country's current forest carbon potential.

Forest for protection

Soil and water. The Government of Myanmar reported that the total area of the PFE allocated for soil and water and covered by management plans is 21.1 million hectares.[b] This is a massive increase to the area reported in ITTO (2006) and is likely due to differences in interpretation.

In response to a request by the Ministry of Agriculture and Irrigation, the Forestry Department has proposed a special project to rehabilitate the watersheds of 53 important reservoirs. The total watershed area of these 53 reservoirs is about 3.6 million hectares and the project is establishing about 4900 hectares of plantation per year.[a]

Biological diversity. Myanmar is one of the most biologically diverse countries in mainland Southeast Asia, with about 11 800 plant species recorded to date, 1071 of which are endemic. There are also over 1000 species of birds, more

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
2377–5182	58	+++	++	+	+	+	

+++ 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*	3300	195	6560	-	-
2010	**5330**	**1370**	**21 100**	**5330**	**-**

* *As reported in ITTO (2006).*

than 300 species of mammal (including the Asian elephant, tiger, Thamin deer, Ayeyarwady dolphin and guar) and 400 reptile and amphibian species. Myanmar has the most diverse snake fauna in the old-world tropics, and it has the world's fifth-richest assemblage of swallow-tail butterflies (68 recorded species). Forty-one mammals, 27 birds, one reptile and three plants found in forests are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species (IUCN 2011). Nine plants are listed in CITES Appendix I, 158 in Appendix II and two in Appendix III (UNEP-WCMC 2011).

Protective measures in production forests. Protective measures in production forests are provided for in guidelines on logging, road construction, pre- and post-logging operations, and the protection of river banks and road margins (ITTO 2006).

Extent of protected areas. There is confusion over the extent of forested protected areas in Myanmar. The total official extent of the protection PFE is 5.33 million hectares, although it is unclear how much of this is forested.[b] The Government of Myanmar lists 34 protected areas in its protected-area system (as of 2008) covering a total area of 2.66 million hectares.[b] According to UNEP-WCMC (2010), 1.37 million hectares of forest are in protected areas that conform to IUCN protected-area categories I–IV. According to the Government of Myanmar (2010), all those forests allocated for soil and water protection are covered by management plans. Since the protection PFE is assumed to be a subset of those forests, all the protection PFE is assumed to be covered by management plans.

Estimate of the area of forest sustainably managed for protection. No information is available on the management status of the protection PFE (Table 7).

Socioeconomic aspects

Economic aspects. ITTO (2006) reported that about 30 600 people were employed by the government in the forest sector, including 1400 professionals and 29 200 technical staff. Of these staff, 11 000 were in the Forest Department, 19 300 were in MTE and about 300 were in the Dry Zone Greening Department.[b] Overall, some 500 000 people are thought to be dependent on the forest sector for employment; the contribution of forestry to GDP was an estimated 0.4% in 2005/06.[b] In 2007/08 the Forest Department spent 11.5 billion kyat on capital and operations and generated 6.03 billion kyat in revenue. The Department has been operating at a loss since 2000/01 (Zaw Win Myint 2009).

Livelihood values. Some 38 million people are dependent on the forest for at least part of their livelihood. They have access to about 7.1 million hectares of forest made available through the 'local supply working circle'.[b]

According to the Government of Myanmar, shifting cultivation is a major cause of forest depletion and degradation in the country.[a] It is an economic practice of the landless poor living in and around the forests and also a cultural practice and way of life. The government has developed a national-level multi-sectoral program of highland reclamation to encourage the upkeep of the traditional land-use system, customary rights and cultural values. In cooperation with other sectors, the Myanmar Forestry Department has been pursuing a number of strategies, including:

- Community forestry based on agroforestry systems.
- The provision of improved technologies, complementing traditional forest-related local knowledge.
- The recruitment of shifting cultivators into routine forestry operations such as plantation establishment.

- The enhancement of income-generating opportunities.
- Provision of awareness-raising campaigns and extension services.[a]

Social relations. Community forestry instructions were issued in late 1995 to promote and facilitate community participation in managing forests. These emphasized the management of forests by rural communities through the protection of natural forest and the establishment of forest nurseries and planted forests to enable such communities to meet their needs for fuelwood and small-diameter timber. The instructions also focus on the flow of benefits to those communities participating in forest management. In 2010 there were 517 community forest agreements/user groups, which participate in the conservation of forest resources and newly established forest plantations.[b] Community forestry has a number of problems, however, especially with regard to tenure and the security of agreements reached with government agencies. Cross-border illegal timber trade has reportedly fuelled ethnic tensions, entrenched power structures and created conditions under which local warlords can thrive (Global Witness 2005). The control of teak-planting by government also limits the profitability of community forestry.

Summary

There appears to have been little change in the approach to forest policy since 2005, with the Forest Law (1992) still applying. Myanmar once boasted an exemplary system of forest management, particularly in its large area of teak forests, but in recent decades there has been significant deforestation and forest degradation. Deforestation may have increased recently in the country's northern frontier forests. The annual allowable cut has been exceeded in recent years, for several reasons. Illegal logging appears to be significant, and the Forest Department has endeavoured to bring it under control by the introduction of measures such as checkpoints along transport routes, inspections of logging operations, and an incentive scheme for staff. Myanmar has an active program for establishing planted forests, including of teak, and is also expanding its protected area system. The forest sector is a major employer, and it also generates considerable export revenue (an estimated US$859 million in 2008), but the Forest Department operates at a substantial loss. Community forestry faces a number of challenges, such as a lack of security of agreements reached with government agencies.

Key points

- Myanmar has an estimated PFE of 22.0 million hectares (compared with 13.7 million hectares in 2005), comprising 15.8 million hectares of natural production forest (compared with 9.7 million hectares in 2005), 5.33 million hectares of protection forest (compared with 3.3 million hectares in 2005) and 882 000 hectares of planted forest (compared with 710 000 hectares in 2005).
- The increase in estimates of the PFE are most likely due to differences in assessment method rather than a real increase.
- An estimated 291 000 hectares of the production PFE are under SFM. No forest is certified, and no estimate was possible of the protection PFE under SFM.
- There are 63 FMUs in Myanmar, of which 41 are dedicated to timber production. Thirty-four FMUs are actively managed for teak and other hardwoods, covering an area of about 470 000 hectares.
- Many of Myanmar's forests are becoming degraded, exacerbated by a lack of law enforcement, particularly in remote regions.

Endnotes

a Government of Myanmar (2010).

b Personal communications with officials at the Forestry Department, Myanmar, 2010.

References and other sources

Eggleston, H., Buendia, L., Miwa, K., Ngara, T. & Tanabe, T. (eds) (2006). *IPCC Guidelines for National Greenhouse Gas Inventories.* Prepared by the National Greenhouse Gas Inventories Programme. Institute for Global Environmental Strategies, Kamakura, Japan.

FAO (2010). Global forest resources assessment 2010 country report: Myanmar (available at http://www.fao.org/forestry/fra/67090/en/).

FSC (2010, website accessed July 2010). FSC certification database (searchable database available at http://info.fsc.org/PublicCertificateSearch).

Gibbs, H., Brown, S., Niles, J. & Foley, J. (2007). Monitoring and estimating tropical forest carbon stocks: making REDD a reality. *Environmental Research Letters* 2 (available at http://iopscience.iop.org/1748-9326/2/4/045023/fulltext).

Global Witness (2003). *A Conflict of Interests: the Uncertain Future of Burma's Forests.* Briefing document, October 2003. Global Witness, London, UK.

Global Witness (2005). *A Choice for China: Ending the Destruction of Burma's Northern Frontier Forests.* Global Witness, Washington, DC, United States.

Global Witness (2009). *A Disharmonious Trade: China and the Continued Destruction of Burma's Northern Frontier Forests*. Global Witness, London, UK (available at www.globalwitness.org/media_library_detail.php/856/en/a_disharmonious_trade_china_and_the_continued_dest).

Government of Myanmar (2010). Report of progress toward achieving sustainable forest management in Myanmar. Submission to ITTO by the Forest Department, Myanmar.

ITTO (2006). *Status of Tropical Forest Management 2005*. ITTO, Yokohama, Japan (available at http://www.itto.int/en/sfm/).

ITTO (2010). *Annual Review and Assessment of the World Timber Situation 2009*. ITTO, Yokohama, Japan.

ITTO (2011; website accessed March 2011). Annual Review statistics database (available at http://www.itto.int/annual_review_output/?mode=searchdata).

IUCN (2011, website accessed March 2011). IUCN red list of threatened species (searchable database available at www.redlist.org).

Kyaw Htun & San Oo (2009). R-PIN and REDD activities review: Myanmar. Presentation given at the regional workshop on forest and climate change: REDD consultation support to asean senior officers on forestry and UNFCCC focal points, 25–26 May 2009, Phnom Penh, Cambodia (available at www.iddri.org/Activites/Interventions/090525_ASEAN_REDD_Myanmar.pdf).

RRI (2009). *Who Owns the Forests of Asia? An Introduction to the Forest Tenure Transition in Asia, 2002–2008.* Rights and Resources Initiative, Washington, DC, United States.

Spalding, M., Kainumu, M. & Collins, L. (2010). *World Atlas of Mangroves.* Earthscan, London, UK.

UNDP (2009). *Human Development Report 2009*. United Nations Development Programme, New York, United States.

UNEP-WCMC (2010). Spatial analysis of forests within protected areas in ITTO countries. UNEP-WCMC, Cambridge, UK. Data prepared for ITTO, 2010 (see Annex 1).

UNEP-WCMC (2011, website accessed March 2011). UNEP-WCMC species database: CITES-listed species (searchable database at available at www.cites.org/eng/resources/species.html).

United Nations Population Division (2010, website accessed March 2010). World population prospects: the 2008 revision (searchable database available at http://esa.un.org/unpp/p2k0data.asp).

Zaw Win Myint (2009). Status of forest law enforcement and governance (FLEG) in Myanmar. Union of Myanmar country paper at the Asia-Pacific Regional Workshop on Strengthening Forest Law Enforcement and Governance (FLEG), 30 November–1 December 2009, Kuala Lumpur, Malaysia.

PAPUA NEW GUINEA

Forest resources

Papua New Guinea (PNG) has a land area of 46.3 million hectares. Its population in 2010 was estimated at 6.9 million people and the population grew by about 2.37% per year in the period 2005–10 (United Nations Population Division 2010). PNG is ranked 148th out of 182 countries in UNDP's Human Development Index (UNDP 2009).

PNG consists of over 600 islands and atolls in four major groups: the eastern half of the island of New Guinea; New Britain; New Ireland; and Bougainville. The western half of the island of New Guinea is a province of Indonesia and, to the south, PNG is separated from Australia by Torres Strait. A spine of mountains, the Owen Stanley Range, runs east to west, on both sides of which are fertile plains, flooded deltas, mangrove swamps and broad, sandy beaches.

Shearman et al. (2008) estimated PNG's forest area at 33.0 million hectares in 2002, which was 71% of the total land area (46.3 million hectares). FAO (2010) estimated the forest area at 28.6 million hectares in 2010. The estimates of Shearman et al. (2008) and FAO (2010) are both used in this profile for various parameters.

Forest types. The forests are varied, stretching from sea level to an altitude of over 4000 m. Shearman et al. (2008) classified them as lowland rainforest (20.3 million hectares), lower montane forest (8.91 million hectares), upper montane forest (702 000 hectares), swamp forest (3.4 million hectares), dry evergreen forest (750 000 hectares) and mangrove forest (575 000 hectares). According to Spalding et al. (2010), PNG has 426 000 hectares of mangroves, which is 75% of all mangroves in the Pacific.

Typical tree species in PNG forests are *Terminalia* spp, *Melaleuca* spp and *Pterocarpus* spp (coastal rainforest); species of *Alstonia*, *Calophyllum* and *Pometia* (lowland rainforest); species of *Canarium*, *Celtis* and *Hopea* (lower montane rainforest); and species of *Araucaria*, *Agathis*, *Lithocarpus* and *Nothofagus* (in the upper montane forest). Another important species is *Eucalyptus deglupta* (ITTO 2006).

Permanent forest estate. There is no formally designated PFE in PNG. The estimate in ITTO (2006) was made on the basis of areas set aside by the government for timber development or reserved for protection; that estimate also comprises the 2010 estimate (Table 1). Under the 2009 Revised National Forestry Development Guidelines, a PFE is to be established comprising 8 million hectares of natural forests and 800 000 hectares of plantations. Given the country's forest-ownership structure, however, it is unclear how, where or when these forests will be secured.[a]

Forest ecosystem health

Deforestation and forest degradation. Shearman et al. (2008) estimated that, in 2002, the rate of forest loss was 1.41%. They also estimated that a total of 5 million hectares of forest was cleared between 1972 and 2002, reducing overall forest cover from 38 million hectares to 33 million hectares. Over the same period, 2.9 million hectares of rainforest had become degraded, principally due to logging. FAO (2010) estimated that forest cover declined by 711 000 hectares (2.4%) between 2005 and 2010 and by 2.80 million hectares (8.9%) between 1990 and 2010. Extrapolating from historical data, Shearman et al. (2008) estimated that the annual rate of deforestation and forest degradation in the period 2002–06 was 0.89% and 0.82%, respectively. Shearman

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*	30.6	30 150	8700	80	1700	10 480
2010	**28.6–33.0**	**22 800****	**8700***	**58‡**	**1700***	**10 458**

* *As reported in ITTO (2006).*

** *Calculated using the ratio of forest with greater than 60% forest cover estimated by UNEP-WCMC (2010) (79.8%) and the total natural forest area estimated by FAO (2010).*

‡ *As reported by the Government of PNG (2010b). This is lower than the area reported in ITTO (2006) because rubber plantations are excluded.*

et al. (2008) estimated the total area of primary forest at 30.1 million hectares (Table 2), but FAO (2010) estimated it at 26.2 million hectares. The Government of Papua New Guinea did not provide data on forest condition for this report.[a]

Much of the deforestation is caused by conversion to other land uses, particularly agriculture.[b] Oil-palm development, for example, has led to the rapid clearing of forest in the West New Britain and Milne Bay provinces, and in several other provinces tropical forests are being similarly earmarked. Some proposed 'oil-palm projects', however, are designed mainly for log extraction, with investors with no expertise in oil palm applying for and obtaining permission to clear forest[a] and subsequently making large profits from timber sales. Shearman et al. (2008) blamed logging as "the major driver of deforestation", estimating that it was responsible for almost half (48%) of the "total forest change" (deforestation and forest degradation) that occurred in the period 1972–2002. Fire affected about 347 000 hectares over the same period.

Vulnerability of forests to climate change. Recent studies have shown that the annual and seasonal ocean surface and island air temperatures in the southern Pacific, including PNG, have increased by 0.6–1 °C since 1910 (Government of PNG 2010a). Over the period 1961–2003 there was a significant increase in the annual number of hot days and warm nights in the region. Climate-change projections indicate a warming trend for all small island states involving an annual mean increase of 1.98 °C by 2050 and 2.81 °C by 2080 (ibid.).

The Government of PNG has established the Office of Climate Change and Environmental Sustainability to address climate-change adaptation and mitigation. PNG's initial communication to the UNFCCC reported that the country will be increasingly vulnerable to climate change in coming years. The government developed the Climate Compatible Development Strategy in 2009, which recognizes the sensitivity of PNG to natural climate-related hazards such as coastal flooding, inland flooding, landslides and drought and indicated that forest and agricultural land will be particularly vulnerable to the effects of climate variability in coming decades.

SFM policy framework

Forest tenure. Customary land ownership is guaranteed by the PNG Constitution and covers nearly the entire country. Ninety-seven percent of the land is held as communal or clan commons, while the remainder is under state or individual/private ownership. There is a large number of clans and tribes, speaking more than 800 languages.

Table 2 Forest condition

	PFE	Non-PFE	Total
	'000 ha		
Area of primary forest	-	-	30 100
Area of degraded primary forest	-	-	2 920
Area of secondary forest	-	-	-
Area of degraded forest land	-	-	-

* *Note that, in this case, 'degraded primary forest' includes secondary forest.*

Source: Shearman et al. (2008).

Table 3 shows estimates of the area of forest owned by clans and the state. Customary rights include rights to all natural resources with the exception of minerals, petroleum, water and genetic resources. Landowner groups are legally entitled to be involved in decisions concerning the management of their forest land. FAO (2010) noted that a trend is emerging in PNG where individuals are buying land from tribal/clan groups for their individual use, although no data were available on the extent of this trend.

Table 3 Forest area, by tenure

Ownership category	Total area	Of which PFE
	'000 ha	
State ownership (national, state or provincial government)	260*	-
Other public entities (e.g. municipalities, villages)	0	-
Total public	**260**	**-**
Owned by local communities and/or Indigenous groups	25 510	-
Privately owned by individuals, firms, other corporate	0	-

* *ITTO & RRI (2009); total tenure does not equal to total estimated forest area because of the use of different datasets. Note that FAO (2010) estimated the area owned by the state at 883 000 hectares and the area owned by Indigenous communities at 28.6 million hectares.*

Criteria and indicators. The Government of PNG did not provide data according to the ITTO C&I reporting format for this report, stating that "PNG has been very slow to recognize the importance of C&I as a tool to guide the policy and operational aspects of forest use and management. … A review using ITTO C&I can only be possible after it has been accepted and implemented at Forest Management Level".[a]

Forest policy and legislation. The main objectives of PNG's national forest policy, which was approved in 1991, are the management and protection of the nation's forest resources as a renewable natural asset; and the utilization of the nation's forest resources to achieve economic growth, employment, greater Papua New Guinean participation in industry, and increased viable in-country processing. Parallel to the development of this policy, the National Forests and Conservation Action Plan was formulated and officially approved in 1996. Three policies linked to the national forest policy were adopted in 2003: the National Eco Forestry Policy; the National Reforestation Policy; and the National Policy on Downstream Processing of Forest Products.

The legal provisions for the implementation of the recommendations of the national forest policy are contained in the following instruments: the Forestry Act (1991, as amended in 2000, 2006 and 2010); the National Forestry Development Guidelines (revised in 2009); the Planning, Monitoring and Control Procedures for Natural Forest Logging Operations (1995); the Key Standards for Selection Logging in Papua New Guinea (1995); the PNG Logging Code of Practice (1996); the National Forest Plan (1996; a draft of a new national forest plan was prepared in May 2006); Procedures for Exporting Logs (1996); and Forestry Regulations (1998) (amended in 2010). PNG has established a number of regulatory instruments to support SFM but there are gaps in implementation. Other legal instruments relevant to forestry are the Land Groups Incorporation Act (1974); the PNG Labour Law (1990); and the Environmental Act (2000).

The revised National Forestry Development Guidelines contain the latest government policy framework for the forest sector. These have been approved by the National Forest Board but are yet to be endorsed by the National Executive Council. The guidelines provide for the establishment of a PFE, and, as of 1 January 2010, the requirement that "all new concessions will be for 100 percent downstream processing", but in other respects it appears to differ little from the previous version of the guidelines issued in 1993.[a]

The 2010 amendment to the Forestry Act (and a similar amendment to the Environment Act) is designed to prevent landowners and third parties from suing resource developers over environmental problems. The amendment has been criticized by NGOs such as Greenpeace PNG as removing "people's rights to go to court and to protect their resources and to protect their rights, rights to life" (Radio National 2010).

Institutions involved in forests. The PNG Forest Authority was created in 1991 under the provisions of the Forestry Act. In 2010 it had a staff of about 325, of whom 126 were based in Port Moresby. Four staff had doctorate degrees, six had masters degrees, 70 had bachelor degrees and there were 109 diploma-holders.[b,c]

The Forest Authority comprises the National Forest Board (NFB) and the National Forest Service (NFS). A number of regulatory and administrative responsibilities have been delegated to the provincial level. The NFB operates through a system of specialist advisory committees and provincial forest management committees that are serviced by the NFS. In the five years to 2006 the annual government budget appropriations for the Forest Authority averaged 23 million kina (plus around 3 million kina for log export monitoring, which is contracted out), compared with the estimated budget request of about 52 million kina. Box 1 sets out some of the Forest Authority's perceived strengths and weaknesses.

The main function of provincial forest management committees (PFMCs), as stipulated in the Forestry Act, is to facilitate consultation with, and ensure the proper involvement of, provincial governments and customary landowners. In addition, PFMCs are entrusted with assisting provincial governments in the preparation of forest plans and development programs and in recommending to the NFB the terms of forest management agreements (FMAs – see below), the selection of operators, the preparation of timber permits and the enforcement of timber-permit conditions. There are indications, however, that PFMCs are not functioning anywhere near an optimal level, due in part to a lack of capacity to enforce their mandates.[b]

The PNG Forest Research Institute is a specialized agency under the purview of the Forest Authority. Its key areas of research are SFM (silviculture and regeneration management); forest biology; forest products; and forest protection. The PNG Forest Research Institute "has great potential to be transformed into a regional-class research resource"[b] but is greatly under-resourced. Moreover, the following issues need to be addressed:

- There has been insufficient coordination between the Institute and other technical divisions of the Forest Authority in dealing with SFM and with ITTO's Objective 2000 and C&I.
- Silvicultural information on indigenous species has been presented and made available but has not been used for plantation development.
- Forest product research to deal with processing efficiency and treatment has been overlooked.
- Measurements from permanent sampling plots have not been analysed to provide certainty on the future availability of resources.[a]

Box 1 Strengths and weaknesses of the PNG Forest Authority

Strengths	Weaknesses
• It is the government's priority economic sector agency.	• Few funds invested in SFM by government. Much of the annual allocation is for administrative overheads and staff salaries.
• Good policy and legal framework for achieving SFM.	• Weak implementation/enforcement of policies and laws. • Inadequate staffing levels in monitoring projects.
• Positive foreign-donor support for forest sector.	• Lack of capacity to receive and implement aid projects.
• Reforestation levy collected and held in trust.	• High landowner demands and disruptions.
• Has developed key standards for logging natural forests (Planning, Monitoring and Control Procedures Manual).	• Poor industry–government cooperation. • Lack of support for field staff, transport and communication facilities for improved monitoring.
• PNG Logging Code of Practice. • Project supervisors in the field.	• NGO-government cooperation lacking (but improving). • Investment in forest plantation is almost negligent. • Implementation of ITTO C&I at FMA level unduly delayed. • Poor coordination and interface between the PNG Forest Research Institute and NFS management. • Reforestation levy not enough to establish new plantations or improve management of existing plantations. • Inadequate cooperation between the Department of Environment and Conservation and the Forest Authority.

Source: Government of PNG (2010b).

The PNG Forest Industries Association is an incorporated national association representing and promoting the interests of the PNG forest industry. The Association is working to forge a closer working relationship between the Forest Authority and industry members with regards SFM and its various components, such as legality of source, governance, and changing the industry's negative public image.[a]

The Department of Environment and Conservation is responsible for the administration of protected areas and also has a monitoring role with respect to adherence to environmental regulations.

The staff of both the Forest Authority and the Department of Environment and Conservation, especially those that are field-based, appear to be overworked and under-resourced and therefore unmotivated. Even though their work is mainly the policing of logging operations, they lack the facilities to do so: each field officer must attend to a large area – often hundreds of thousands of hectares – with almost no equipment or infrastructure.[b]

Log shipments are monitored by SGS, which has officers at all log export sites or projects who check 10% of all logs prior to shipment.[c] There is no monitoring of sawn timber and no tracking of logs to end-users.[a] The process has enabled the capture of substantial revenues by the PNG government, but it does not provide information on the level of sustainable practice of the timber permit-holder.[b]

The Land Groups Incorporated Act empowers landowners within a group to form a single legal body – an incorporated landowner group (ILG). Each ILG is required to list its members and land boundaries, but the land is not usually registered in the specific ILG name. Due to shortcomings – such as undefined boundaries, a lack of prior informed consent, and failure to follow formal procedures – many logging projects are implemented without an ILG certificate. Proceeds from FMAs are paid directly to clan agents representing landowners, who are supposed to distribute the money among clan members according to customary laws. The delay in the disbursement of royalties from the Forest Authority to the agents, exacerbated by disputes about land tenure, compound the inefficiency of the system. Several modifications have been proposed and some implemented, but there is growing criticism by landowners about the effectiveness of the system.[b]

National and international NGOs have taken a lead in the development of ecoforestry initiatives. They also have programs to train landowners in SFM.

Status of forest management

Forest for production

According to the 1991 Forestry Act (Section 56) the government may acquire timber rights from customary owners pursuant to an FMA between the customary owners and the government. The National Forest Development Guidelines specify that the customary land over which an FMA has been negotiated and a timber permit issued should be managed so as to maintain or improve the forest's capacity to produce timber and other commercial forest products on a sustained-yield basis and to provide opportunities for the meaningful participation of the customary owners. The PNG Logging Code of Practice and Key Standards for Selective Logging in PNG also provide specifications and prescriptions for reducing the impact of logging.

Before the promulgation of the Forestry Act, timber rights were acquired by a process referred to as timber rights purchase. The rights acquired under this system were only for the harvesting of merchantable timber and did not transfer the responsibility for forest management to the state or concessionaires. The national forest policy confirmed the government's intention to proceed with the acquisition of timber rights and to provide for their long-term management. In an FMA the Forest Authority secures a commitment from the customary landowners to follow recommended forest management practices while simultaneously offering investors access to the forest for a minimum of 35 years. Implementation may occur according to one of several kinds of licence, under which the state manages the forest on behalf of the landowners for the duration of the FMA. With the consent of the landowners through an FMA, the management roles of the state, including timber harvest and construction of infrastructure, may be implemented by an investor. Management responsibility can also be delegated to legally established landowner companies. The FMA should specify the returns due to the landowner.

According to the draft national forest plan, the total area of forests classified as production forests is 13.75 million hectares – to which could be added

'reserve forests'[1] and 'salvage forests', which could potentially be allocated to timber production.[b] This is an administrative classification, since the actual harvesting of these forests ultimately depends on the development of FMAs between the Forest Authority and landowner groups. FAO (2010) estimated the total area available for production at 8.54 million hectares, comprising production forests and multiple-use forests.

The system for the awarding of FMAs is a much-debated and frequently challenged process and contains elements of several types of concession-granting modalities. Some observers have noted that it has some of the undesirable characteristics of its predecessors, especially with regard to the rights of customary landowners and to environmental protection provisions. There are additional controversies and misgivings about the geographical extension of some FMAs and the process of renewal of some agreements beyond their original expiry dates. The means by which the government, including the Forest Authority, deals with such issues appear to be non-transparent and non-participatory. Many FMAs have been the subject of litigation over their validity and the extension of licences or permits.[b]

As of 2010, the PNG government had acquired timber rights from customary landowners involving about 12 million hectares of forest.[a] These rights are normally allocated to foreign developers with the necessary financial capabilities. Of the acquired area, an estimated 4.9 million hectares of forests were under active timber extraction licences in 2007; of this, Rimbunan Hijau or its affiliated companies had logging concessions amounting to 2.55 million hectares.[b]

For the total forest area under active timber extraction licences, 41 project supervisors of the Forest Authority are assigned to field monitoring. Communication is difficult between headquarters and project supervisors. Often there is no road to the FMA from Port Moresby, no telephones and no functioning radio communication. Government field staff are often dependent on the contractor's transport to access the FMA and to travel within it.[b]

The Forest Authority is expected to contribute to the government's Medium Term Development Strategy by facilitating the development of what have been termed impact forest projects, which would involve a commitment of currently unallocated production forests. Given the lack of capacity within the Forest Authority to oversee the management of existing production forest, this would be a cause for concern.[b]

For some years the AAC from natural forests has been set at about 3 million m^3 based on the allowable harvest levels specified under timber permits and FMAs. If this AAC was to be met it would involve the harvest of about 120 000 hectares of natural forest per year.[a]

The AAC has been set without the benefit of a national forest inventory, even though such an inventory is stipulated in the national forest policy. Much of the resource inventory, therefore, is carried out speculatively – mostly by the project proponent or permit-holder – to estimate volume, yield, type and characteristics of the forest resource. In 2006 the PNG Forest Research Institute was requested to develop a proposal for a national forest inventory to be submitted to the Forest Authority Forest Planning Division. However, no financial provisions have been allocated within the National Forest Service budget for this activity.[b]

Permit-holders are required to submit five-year plans and annual plans incorporating details of their operations. Combined, these plans should address, among other things, the forest management procedures to be employed, environmental issues, project benefits, infrastructure development (including for the community), reforestation, employment and training, and reforestation. However, verification procedures to ensure that these planned operations are achieved, as well as independent operational and financial audits and long-term post-logging inventories, are often lacking.

The creaming of premium species (and the leaving of other commercial, but less-valuable, species, which should be removed for silvicultural reasons) is not permitted but is reported to be taking place. Re-entry to 'closed' logging areas is also known to occur: both creaming and re-entry are serious factors undermining SFM.[a]

1 There are 13.2 million hectares of 'reserve forest', which are forests in areas that are inaccessible by road but which can be logged using methods such as skyline logging or helicopter logging. Such methods, however, are not practised in PNG due to their cost and a lack of available technology.[c]

The AAC does not take into account the timber harvested under forest-clearance authorities for agriculture, estimated at about 1.8 million m^3 per year.[a]

Land leases, landowner disruptions and fiscal arrangements have not been resolved and are obstacles to the success of private-sector partnerships in resource management.[a]

There is a lack of transparency in the forest sector. For example, in the acquisition of forest areas for FMAs the only aspect publicized is the notice of tender; no subsequent steps related to the acquisition and management of the FMAs or the extension of timber rights, or the associated financial assessments, are available publicly. Other problems associated with the process of developing FMAs include:

- The absence of an adequate national forest inventory.
- Controversies associated with the selection of concessionaires.
- The virtually complete absence of field monitoring.
- Questions arising from the calculation of revenues and from incomplete and delayed remittances to landowners.[b]

Recent amendments to the Forestry Act have made it easier to clear forest for agricultural and road-construction projects, placing the responsibility for the vetting of proposals and the selection of investors with government agencies other than Forest Authority, such as the Department of Agriculture and the Department of Livestock and Works. The Forest Authority controls the project through the issuance of forest clearance authorities (FCAs) and renewals upon satisfactory performance at various stages. Recently more than six large-scale FCAs have been issued, opening the way for a huge (albeit temporary) increase in the log harvest.[a,c]

Silviculture and species selection. The silvicultural system prescribed for natural forests is selective logging, involving the removal of mature and overmature trees to allow the remaining crop to grow naturally to maturity. Even though the pre-FMA system was also described as selective logging, all trees above the prescribed limit in a management unit were cut over within 10–20 years (i.e. less than the planned felling cycle), thus consuming the resource faster than could be sustained. Since 1991–92, all new forestry operations have had an assigned cutting cycle of 35 years.

The results of the 'reforestation naturally' program, which was designed and initiated under the Kandrian–Gloucester Integrated Development Program, indicate that this could be a successful forest replacement and management option if applied widely. In the period 1997–2006, however, its implementation covered only 43 000 hectares at a total cost of 2.7 million kina, which was drawn from a reforestation levy paid to the Forest Authority by log exporters. Growth measurements are yet to be analysed but observations suggest that the program is showing signs of success in the regeneration of commercial species in logged-over forests. Sixty percent of the budget for the program is used to pay for the engagement of landowners, who plant wildlings on former skid tracks and log landings and in other gaps where there is little spontaneous regeneration of commercial species.[a]

The tropical forests of PNG consist of a heterogeneous mixture of about 200 tree species. Based on quality and market acceptability, these species have been categorized into four groups for fixing royalties and charges. Important species harvested include *Intsia bijuga* (kwila), *Pometia pinnata* (taun), *Pterocarpus indicus* (rosewood), *Calophyllum* spp, *Celtis* spp, *Canarium indicum*, *Dillenia papuana, Terminalia* spp, *Buchanania* spp, *Palaquium* spp and *Homalium foetidum*. No data were available on the relative economic importance of these or other species at the national level. In the absence of updated information, Table 4 shows the list of commonly harvested species reported in ITTO (2006).

Table 4 Commonly harvested species for industrial roundwood

Timber species
Pometia pinnata (taun)
Intsia bijuga (kwila)
Eucalyptus deglupta
Calophyllum spp
Anisoptera thurifera

Source: ITTO (2006).

Planted forest and trees outside the forest. Estimates of the area of planted forest vary from 57 900 hectares, comprising Forest Authority plantations of 25 400 hectares and private plantations of 32 500 hectares (reported in Table 5)[a], to 63 200 hectares (FAO 2010), and there are also about 23 800 hectares of rubber plantations (ibid.). The rate of expansion of the plantation estate is low: about 200 hectares of *Pinus* species and *Eucalyptus pellita* (an indigenous species) are being established per year at Umi in Morobe Province.[a]

Across the plantation estate, *E. deglupta* (another indigenous species) is the main planted tree, along with *E. grandis, Acacia mangium, Tectona grandis, Terminalia brassii, Pinus caribaea, P. patula, Araucaria* spp*, Ochroma lagopus* and *Octomeles sumatrana*.

Forest certification. PNG has a national FSC working group and has developed national certification standards. In 2008 SGS developed a timber legality and traceability standard for PNG. Two forest areas have been FSC-certified: a natural forest covering 2705 hectares managed by the Foundation for People and Community Development near Madang, and an area of 19 920 hectares of planted forest (mostly *Eucalyptus deglupta*) managed by Open Bay Timber[2] (FSC 2010).

Estimate of the area of forest sustainably managed for production. A small area of production forest is operating under management plans. Five-year working plans are a broad statement of how an FMA will be managed by its permit-holder. Annual logging plans focus on harvesting at the coupe level.[c]

In addition to the forests that have been certified, two forest operations have demonstrated high-quality forest management: Cloudy Bay Sustainable Forestry Limited, and Vanimo Forest Products.[c] The Cloudy Bay operation commenced in 2003 under an FMA covering 148 900 hectares. The annual allowable cut is 60 000 m^3: the company's first sawmill, at Bonoabo, is processing 15 000 m^3 per annum and a second sawmill is under construction at Bam that will process 45 000 m^3 per annum. The concession has been allocated for a 35-year period.

NTFPs play many cultural roles in PNG.

Vanimo Forest Products is one of the major operators in the West Sepik (Sandaun) Province as well as in PNG as a whole. The combined harvest of the company's licensed areas, which cover 545 000 hectares, is 444 000 m^3 per year. The company has a sawmill with an annual log output of 50 000 m^3 and the balance is exported as round logs. The following observations can be made:

- The field operations in the Vanimo licensed areas are planned and executed well, and are supervised by NFS officers.
- Roads are well-constructed and are used by both the company and community services because they link remote villages.
- Logged-over forests appear to show good regeneration of commercial species, but their management requires further input from the Forest Authority.

2 Open Bay Timber has also harvested timber in the natural forests of the area but ceased doing so at the expiry of the timber rights purchase agreements between the landowners and the state. The Forest Authority is in the process of renewing the agreements to enable natural-forest harvesting in an area of about 100 000 hectares.[c]

At least 193 000 hectares of natural forest are considered to be under sustainable management, comprising the area of certified forest, the Cloudy Bay Sustainable Forestry operation, and the small area of forest managed by the Foundation for People and Community Development near Madang (Table 5). It would appear, therefore, that the estimate of 1.5 million hectares of sustainably managed forest made in ITTO (2006) was a significant overestimate.

Timber production and trade. Total industrial log production in PNG was estimated at 2.91 million m^3 in 2009, up from 2.25 million m^3 in 2004 and 2.12 million m^3 in 1999 (ITTO 2011). The forest industry is based predominantly on log exports. An estimated 1.93 million m^3 of logs were exported in 2009 (ITTO 2011), making PNG the world's second-largest exporter of tropical logs after Malaysia. PNG earned US$172 million in 2009 from timber exports, US$141 million of which was from logs (ITTO 2011).

Non-timber forest products. The people of PNG make use of many NTFPs for their livelihoods and consume bush meat, wild tubers, medicinal plants and other produce on a daily basis. Butterflies, live birds, *Gyrinops ledermannii* (eagle wood), *Santalum* (sandalwood) and rattan products are important sources of local income. Despite the significant value of and community dependence on NTFPs, there appear to be no firm government policies for their management and exploitation. Within the Forest Authority there is a general lack of capacity to assess the market for timber, valued-added forest products, and NTFPs.[b]

Forest carbon. Gibbs et al. (2007) estimated national-level forest biomass carbon stock at 4154–8037 MtC and FAO (2010) estimated it at 2306 MtC. PNG was one of a group of rainforest nations which, in 2005, promoted the REDD agenda within the framework of the UNFCCC. At the national level, the Forest Authority has developed a policy framework called the Forestry and Climate Change Framework for Action 2009–2015. Given PNG's complex tenurial conditions (for example, most forest is under customary ownership, but this does not include the right to benefit from forest carbon projects), further policy work is required to balance the competing interests of local communities, government and industry. PNG participates in the Forest Carbon Partnership Facility and the REDD+ Partnership but has not yet formulated an overall readiness plan. The country has considerable potential to reduce emissions from forest degradation and to enhance carbon sinks through SFM (Table 6).

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*	8700	5600	4980	19	1500	80	-	0
2010	**8700**	**4900**	**738**	**2.7**	**193**	**58**	**31.2****	**19.2**

* *As reported in ITTO (2006).*
** *The Bulolo forest plantation in Morobe Province, and the certified area of Open Bay Timber.*

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
4154–8037	79	+++	+	+	+	++	++

+++ 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).

Forest for protection

Soil and water. PNG's rugged terrain and steep slopes mean that soil and water conservation will always be important. The Logging Code of Practice, which is applied to state-acquired concession areas, includes measures for the protection of water and soil resources, but these are not always adhered to. No data are available on the extent of catchment protection forests.

Biological diversity. New Guinea is one of the most floristically rich islands on the planet. An estimated 20 000 species of higher plants have been found – about 7.5% of the world's total number of higher plant species. The world's greatest diversity of orchids (over 2000 species) and a similar number of fern species occur there. PNG also contains important representatives of the flora of the ancient super-continent Gondwanaland, including a large contingent of southern conifer species and *Nothofagus* (southern beech). Thirty-five mammals, 30 birds, ten amphibians, two reptiles and one plant found in forests are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species (IUCN 2011). Six plants are listed in CITES Appendix I and 109 are listed in Appendix II (UNEP-WCMC 2011).

Protective measures in production forests. There are regulations for commercial forestry operations in order to protect catchments and prevent soil erosion. As noted earlier, however, the enforcement of these is often problematic.

Extent of protected areas. At present there is no agreed legal national definition of protected areas in PNG.[b] Data on protected areas and protection forests as identified by the Forest Authority and the Department of Environment and Conservation are vague and vary widely, which is perhaps a reflection of poor communication between the two organizations. According to the Department of Environment and Conservation there are 1.64 million hectares of protected areas in PNG, comprising national parks, memorial parks, protected areas, provincial parks, reserves, wildlife management areas and sanctuaries, although the extent to which these areas are forested is unclear. According to the Forest Authority there are 1.2 million hectares of protection forests[a], and a third estimate puts the area of protection forest at 547 000 hectares.[b] UNEP-WCMC (2010) was unable to provide an estimate of the area of forest in protected areas in PNG. The delineation of protected areas on the ground, the institution with management authority over them, and the extent of monitoring and enforcement are all uncertain.[b]

Estimate of the area of forest sustainably managed for protection. Details are scant about the system and condition of protected areas. The Department of Environment and Conservation is mandated to manage protected areas and to monitor adherence to environmental regulations. However, the Department's role has been marginal in administering protected areas, with limited staff based in Port Moresby and limited operational interaction with the Forest Authority.[b]

Insufficient information was available to estimate the area of protection PFE under SFM (Table 7).

Socioeconomic aspects

Economic aspects. Forestry is the third-largest foreign-exchange earner after mineral and agricultural exports (Overseas Development Institute 2007). The forest industry employs an estimated 10 000 people.[a] The government collects revenues from a log export tax and a reforestation levy, while resource owners receive a royalty on timber harvested (10 kina per m^3) and other levies and premiums. It has been observed, however, that many of the benefits of forestry operations have generally not filtered through to landowners, and income has not been saved or invested to ensure long-term development (PNG Forest Authority 2002). In 2005 the forest sector generated revenue worth about 130 million kina and total public expenditure in the sector was about 23.4 million kina.

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*	1700	362	-	-	-
2010	**1700**	**-**	**0**	**-**	**-**

* *As reported in ITTO (2006).*

Livelihood values. About 80% of the PNG population is rural and dependent on forests for a wide range of subsistence needs, including food, fuel, shelter, medicines and cultural aspects, as well as to supply land that is used in shifting agricultural systems. No quantitative information was available for this report.

Social relations. Customary landowners participate in the process of timber rights purchases by the Forest Authority but are not much involved in the subsequent management and development of the resource.[a] The purchase of rights usually involves payments or royalties and levies to landowner groups, and this has led to conflicts and tensions within such groups. The presence of logging camps (and the associated disruptions to social and cultural environments) has also created tensions in some communities.

Since the 1970s the PNG government has put in place various mechanisms designed to enable the participation of customary landowners in the development of their forest resources. Broadly, the policy evolution has proceeded in the following way[c]:

- In the late 1970s to the mid 1980s the government established an entity called the Forest Development Corporation for landowners and the respective provincial governments to have a stake in the development of the forest resources. This concept failed due to limited knowledge of the forestry business.
- In the mid 1980s to the late 1990s the landowner company concept was introduced. Alhough the concept was good there were instances where company directors were not true representatives of the resource owners, and this led to the misuse of funds.
- Since the late 1990s all clan groups signatory to an FMA become an incorporated entity and the chairman of the group automatically becomes the director of the landowner company. Thus, the landowner group forms the building block of the landowner company, a legitimate company representing the landowners. This concept appears to be working, even though there have been some cases of funds mismanagement.

Summary

Revised forestry development guidelines have been developed although they have not been endorsed by the National Executive Council. Although similar to those issued in 1993, these guidelines specify the establishment of a PFE. Presently, PNG does not have a formal PFE and almost the entire forest estate is under customary land ownership. A recent amendment to the Forestry Act may reduce the rights of customary landowners to sue resource developers over environmental problems. The PNG Forestry Authority has well-qualified staff but is seriously under-resourced and is unable to conduct significant field monitoring. Provincial forest management committees established to facilitate consultation with landowners are also under-resourced. The use of a private company to monitor log shipments has enabled the PNG government to capture significant revenue from export levies. The distribution of revenue from logging contractors to clan members is often delayed and exacerbated by land-tenure disputes. A post-logging forest regeneration regime has been developed and applied to a relatively small area of forest.

Key points

- PNG has about 10.5 million hectares of forest (the same as estimated for 2005) that might be considered permanent; these include 8.7 million hectares of forest over which timber rights have been acquired (production PFE – as for 2005), 1.7 million hectares allocated for protection (as for 2005) and about 58 000 hectares of timber plantations.
- An estimated 193 000 hectares of the production PFE are under SFM, 2700 hectares of which are certified. No estimate was possible of the area of protection PFE under SFM.
- As of 2010, the PNG government had acquired timber rights from customary landowners involving about 12 million hectares of forest. These rights are normally allocated to foreign developers with the necessary financial capabilities. Of the acquired area an estimated 4.9 million hectares of forests were under active timber extraction licences in 2007.
- Re-entry to 'closed' logging areas and the 'creaming' of premium species are undermining SFM.

- PNG is a major exporter of tropical logs, shipping out an estimated 1.93 million m^3 in 2009.
- PNG's forests are thought to be vulnerable to climate change, but the country also has potential for forest-based carbon capture and storage.

Endnotes

a Government of Papua New Guinea (2010b).

b ITTO (2007).

c Personal communications with D. Kare, who was commissioned to prepare PNG's submission for this report. As part of the submission he reviewed the operations of Cloudy Bay Sustainable Forestry Limited and Vanimo Forest Products.

References and other sources

FAO (2010). Global forest resources assessment 2010 country report: Papua New Guinea (available at http://www.fao.org/forestry/fra/67090/en/).

FSC (2010, website accessed July 2010). FSC certification database (searchable database available at http://info.fsc.org/PublicCertificateSearch).

Gibbs, H., Brown, S., Niles, J. & Foley, J. (2007). Monitoring and estimating tropical forest carbon stocks: making REDD a reality. *Environmental Research Letters* 2 (available at http://iopscience.iop.org/1748-9326/2/4/045023/fulltext).

Government of PNG (2010a). Pilot program for climate resilience. Proposal for Papua New Guinea Phase 1 activities. Submitted to Climate Investment Funds, World Bank, May 2010. http://www.climateinvestmentfunds.org/cif/sites/climateinvestmentfunds.org/files/Papua%20New%20Guinea%20Phase%201%20Proposal.pdf

Government of Papua New Guinea (2010b). Report of progress toward achieving sustainable forest management in Papua New Guinea. Submission to ITTO by the PNG Forest Authority, Port Moresby, Papua New Guinea. Prepared by Dike Kari.

ITTO (2006). *Status of Tropical Forest Management 2005*. ITTO, Yokohama, Japan (available at http://www.itto.int/en/sfm/).

ITTO (2007). Achieving the ITTO Objective 2000 and sustainable forest management in Papua New Guinea: report of the diagnostic mission. ITTC(XLII)/7. ITTO, Yokohama, Japan.

ITTO (2011, website accessed March 2011). Annual Review statistics database (available at http://www.itto.int/annual_review_output/?mode=searchdata).

ITTO & RRI (2009). Tropical forest tenure assessment. trends, challenges and opportunities. ITTO, Yokohama, Japan and Rights and Resources Initiative, Washington, DC, United States.

IUCN (2011, website accessed March 2011). IUCN red list of threatened species (searchable database available at www.redlist.org).

Overseas Development Institute (2007). *Issues and Opportunities for the Forest Sector in Papua New Guinea.* Overseas Development Institute, London, UK.

PNG Forest Authority (2002). National forest policy review. Country report presented at the 19th Session of the Asia-Pacific Forestry Commission, Ulaanbaatar, Mongolia, 28–30 August 2002.

Radio National (2010). Greenpeace accuses PNG govt over new environment laws. Transcript of interview with Dorothy Tekwei, Greenpeace PNG. Pacific Beat, Radio National (available at http://www.radioaustralia.net.au/pacbeat/stories/201006/s2920632.htm).

Shearman, P., Bryan, J., Ash, J., Hunnam, P., Mackey, B. & Lokes, B. (2008). *The State of the Forests of Papua New Guinea: Mapping the Extent and Condition of Forest Cover and Measuring the Drivers of Forest Change in the Period 1972–2002*. University of Papua New Guinea, Port Moresby, PNG.

Spalding, M., Kainumu, M. & Collins, L. (2010). *World Atlas of Mangroves*. Earthscan, London, UK.

UNDP (2009). *Human Development Report 2009*. United Nations Development Programme, New York, United States.

UNEP-WCMC (2010). Spatial analysis of forests within protected areas in ITTO countries. Data prepared for ITTO. UNEP-WCMC, Cambridge, UK.

UNEP-WCMC (2011, website accessed March 2011). UNEP-WCMC species database: CITES-listed species (searchable database at available at www.cites.org/eng/resources/species.html).

United Nations Population Division (2010, website accessed March 2010). World population prospects: the 2008 revision (searchable database available at http://esa.un.org/unpp/p2k0data.asp).

PHILIPPINES

Forest resources

The Republic of the Philippines lies to the east of continental Asia between the South China Sea and the Philippine Sea, extending from 5° to 20° north of the equator. It comprises an archipelago of over 7000 islands with a total land area of 29.8 million hectares. In 2010 the estimated population of the Philippines was 93.6 million people and the growth rate in the ten years to 2010 was about 1.87% (United Nations Population Division 2010). The Philippines is ranked 105th out of 182 countries in UNDP's Human Development Index (UNDP 2009).

FAO (2010) estimated the forest area in the Philippines at 7.66 million hectares, which is 26% of the total land area. The Government of the Philippines estimated the total forest area at 7.17 million hectares (including 737 000 hectares that are outside the 'forestlands' category).[a]

Forest types. The Philippines has two broad biogeographical regions: the east, which remains wet throughout the year, and the west, which has a dry season. The forests have been classified by climate and altitude into evergreen rainforest (81%), semi-evergreen forest (10%) and mountain forest (9%). They have also been classified as closed forest (i.e. with greater than 40% cover), open forest (10–40% canopy cover), mangrove forests, and plantations.[a] Philippine forests may also be classified into five broad forest types on the basis of species composition:

- Dipterocarp forests, in which timber species of the dipterocarp family, such as *Pentacme contorta* (white lauan), *Shorea negrosensis* (red lauan) and *Dipterocarpus grandiflorus* (apitong), dominate stands. In the past, this forest type was the main source of raw material for the timber industry.
- *Molave* forest, which is more open than dipterocarp forest, with a timber volume averaging 30 m^3 per hectare. This forest type occurs in regions where there are distinct wet and dry seasons. Major species include *Vitex parviflora* (molave), *Pterocarpus* spp (narra) and *Intisa bijuga* (ipil).
- Pine forests, which are found in the high mountainous regions of northern Luzon and Mindoro. The principal species are *Pinus insularis* and *P. merkusii.*
- Mangrove forests, which occur on tidal flats in estuaries and on the shores of protected bays. In the 1950s mangrove forests covered an area of more than 375 000 hectares, but today degraded mangrove forests cover about 250 000 hectares (Spalding et al. 2010).
- Beach forests, which occur along streams and on tidal flats. They usually comprise pure stands of nipa palm (*Nipa fruticans*), but may also contain species such as *Terminalia catappa* (talisai), *Barringtonia asiatica* (botong) and *Calophyllum inophyllum* (palomaria).

Permanent forest estate. The country's land resources are classified into forestlands and alienable and disposable (A&D) lands. All lands in the public domain with slopes of 18% or greater are classified as forestlands and are owned by the state. A&D lands are subject to the granting of private rights and allocation to various (principally agricultural) uses. The entire extent of forestlands (15.9 million hectares) has been demarcated with 'monuments'[a]; within this area there is no differentiation in the field between production and protection forest.

Information on the extent and condition of forestland and A&D land is often confusing. Most forests are found on forestland, and most

cropland on A&D land, but these land uses are not always consistent with the legal classes. Of the area presently classified as A&D land, 30–35% has slopes greater than 18%. Conversely, as much as 28% of forestlands have slopes of less than 18%. About 40% of classified forestlands are not used for forestry purposes (e.g. in urban areas such as Quezon City, General Santos City and Metropolitan Cebu).[a] On the other hand, certain A&D lands or even private lands cannot be used in community-based forest production due to policy constraints.

The actual extent of forest in the PFE is also unclear. For example, in its submission to ITTO for this report, the Government of the Philippines (2009) variously reported a PFE of 15.9 million hectares (when reporting the extent of designated forestlands), 6.82 million hectares (when reporting on forest condition classes), 6.43 million hectares (when reporting on forest area by forest type), and 5.4 million hectares (when reporting on changes in forest area). Moreover, it reported identical areas for protection forests in both the PFE and non-PFE (1.339 million hectares in each). The estimate of production PFE given in Table 1 is based on the estimate given in ITTO (2006). It is assumed that no forests on A&D lands are in the PFE. The total extent of planted forest is also unclear, with estimates of 314 000 hectares[c], 330 000 hectares (FMB 2010) and 352 000 hectares (FAO 2010).

Forest ecosystem health

Deforestation and forest degradation. Deforestation occurred at an annual rate of about 316 000 hectares in the 1980s, caused by land conversion, shifting cultivation, forest fire and over-logging.[a] According to FAO (2010), total forest area increased by 274 000 hectares between 2005 and 2010 and by 1.10 million hectares between 1990 and 2010, mainly due to natural regeneration on degraded lands.

In 2006 about 28 000 hectares of forest were formally cleared for agriculture, settlements, infrastructure or other purposes, unplanned fire destroyed an estimated 9000 hectares, and drought, storms and pests and diseases reportedly affected about 7700 hectares of forest.[a] Based on arrests, illegal exploitation was reported to have occurred on about 1500 hectares of forestland, although this is perhaps more a reflection of the efficacy of forest law enforcement than of the absolute extent of illegal forest activities.[a] Table 2 presents an estimate of the area of natural forests by condition.

Vulnerability of forests to climate change. Mean annual temperature has increased in the Philippines in the last 20 years. Those regions that have warmed the most (northern Luzon and Mindanao) have also dried the most. There has also been an increase in the frequency of typhoons and other wind damage. Floods have caused widespread damage and large numbers of casualties in recent years.

About 1.02 million hectares of natural forests are considered highly vulnerable to climate variability (Cruz & de Luna 2009), mostly located in Davao del Sur, Leyte, Sarangani, Sultan Kudarat and Zamboanga del Norte. Natural forests in Leyte are at risk of increased damage from strong winds and excessive rain associated with typhoons. In Mindanao, which is not frequently affected by typhoons, the natural forests are more likely to be affected by drought, although the risk is unknown. Among other things, higher drought frequency and severity can increase the risk of grass, brush and forest fires (ibid.).

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*	5.4–7.2	5288	4700	274	1540	6514
2010	**7.17–7.66**	**3248****	**4700‡**	**314[b,†]**	**1340[a]**	**6354**

* *As reported in ITTO (2006).*

** *Calculated using the ratio of forest with greater than 60% forest cover estimated by UNEP-WCMC (2010) (42.4%) and the total natural forest area as estimated by FAO (2010). DENR (undated) estimated the area of closed natural forest at 2.48 million hectares.*

‡ *Based on ITTO (2006) and personal communications – see endnote b.*

† *Based on projected planting rate. FAO (2010) reported a planted-forest area of 352 000 hectares but noted that data on reforestation are weak because of the possibility of double-counting.*

Table 2 Forest condition

	PFE	Non-PFE	Total
	'000 ha		
Area of primary forest	-	-	822[c,*]
Area of degraded primary forest	-	0	0
Area of secondary forest	-	-	2560[c]
Area of degraded forest land	-	-	4031[c]

* *FAO (2010) reported a primary forest area of 861 000 hectares, which was unchanged since 1990 on the basis that a 1990 DENR regulation provided for a shift in logging from old-growth forest to residual forest.*

The Presidential Task Force on Climate Change was created in 2007 with the aim of providing mitigation and adaptation measures to reduce the impacts of climate change on identified sectors, including the forest sector. The Government of the Philippines has also established the Inter-Agency Committee on Climate Change, which is responsible for ensuring that the Philippines meets its obligations to the UNFCCC. The Philippine Climate Change Act (RA 9729), enacted in October 2009, created the Climate Change Commission, the sole policymaking body on climate-change issues, and initiated the formulation of the National Framework Strategy on Climate Change (which was approved by the President of the Philippines in April 2010).

SFM policy framework

Forest tenure. The entire land area formally designated as forestland is owned by the state. Since the PFE falls within that estate, the entire PFE is also owned by the state (Table 3). Considerable portions of forest are held by the private sector, communities, people's organizations and Indigenous people under various kinds of tenure arrangement that do not include outright ownership. These include:

- Community-based forest management agreements (CBFMAs) – 25-year leases for communities, renewable for another 25 years over forest areas of a maximum of 5000 hectares each.
- Industrial forest management agreements – 25-year production-sharing agreements for private companies, renewable for another 25 years, mainly comprising industrial plantations.
- Socialized industrial forest management agreements (SIFMAs) – 25-year leases for communities, renewable for another 25 years, mainly comprising community-based plantations.
- Timber licence agreements (TLAs) – 25-year leases renewable for another 25 years. These are no longer allowed under the Constitution and will cease once the last TLA expires in 2011 (land currently assigned under TLAs will have to shift to other production-sharing or joint-venture agreements).
- Certificates of ancestral domain title, which are titles or certificates to ancestral land domains on both forestland and A&D lands.

An estimated 7.1 million hectares of land (both within and outside the PFE) has been allocated to Indigenous communities under certificates of ancestral domain title or are under ancestral domain claim.[a] It is unclear, however, what effect the granting of rights to ancestral lands and domains has on ownership; it appears that, while recognizing rights, the state retains ownership of the resources on those lands (Fey 2007). The rights of Indigenous peoples over ancestral domains are clear. While the government retains legal ownership over natural resources (although this is being contested), Indigenous peoples are given the preferential option to use those resources and thus other bodies/entities intending to extract resources or conduct any development options in the area must obtain the free, prior informed consent of the relevant Indigenous community (C. Guerrero, pers. comm., 2010).

In recent years a new forests and forestlands management strategy has started to emerge that recognizes, through a co-management approach, the crucial role that local government units and upland dwellers play in forest and land management. The issuing of individual property rights (IPR) agreements is a means by which the Department of Environment and Natural Resources (DENR) and the local government units share stewardship of forests and forestlands with claimants/occupants. An IPR agreement gives each occupant in a

co-managed area the right to use, develop and manage a maximum of five hectares of land for 25 years, renewable for another 25 years at the option of both parties. Claimants can use the land to farm and harvest the crops they have planted. As stewards and managers of the resource they are bound to help protect and conserve the forest and its resources, and to reforest open and denuded areas. IPR agreements allow community members to benefit commercially from their upland farms, thus motivating them to develop bare forestlands and adopt sustainable and environment-friendly farming methods, such as agroforestry, that minimize forest conversion, slash-and-burn activities and wanton timber-cutting. With the support of local government units, DENR, civil society and the private sector, IPR agreement-holders are encouraged to use their own labour, know-how and available capital to develop their claims, consistent with the co-management agreement and in support of the land-use plans of local government units.

The role of IPR agreements is still in its infancy. In January 2007, in a milestone for forest management in the country, IPR agreements covering about 20 hectares were issued by the municipal government of Quezon and the Provincial Environment and Natural Resources Office to eight upland farmers. Another 43 farmers were party to IPR agreements in February 2008.

Table 3 Forest area, by tenure

Ownership category	Total area	Of which PFE
	'000 ha	
State ownership (national, state or provincial government)	-	6354
Other public entities (e.g. municipalities, villages)	-	0
Total public	**-**	**6354**
Owned by local communities and/or Indigenous groups	-	0
Privately owned by individuals, firms, other corporate	-	0

Source: Government of the Philippines (2009).

Criteria and indicators. The Philippine system of C&I for the sustainable management of forests is an adaptation of the ITTO model (ITTO 2005) refined to suit the local context. Specifically, the purpose of the Philippine C&I is to provide the government, through DENR, and other forest managers with an improved tool for assessing changes and trends in forest conditions and forest management systems. The Philippine C&I provide a means of assessing progress towards the attainment of the objective set under Executive Order 318, otherwise known as Promoting Sustainable Forest Management in the Philippines. The approved set of Philippine C&I is used formally by the government in the performance evaluation of various types of FMUs through a memorandum order issued by DENR in July 2007. The Government of the Philippines used the ITTO C&I in its submission to ITTO for this report.[a]

Forest policy and legislation. The foundation of forest policy is Presidential Decree 705 (1975), as amended; it is known as the Revised Forestry Code of the Philippines. According to this Code (Section 2), the components of forest policy are the multiple-use of forests, the systemization of land classification, the establishment of wood-processing plants and the protection, development and rehabilitation of forestlands. The Code was drawn up when the major emphasis was on the large-scale commercial harvesting of state-owned natural forests by large corporations.

The 1987 Constitution, which reflects a general reorientation of natural resource management policies in favour of co-production, installed community-based forest management (CBFM) as the main framework for forest resource management. Today, communities are the main implementers of SFM strategies and programs in both planted and natural forests. Nevertheless, a systematic approach to SFM is not yet apparent on the ground. A major law on a National Integrated Protected Area System (NIPAS), the NIPAS Act, was enacted in 1992 and the Indigenous Peoples' Rights Act was enacted in 1997; both provide overarching directions for forest management. Other relevant laws include the Local Government Code, enacted in 1991, and the Wildlife Conservation and Protection Act, enacted in 2001.

The Forestry Code and subsequent laws and regulations have not been fully harmonized and updated to reflect this reorientation. A Sustainable Forest Management Bill has been under consideration by the national legislature since 1989 but, to date, has not been passed into law. The bill has seven guiding principles: watershed as the basic forestland management unit; multi-sectoral participation; CBFM; the protection of

forestlands and natural resources as a priority concern; reforestation as a priority measure; security of tenure of stakeholders; and professionalism in the forest service (Fourteenth Congress of the Republic of the Philippines undated).

The optimal use of the country's land and its sustainable management, as set out in a national land-use plan, is the key feature of the much-awaited Act on National Land-use Policy. Should the Act pass into law, it would, among other things, identify mechanisms for the allocation of unused and under-used private and A&D lands for tree plantations to augment the limited wood supply from natural secondary forests.

Institutions involved in forests. DENR is the government agency responsible for the management of forests and protected areas. Other institutions with responsibilities related to forests include the Forest Management Bureau (FMB, part of DENR), which has responsibility for the management of the country's forest resources; the Environmental Management Bureau, which is responsible for the management of the overall environment; the Protected Areas and Wildlife Bureau, which is responsible for the management of an integrated protected areas system and the conservation of biological diversity; and the Ecosystem Research and Development Bureau, which is responsible for forest ecosystem research and technology development. The Philippine Wood Producers' Association is responsible for carrying out timber production and processing on government forestlands. The total 2009 budget of DENR for forest management and administration and forest-related projects was US$84.8 million.[a]

Under Executive Order 606 (27 February 2007) on sustainable upland development, DENR has embarked on a comprehensive upland development program. The organization's 2009 resources for forest development and management were substantially reconfigured to focus on the restoration of the ecosystem services provided by vital watersheds and protected areas while simultaneously catalysing improvements in upland productivity, creating incomes for upland poor, mitigating hunger among highly vulnerable populations, engaging with organized upland communities, and providing a climate for gainful economic production among poor upland dwellers.[a]

The Philippines Local Government Code (1991) confers certain central government powers relating to forest taxation, budgeting, planning and project management on local government units. Some officers, mostly involved in social forestry, were also devolved to local governments, which created their own environment and natural resources offices. The process of devolution in the government forest sector is ongoing, with closer coordination between DENR and the Department of Interior and Local Government. Local government units are assuming a greater role in forest management and strengthening co-management mechanisms with DENR in agroforestry and watershed management. Several foreign-funded forestry projects are being implemented with local governments as executing agencies.

With support from ITTO, DENR is developing a forest information system to promote SFM and aid policy formulation and decision-making through improved data collection and information processing. Also through an ITTO-funded project, the FMB has been developing an integrated chain-of-custody and timber-tracking system, particularly to assist in identifying and quantifying illegal timber and other forest products. The project assessed the impacts of the existing Log Control Monitoring System and the Forest Stock Management System, as pilot-tested in selected regions in the Philippines, to determine gaps in the system and to expand it to include a chain-of-custody module. The resultant Philippine Timber Tracking System includes improved field procedures in data-gathering at the seven nodes identified for chain of custody and timber-tracking, software for data entry and report generation, and a database for timber-tracking. The system has been piloted in one Integrated Forest Management Agreement (IFMA) operation and DENR plans to implement the system nationwide. It is hoped that this management tool will facilitate forest law enforcement, chain-of-custody procedures and forest certification.[a]

In 2008 the FMB computerized its forms for certificates of timber origin and certificates of lumber origin. These are management tools for monitoring and tracking the movement and legality of origin of locally produced forest products that are transported and traded within the country.

Status of forest management

Forest for production

No other Asia-Pacific country was deforested as extensively as the Philippines in the period after World War II. Even though TLAs, until recently the system for allocating logging rights, stipulated that logging operations should be conducted according to a system of selective logging, the detailed guidelines for forest management were hardly ever applied. Many of the problems associated with the large-scale destruction of the forest resource can be linked to a combination of land-tenure and concession-tenure issues and the lack of ability or will to enforce the conditions of the concessions. In order to prevent the loss of old-growth forests, Decree 24/1991 imposed a ban on old-growth (or primary-forest) logging from January 1992 and shifted logging to second-growth (residual) forests. Silvicultural prescriptions were not followed. Today, the control of illegal activities remains a major challenge and is considered one of the main obstacles to SFM (ITTO 2006).

The legal basis of the TLA system changed under the 1987 Constitution, resulting in a dramatic reduction in the awarding of concessions. However, TLA-holders were allowed to continue to operate until the expiry date indicated in the original agreements, subject to certain requirements. Areas under TLAs started to be phased out in favour of awarding forest harvesting rights embodied in timber production sharing agreements (TPSAs). The TPSA system increased government revenues, but these revenues did not generally go back into forest management as originally intended.

TPSAs evolved into IFMAs, SIFMAs and CBFMAs, all of which aim to encourage investment in maintaining the forest growing stock through a performance bond. These instruments take into account the provisions of the Indigenous People's Rights Act (1997), according to which Indigenous people have the right to title over their ancestral lands and to have a say in the management of those lands.

Most expiring TLAs have opted to convert to IFMAs, but CBFMAs are becoming the dominant form of allocation (by area). TLAs whose permits have expired and which have not been converted to IFMAs or CBFMAs become open-access areas.

As of early 2009 there were forest-use agreements covering a total of 7.2 million hectares, comprising:

- Six operating TLAs covering 325 310 hectares of forestlands.
- 148 IFMAs with an operational area of 782 931 hectares of forestlands.
- 1803 SIFMAs covering 34 727 hectares of forestlands.
- 5503 communities with CBFMAs covering 5.97 million of forestlands.
- 198 tree farm and agroforestry farm lease agreements covering 99 994 hectares.[a]

Little information is available on the status of management under any of these forest-use agreements.

Under CBFMAs, organized communities operate within allowable-cut limits set by government. They harvest timber and other forest products to sell, use for their own needs, or process, and at the same time protect the forest against illegal logging and other unauthorized activities. The sale of timber, rattan, bamboo and other forest products has provided additional income for upland communities.

All holders of TLAs and IFMAs are required to submit to DENR a five-year medium-term forest management plan, an integrated annual operation plan and a yearly concession report. These plans are oriented to sustainable production based on prescribed selective logging appropriate for the Philippine dipterocarp forest. The general objective of the medium-term forest management plan is to sustainably manage natural forests for the production of high-quality dipterocarp timber without jeopardizing the rights of affected communities, including Indigenous people, or impairing the non-timber benefits obtained from the forest. In dipterocarp forest, only mature and overmature trees of merchantable height with a dbh of 60 cm and above may be harvested on a minimum operable production area of 1200 hectares. Sustained-yield management is supported by growth and yield studies for various forest types.

In the case of IFMAs with attached natural forest, licensees are required to submit a management plan and an integrated annual operation plan for sustainable production from adequately stocked

forest and the conversion to plantations of inadequately stocked natural forest. The cutting of trees in areas greater than 50% slope or within 20 m of rivers and roads is not allowed. Licensees are also required to plant trees in bare areas and to keep them under permanent forest cover. Objectives and prescriptions are similar to the requirements for TLAs.

CBFMA-holders are required to submit a comprehensive management and development plan (oriented to plantation establishment, since forest areas are mainly denuded or degraded). In rare cases, secondary-growth forests are attached to CBFM areas.

The medium-term plan and integrated annual operation plan are submitted to the FMB and DENR for review and evaluation prior to harvesting and other forest operations in the operable production forest. The FMB conducts yearly evaluations of the performance of each licensee, using a composite team of professionals from DENR and the academic sector to determine conformance with rules and regulations on timber harvesting, selective logging, AAC, pre-logging and post-logging operations, forest protection, community services and environmental compliance. DENR also conducts ad-hoc, unannounced field inspections of production areas under licence to detect violations of rules and regulations, illegal logging and poaching, and the improper use of documents such as the certificates of timber origin. These mechanisms have resulted in the suspension and cancellation of licence-holders not following prescriptions and conducting illegal activities.[a] The main violations include over-cutting in operable areas, illegal logging in non-operable areas or outside boundaries, poor forest protection leading to encroachment in production areas, and the recycling of permits and documents for harvest and transport. There are also cases of non-payments of forest charges, silvicultural fees, the environmental guarantee fund, and trust funds for reforestation and timber stand improvement.

In IFMAs with responsibility for the management of natural forests, provisions for the replacement of inadequately stocked natural forest with plantations were often abused, as adequately stocked forest was logged and sold. This led to a suspension of this type of IFMA for several years to prevent further abuse and the destruction of potentially viable secondary forests. There have been no reported violations in IFMAs that are solely conducting plantation activities on denuded and degraded areas.[a]

Silviculture and species selection. TLAs for logging in natural forest follow a system of selective cutting, while forest plantations follow a system of clearfelling and artificial regeneration. Many species are used, and it is difficult to determine which are the most commercially important. Most of the species listed in Table 4 are from plantations.

Planted forest and trees outside the forest. There are an estimated 314 000 hectares of planted forests in the Philippines. They include those developed by the government in regular reforestation projects, by communities in CBFMAs and SIFMAs, and by industrial concerns through IFMAs, as well as tree farms developed by small landholders on private lands. No recent aggregated information is available on the survival, growth or yield of plantations, but all are thought to be low. Corporate-sector involvement in the growing of industrial plantations is being encouraged through IFMAs for the development of integrated industrial forest plantations.

Forest certification. As of December 2010, no forest in the Philippines had been independently certified as well managed (e.g. FSC 2010).

Table 4 Commonly harvested species for industrial roundwood

Species	Notes
Paraserianthes falcataria (falcata)	Harvest in 2006 = 413 000 m^3/year; from secondary forests and planted forests.
Gmelina arborea (yemane)	Harvest in 2006 = 263 000 m^3/year; from planted forests.
Acacia mangium (mangium)	Harvest in 2006 = 126 000 m^3/year; from planted forests.
Eucalyptus deglupta (bagras)	Harvest in 2006 = 34 000 m^3/year; from planted forests.
Swietenia mahoganii (mahogany)	Harvest in 2006 = 78 000 m^3/year; from planted forests, used in sawmilling and plywood industries.
Shorea negrosensis (red lauan)	Harvest in 2006 = 24 300 m^3/year; used in sawmilling and plywood industries.

Source: Government of the Philippines (2009).

Young forest-dwellers collect NTFPs in Mindanao.

Estimate of the area of forest sustainably managed for production. Given a lack of information on forest management at the FMU level, the extent of SFM is difficult to gauge. Forest management is still evolving towards community-based approaches, but there is a lack of policies to support communities in adopting SFM practices, and the effectiveness of current arrangements for co-production is a subject of debate. The total area of PFE under management plans is 822 000 hectares (of which about 80% is probably natural forest), a slight decrease over the area reported for 2005 (and less than the 2.25 million hectares reported in FAO 2010). On the basis of an estimate provided by the Government of Philippines, FAO (2010) reported that 4.05 million hectares of natural forest were under sustainable management, the Government of the Philippines reporting that "all forest area covered with management plans is considered to be under sustainable management". In general, however, data on the quality of management are lacking. The area of natural forest managed sustainably is estimated by ITTO to be at least 79 000 hectares, comprising a forest concession managed with ITTO assistance in Surigao del Sur (Table 5).

Timber production and trade. The production of industrial roundwood in the Philippines peaked at 11.2 million m^3 in 1974 (FAO 2001); in 1977 there were 325 sawmills and 70 wood-based panel manufacturing units (ibid.). Production fell to a low of about 401 000 m^3 in 2001 before recovering to 857 000 m^3 in 2009 (ITTO 2011). In 2009 the Philippines imported 89 000 m^3 of logs, 165 000 m^3 of sawnwood, 24 000 m^3 of veneer and 111 000 m^3 of plywood (ibid.).

Non-timber forest products. An estimated 5.15 million linear metres of un-split rattan (from an annual allowable cut of 21.9 million linear metres – FMB 2010), 13.2 million pieces of nipa shingles, 872 000 pieces of bamboo, 196 000 pieces of anahaw leaves, and 248 000 kilograms of almaciga resin were harvested commercially in the Philippines in 2008, and NTFP exports were worth an estimated US$873 000 (ibid.). The leaves of *Nipa fruticans* are used for thatch and its sap is used for the manufacture of vinegar, alcohol and sugar.

Forest carbon. Changes in land use are the greatest source of GHG emissions in the Philippines. Gibbs et al. (2007) estimated the national-level forest biomass carbon stock at 765–1530 MtC,

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*	4700	-	910	0	76	274	274	0
2010	**4700**	**4700****	**658[a,b,c]**	**0**	**79[a]**	**314**	**164[a,b,c]**	**0**

* *As reported in ITTO (2006).*

** *Note that the Government of the Philippines (2009) reported that 7.2 million hectares were under licence. However, this area is greater than the natural-forest production PFE, and, while it is under some form of contractual arrangement, it is unclear how much of the land is actually forested or is intended to be returned to forest cover. The figure given here equates to the total production PFE.*

Eggleston et al. (2006) estimated it at 2503 MtC and FAO (2010) estimated it at 663 MtC. In 2009 in collaboration with Intercooperation, IUCN-Netherlands and GTZ the Government of the Philippines initiated a national process to develop a bottom-up, participatory, mulit-stakeholder REDD+ strategy with an emphasis on community-based approaches. The Philippines is a participant in UN-REDD and the REDD+ Partnership.

The Philippines REDD process is designed as a mechanism for consultation with strong civil-society participation with the aim of preventing further deforestation and forest degradation; increasing carbon stocks; delivering co-benefits such as biodiversity conservation, ecological restoration and equitable benefit-sharing; and addressing progressive pro-community land-tenure and forest management policies. The country has a relatively high potential for the enhancement of carbon sinks (Table 6).

Forest for protection

Soil and water. The Philippines has 126 watershed forest reserves covering an area of 1.50 million hectares, of which 87 are managed under the NIPAS Act. Although these reserves are principally protected and managed for soil and water conservation, most do not have management plans. The government has commenced a process to prioritize watersheds for integrated land-use planning purposes in conjunction with the delineation of forest boundaries, and DENR has provided detailed guidelines on the preparation of integrated watershed management plans through Memorandum Circular 2008–05 (22 October 2008). The watershed and ecosystem management framework prescribed by government will be used principally to strengthen the co-management of watersheds by DENR and local government units.

The Revised Forestry Law (Chapter III) and the Philippine Environment Code (Chapter III and Chapter VI) have provisions on watershed and ecosystem management, including procedures for the protection and management of sensitive areas for soil and water conservation. A July 2007 DENR memorandum order mandated the review of all titled properties within protected areas and proclaimed watersheds.

Biological diversity. The Philippines is rich in biodiversity, containing an estimated 38 600 forest-dependent species of mammals, birds, reptiles, amphibians and fish.[a] Thirty-three species of mammal, 57 birds, 28 reptiles, 48 amphibians, one fish, eight arthropods and 31 plants found in forests are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species (IUCN 2011). Thirteen plants are listed in CITES Appendix I and 135 in Appendix II (UNEP-WCMC 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
765–1530	42	+	+++	++	++	+	+++

+++ 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*	1540	1540	-	-	-
2010	**1340**	**1950**	**613****	**1340[a]**	**-**

* *As reported in ITTO (2006).*
** *FAO (2010).*

DENR Administrative Order 2007–01 (22 January 2007) established a national list of threatened Philippine plants and their categories, aligned with CITES appendices. The list includes 99 species that are critically endangered, 187 that are endangered, 176 that are vulnerable, and 64 that are threatened.[a]

Protective measures in production forests. Protective measures and procedures have been prescribed to protect biodiversity and environmental attributes in production forests, focusing on retaining undisturbed areas; protecting rare, threatened and endangered species; protecting features of special biological interest such as nesting sites, seed trees, niches and keystone species; and assessing recent changes on these aspects through inventories, monitoring and assessment programs and comparisons with control areas. The Biological Monitoring System being implemented by DENR's Protected Areas and Wildlife Bureau is used to assess changes in biological diversity in both production forest and protected areas.

Wood production from natural forests is progressively being reduced and efforts are being made to increase the area of planted forest.

Extent of protected areas. As of 2007, 107 protected areas covering about 3.34 million hectares had been proclaimed under the NIPAS Act. According to UNEP-WCMC (2010), 1.95 million hectares of forest are in protected areas that conform to IUCN protected-area categories I–IV. Many of the forests in protected areas are residual forests that were previously part of the production forest estate.

Estimate of the area of forest sustainably managed for protection. Management plans are being formulated for conservation reserves and watershed areas with international assistance. For example, the Global Environment Facility and the World Bank are supporting management and implementation activities in the four priority watershed areas of Sierra Madre: the Angat–Ipo and Dona Remedios Trinidad watersheds, Bicol River Basin, Kanan Watershed and Ligawasan Marsh. The FMB evaluated 14 watershed management plans in 2008.

Insufficient data were available to estimate the area of the protection PFE under SFM (Table 7).

Socioeconomic aspects

Economic aspects. The estimated contribution of the forest sector to GDP was 1.6% in 1975, 0.14% in 1999, 0.05% in 2003 and 0.7% in 2008.[a] FAO (2010) estimated total government revenue from the forest sector in 2005 at 136 million Philippine pesos, while the estimated total government expenditure in the forest sector was 1.98 billion Philippine pesos.

An estimated 21 000 people are employed in the forest products industry (excluding furniture-making), of which about 17 000 are male and 4000 are female. About 630 people are employed in direct forest operations under TLAs or IFMAs. The government sector employs about 22 500 professionally qualified people supporting forestry and about 900 trained forest workers.[a] FAO (2010) estimated that about 910 people were employed in protected-area management in 2005.

Livelihood values. About one-third of the Philippine population lives below the poverty line. About 25 million Filipinos live in uplands, half of them occupying forestlands and dependent on them for subsistence uses and traditional and customary lifestyles. Communities occupying 1.6 million hectares of forestlands under CBFMA tenure are mostly dependent on government assistance and forest-based subsistence activities while awaiting plantation development.[a]

Social relations. The Philippines has been experimenting with people's participation for more than 30 years. CBFM has been given the status of the flagship/banner program of DENR, particularly to address poverty and the lack of economic

development in upland and forest-dwelling communities.

About 12 million Indigenous people representing 110 different ethno-linguistic groups live in various forest, lowland and coastal areas. The Indigenous Peoples Rights Act (1997) recognizes, promotes and protects the following rights of Indigenous peoples: the right to ancestral domains/lands; the right to self-governance and empowerment; the right to social justice and human rights; and the right to cultural integrity. The law provides an enabling legal framework for the participation of Indigenous people in SFM, principally through CBFM and forest protection in their ancestral lands.[a]

Nevertheless, Indigenous and non-Indigenous people in many forest areas have limited means of earning cash and many therefore engage in unregistered logging or rattan extraction. Attempts by DENR to police such activities are often seen as unjust, since corporations or local personalities similarly engaged may be prosecuted less readily. Non-indigenous groups have few legal options for protecting their rights, and those that are available are highly bureaucratic. There are many cases of overlapping land-tenure claims by Indigenous and non-indigenous groups, including in the implementation of the NIPAS (Fey 2007).

Summary

The Philippines has lost a substantial part of its natural forest, and timber production has declined dramatically in the last three decades. Considerable efforts have been made to encourage community forestry on degraded forestland. More than 5000 communities have community-based forest management agreements with the government over nearly 6 million hectares, and there is now also a mechanism for individuals to engage in forest stewardship. However, the extent to which these measures provide secure tenure is contested, and national legislation to bring greater certainty to the forest sector is stalled. Carbon capture and storage has the potential to increase the income that can be earned from forest restoration. In the longer term, this could help to improve the ability of upland areas to provide a range of ecosystem services.

Key points

- The Philippines has an estimated PFE of 6.35 million hectares (compared with 6.51 hectares in 2005), comprising 4.70 million hectares of natural production forest (the same as estimated for 2005), 1.34 million hectares of protection forest (compared with 1.54 million hectares in 2005) and 314 000 hectares of planted forest (compared with 274 000 hectares in 2005).
- At least 79 000 hectares of the production PFE are under SFM. No forest is certified, and no data were available on the area of the protection PFE under SFM.
- In addition to existing mechanisms for community forestry, the federal and local governments are beginning to share the stewardship of forests and forestlands with local people under individual property rights agreements, although to date few such agreements have been issued.
- Resources within the Department of Environment and Natural Resources have been reconfigured to focus on the restoration of ecosystem services and the creation of economic opportunities in upland areas.
- A timber-tracking system is being piloted and there are plans to deploy it nationwide in the hope it will facilitate forest law enforcement.
- The Presidential Task Force on Climate Change was created in 2007 to, among other things, provide mitigation and adaptation measures for reducing the impacts of climate change on the forest sector.
- The Government of the Philippines is strongly engaged in international REDD+ processes. The country has considerable potential for carbon capture and storage through forest restoration and afforestation, if forest governance can be improved.

Endnotes

a Government of the Philippines (2009).

b ITTO estimate.

c Personal communications with R. Umali, 2010. Ricardo Umali is President and CEO, Sustainable Ecosystems International Corp., and worked as a consultant in the preparation of Government of the Philippines (2009).

References and other sources

Cruz, R. & de Luna, C. (2009). Climate change impacts, vulnerabilities and adaptation in the forestry sector. Excerpt from the report Vulnerability and adaptation assessment for the forestry sector (forestry, biodiversity and water resources) as a contribution to the preparation of the second national communication to the UNFCCC.

DENR (undated, website accessed March 2011). Statglance2009 (available at http://forestry.denr.gov.ph/).

Eggleston, H., Buendia, L., Miwa, K., Ngara, T. & Tanabe, T. (eds) (2006). *IPCC Guidelines for National Greenhouse Gas Inventories.* Prepared by the National Greenhouse Gas Inventories Programme. Institute for Global Environmental Strategies, Kamakura, Japan.

FAO (2001). *Yearbook of Forest Products*. FAO, Rome, Italy.

FAO (2010). Global forest resources assessment 2010 country report: Philippines (available at http://www.fao.org/forestry/fra/67090/en/).

Fey, C. (2007). Review of legal frameworks for communitybased natural resource management in selected asian countries (draft). World Agroforestry Centre, Bogor, Indonesia.

FMB (2010, website accessed 2010). 2008 Philippine forestry statistics (available at http://forestry.denr.gov.ph/stat2007.htm). Forest Management Bureau.

Fourteenth Congress of the Republic of the Philippines (undated). Senate SB No 80. Introduced by Senator Loren Legarda (available at http://www.senate.gov.ph/lisdata/41423550!.pdf).

FSC (2010, website accessed December 2010). FSC certification database (searchable database available at http://info.fsc.org/PublicCertificateSearch).

Gibbs, H., Brown, S., Niles, J. & Foley, J. (2007). Monitoring and estimating tropical forest carbon stocks: making REDD a reality. *Environmental Research Letters* 2 (available at http://iopscience.iop.org/1748-9326/2/4/045023/fulltext).

Government of the Philippines (2009). Report of progress toward achieving sustainable forest management in the Philippines. Submission to ITTO by the Forest Management Bureau, Department of Environment and Natural Resources, the Philippines.

ITTO (2003). Achieving the ITTO Objective 2000 and sustainable forest management in the Philippines. Report of the diagnostic mission. Presented at the thirty-fifth session of the International Tropical Timber Council, November 2003. ITTO, Yokohama, Japan.

ITTO (2005). *Revised ITTO Criteria and Indicators for the Sustainable Management of Tropical Forests Including Reporting Format.* ITTO, Yokohama, Japan.

ITTO (2006). *Status of Tropical Forest Management 2005*. ITTO, Yokohama, Japan (available at http://www.itto.int/en/sfm/).

ITTO (2011, website accessed March 2011). Annual Review statistics database (available at http://www.itto.int/annual_review_output/?mode=searchdata).

IUCN (website accessed March 2011). IUCN red list of threatened species (searchable database available at www.redlist.org).

Spalding, M., Kainumu, M. & Collins, L. (2010). *World Atlas of Mangroves.* Earthscan, London, UK.

UNDP (2009). *Human Development Report 2009*. United Nations Development Programme, New York, United States.

UNEP-WCMC (2010). Spatial analysis of forests within protected areas in ITTO countries Data prepared for ITTO.. UNEPWCMC, Cambridge, UK.

UNEP-WCMC (2011, website accessed March 2011). UNEP-WCMC species database: CITES-listed species (searchable database at available at www.cites.org/eng/resources/species.html).

United Nations Population Division (2010, website accessed March 2010). World population prospects: the 2008 revision (searchable database available at http://esa.un.org/unpp/p2k0data.asp).

THAILAND

Forest resources

Thailand is located in the southeastern part of continental Asia, bordered by Myanmar, the Lao People's Democratic Republic, Cambodia and Malaysia. It has a land area of 51.3 million hectares and a population in 2010 of 68.1 million people (United Nations Population Division 2010); it is ranked 87th out of 182 countries in UNDP's Human Development Index (UNDP 2009). Thailand is divided into five regions: Northern, Northeastern, Central, Eastern and Southern, with a total of 76 provinces and 716 districts. Each district is further divided into sub-districts (tambons).[a]

Estimates of forest cover include 15.9 million hectares (Government of Thailand 2009) and 19.0 million hectares (FAO 2010). A change in the methodology used to estimate forest cover led to a significant increase in reported forest cover from 1998 (13.0 million hectares) to 2000 (17.1 million hectares; Government of Thailand 2009).

An analysis of 2008 Landsat data indicated that 55.3% of the Northern region, 32.9% of the Central region, 27.4% of the Southern region, 22% of the Eastern region and 16.5% of the Northeastern region were forested.[a]

Forest types. The forests can be classified as:

- Evergreen forests with three sub-types – tropical rainforests, semi-evergreen forests and hill evergreen forests, dominated by species of the genera *Dipterocarpus*, *Hopea*, *Shorea*, *Lagerstroemia*, *Diospyros*, *Terminalia* and *Artocarpus*.
- Pine forests, mainly of *Pinus merkusii.*
- Mangrove and coastal forests, the main mangrove genera being *Rhizophora*, *Avicennia* and *Bruguiera* and the main beach genera being *Diospyros*, *Lagerstroemia* and *Casuarina.*
- Mixed deciduous forest, the dominant species being *Tectona grandis* (teak), *Xylia kerrii*, *Pterocarpus macrocarpus*, *Dalbergia* spp and *Afzelia xylocarpa.*
- Dry dipterocarp forest (ITTO 2006a).

Mangrove forests containing more than 35 species occur mainly on the country's west coast. While estimates vary it is likely that about half of Thailand's mangroves have been lost since the 1960s. Currently there are an estimated 248 000 hectares (Spalding et al. 2010).

Permanent forest estate. In Thailand the PFE is not deliberately demarcated and reserved, and the area of reported PFE has, therefore, changed over time. In 1991 the reported area of PFE was 23.5 million hectares, much of it already without forest cover. Table 1 presents an estimate of the current PFE based on a review by ITTO (2006b); it comprises 1.9 million hectares of state-owned plantations, an area of semi-natural teak forest categorized here as part of the natural production PFE, and just over ten million hectares of protection forest. Theoretically, forest reserves (see below) should be classified as PFE. Despite their legal status, however, they lack protection and many of them have lost their forest cover; moreover, few have an inventory or a management plan (ITTO 2006b).

Forest ecosystem health

Deforestation and forest degradation. During the 1960s and 1970s, widespread deforestation was caused by timber extraction and clearing for subsistence farming and commercial agriculture. During this time it is estimated that forest cover declined from 60% of the land area to around 25%

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*	13.0–16.8	10 127	0	1870	8260	10 130
2010	**17.2–19.0**	**6140****	**251‡**	**1900†**	**10 000**	**12 160§**

* *As reported in ITTO (2006a).*

** *Calculated using the ratio of forest with greater than 60% forest cover estimated by UNEP-WCMC (2010) (32.3%) and the total natural forest area as estimated by FAO (2010).*

‡ *Semi-natural planted teak forest.*

† *Derived from STCP Engenharia de Projectos Ltda (2009), including eucalypt, pines, acacias and teak plantations. An addition area of 2.1 million hectares is planted with* Hevea brasiliensis *(but is not counted here).*

§ *FAO (2010) estimated the PFE to be 16.4 million hectares.*

(RECOFTC–ASFN 2010). Growing realization of the importance of forests for environmental protection, ecosystem services and livelihoods led to the introduction of a logging ban in 1989 to protect the remaining natural forest. According to FAO (2010), the annual rate of deforestation has been declining for some years, from 0.77% between 1990 and 2000, to 0.11% between 2000 and 2005, to 0.08% between 2005 and 2010. An increase in the area of planted forest, however, masks a continued decline in the natural forest area (ITTO 2006b). Even taking into account planted forest (excluding plantations of *Hevea brasiliensis*), the Government of Thailand (2009) indicated significantly greater deforestation, from 17 million hectares in 2000 to 15.9 million hectares in 2006, an average annual rate of 1.1%. Many of the remaining native forests have been over-exploited and are now seriously deficient in growing stock and biodiversity[a], although there are about 6.7 million hectares of primary forest (Table 2).

The estimated annual average area of forest affected by fire in the period 2003–07 was 21 000 hectares, which was dramatically less than the 350 000 hectares per year reported for the period 1998–2002 (FAO 2010). Forests are also subject to a range of other disturbances, including those caused by encroachment for agriculture, refugees from neighbouring countries seeking living space, the development of infrastructure, and illegal logging (ITTO 2006a).

Vulnerability of forests to climate change. Thailand's weather is greatly influenced by monsoons that produce three seasons in the north and two seasons in the southern peninsular region. As with other countries in the region, Thailand is at risk from sea-level rise, higher temperatures, more frequent droughts, and changes in rainfall patterns that are likely to affect agriculture and cause increased flooding. Data from Thailand's Meteorological Department show that average temperatures have increased steadily in the last 40 years and rains have been arriving later. The agricultural sector, which employs 49% of the population and contributes 10% of GDP, is most at risk. Extreme climatic events, including floods, are likely to become more frequent and/or severe with future climate change (IPCC 2001). Thailand completed a first draft of its National Climate Change Master Plan (2010–2019) in early 2009. As of mid 2010 this was still under review by stakeholders.

Table 2 Forest condition

	PFE	Non-PFE	Total
	'000 ha		
Area of primary forest	-	-	6726
Area of degraded primary forest	-	-	-
Area of secondary forest	-	-	8728*
Area of degraded forest land	-	-	-

* *'Other naturally regenerated forest'.*

Source: FAO (2010).

SFM policy framework

Forest tenure. Forests in Thailand are owned by the state, except for planted forests established on private lands. FAO (2010) estimated that 2.2 million hectares of forests were owned by private firms or individuals and the remainder was owned by the state (Table 3). About 250 000 hectares of forests are reserved for Indigenous and local communities (RRI 2009).

Thailand has 1221 national forest reserves covering an area of 23.4 million hectares (nearly half of the country's total land area), although large parts of these reserves are no longer forested. The largest share (11.2 million hectares) of the national forest reserves are in the Northern Region. About 20% of the country's 56 000 villages are located within national forest reserves (ITTO 2006b).

The government has issued various types of tenure rights for people living in national forest reserves. The establishment of community forests is currently permitted in national forest reserves under formal management by the Royal Forest Department (RFD) and in other forests which are not yet occupied or developed for use (RECOFTC–ASFN 2010). Local communities have no formal use rights in protected areas, although they are allowed to collect some basic forest products such as dry fuelwood and NTFPs for household use, with permission from the Department of National Parks, Wildlife and Plant Conservation (DNP).

Criteria and indicators. Although Thailand does not have an official C&I framework for monitoring, assessment and reporting on SFM in natural forests, it has prepared a set of C&I for the sustainable management of planted forests and also benefited from an ITTO C&I training workshop in 2009. The Thai Industrial Standard Institute (TISI), a government agency that has responsibility for the preparation, adoption and application of standards, has prepared two draft proposals, Sustainable Forest management System: Guidelines for Sustainable Forest Management System Auditing (TIS 1406Y), and Sustainable Forest Management System: Guidelines on Competence of Sustainable Forest Management System Auditors (TIS 1406X), to be approved by the relevant Thai authorities. The submission to ITTO for this report was not in the ITTO C&I reporting format.

Forest policy and legislation. The 1997 Constitution recognizes the right and duty of traditional and other local communities to participate in natural resource management, and the right of the Thai people to participate in national policy formulation regarding resources and environmental development and conservation. A process of drafting a Community Forest Bill to provide a legal framework for community forestry began in 1991, but it has been hampered by a lack of consensus on key issues, in particular whether community forestry should be permitted in protected areas. The Bill was passed by the National Legislative Assembly in November 2007 but it has since been challenged in the Constitutional Court.

Thai forestry is regulated by a number of legislative instruments, including the Forest Control Act (1941), the National Park Act (1961), the National Reserved Forest Act (1964), the Wild Animal Reservation and Protection Act (1992), the Forest Plantation Act (1992) and the Reforestation Act (1992). Overall more than 20 laws and a number of Cabinet decisions are relevant to forest management (ITTO 2006b).

The 1941 national forest policy focused on timber production and dealt solely with the management

Table 3 Forest area, by tenure

Ownership category	Total area	Of which PFE	Notes
	'000 ha		
State ownership (national, state or provincial government)	16 700	12 200	250 000 hectares reserved for Indigenous and local communities, mainly in the Northern Region.
Other public entities (e.g. municipalities, villages)	0	0	
Total public	**16 700**	**12 200**	
Owned by local communities and/or Indigenous groups	0	0	
Privately owned by individuals, firms, other corporate	2200	0	.

Source: FAO (2010).

of plantations and logging concessions in natural forests. The 1985 forest policy sought to establish the long-term coordinated management of forest resources, envisaging increasing the area of forest to 40% of the land area (15% for conservation and 25% for production).

With the imposition of a logging ban in 1989 the focus of forestry moved strongly towards conservation. The First Policy and Prospective Plan for the Enhancement and Conservation of National Environmental Quality (1997–2016) included guidelines for institutional reforms for the management of community forests, water, biodiversity and watershed protection, and the participation of people and communities. The forest-cover target was set as 50% (30% for conservation and 20% for production) (ITTO 2006b).

References to the forest sector in the country's 9th National Economic and Social Development Plan (2002–06) were general and provided insufficient guidance to government and stakeholders on the development of the forest sector (ITTO 2006b). The 10th plan (2007–2011), however, contains several specific targets to 'conserve natural resources and biodiversity', including:

- Maintaining forest at not less than 33% of the total land area, including conservation forest at no less than 18% of the total land area.
- Restoring 2.9 million rai (464 000 hectares) of conserved forest.
- Developing a GIS database and a 1:4000 information map to be used together with local participation in identifying reserved forest boundaries.
- Promoting community rights and participation in resource management, including through measures that would promote communities as strong social network bases for natural resource recovery and management.

Institutions involved in forests. The RFD was established in 1896 as the sole agency for the administration and management of forest resources. As a result, the ownership and control of all forests were transferred from feudal chiefs to the government. In 2002 the RFD was divided into three departments: the RFD, the DNP and the Department of Marine and Coastal Resources (DMC). All three are under the supervision of the Ministry of Natural Resources and Environment. The RFD is responsible for forests outside protected areas (protected areas are the DNP's responsibility). The DMC is responsible for the management of coastal flora and fauna, including mangrove forests, and the Forest Industry Organization is responsible for government-owned plantations (Government of Thailand 2009). The total staff employed in public forest institutions in 2007 was 2329 (FAO 2010). The DNP and RFD have regional offices, which are responsible for all forest-related activities. These liaise with the superintendents of national parks and wildlife sanctuaries as well as with provincial and local authorities, such as Tambon administrations. Technical extension assistance to forest farmers is provided by specialized departments and the regional offices (Government of Thailand 2009).

The Forest Industry Organization was established in 1956 to oversee the industrial use of Thai forests. It has evolved into a diversified organization operating in resource management, industrial timber-processing and marketing, tourism, conservation and social development. The organization lacks a clear long-term vision and strategy about its future role (ITTO 2006b).

Some community forest organizations have built regional networks. For example, the Northern Farmer's Network is active across several northern sub-watersheds (Government of Thailand 2009). The Indigenous Knowledge and Peoples Network is a regional network of Indigenous communities throughout mainland Southeast Asia with the aim of protecting, promoting and enhancing the practice of Indigenous landscape and forest management.

Mutual suspicion between NGOs and forest-related public agencies has been diminishing, partly as a result of the opening-up of policy processes to broader participation, and there is an appreciation among most parties of the need to cooperate. However, government policies still tend to be opaque and access to information still needs to be improved. From the government's perspective, the fragmentation of the NGO community makes dealing with them somewhat cumbersome (ITTO 2006b).

Research in forestry is scattered. The RFD Research Division was divided into two when the DNP was established and there is no central body for forestry research, which has resulted in some

overlap and a lack of coordination. Many actors including universities and the private sector are conducting forestry-related research on specific issues of immediate interest to them. The Forest Restoration Research Unit[1] conducts participatory forest restoration research and capacity-building in northern Thailand.

Status of forest management

Forest for production

Prior to 1989, Thailand approached natural forest management on the basis of forest management (working) plans. General management guidelines prescribed that deciduous teak forest should be managed under a 30-year felling cycle. The dry dipterocarp forest was to be managed under the modified 'coppice' and 'coppice with standards' systems, based on a 20-year rotation. For the tropical evergreen forest, the management system adopted was similar to the selection cutting system prescribed for the deciduous teak forest, based on a 30-year felling cycle.

In the period 1960–1988, timber harvesting was carried out through more than 500 timber concessions covering about half the country; under this system the forests were over-harvested and residual stands were badly damaged. In 1989, after disastrous flash floods in 1988 in Nakomsithammarat Province, the government banned logging in natural forests, cancelled all concessions and abandoned the working-plan system (ITTO 2006a).

Despite the logging ban, however, the forests remained accessible and forest clearance and encroachment became widespread. In 1995 it was estimated that about 10 million people were living on state forest lands; these lands were subsequently allotted to the squatters (Nalampoon 2002). In 1996, the Government of Thailand revoked all logging licences in mangrove forests to reduce their destruction. Today, there is no official logging in natural forest.

National efforts by the DNP and the RFD to combat forest loss and degradation have focused on encouraging local community and forest-dwellers to participate in conservation and forest restoration projects as well as on strengthening law enforcement and public-awareness campaigns. In the Tenasserim Biodiversity Corridor in the provinces of Ratchaburi and Kanchanaburi, a pilot REDD initiative is testing the use of participatory governance structures and mechanisms such as a community revolving fund to enable communities to manage forests and undertake livelihood activities (Government of Thailand 2009).

The most critical constraints impeding progress towards SFM in Thailand are bottlenecks in the regulatory framework; a lack of coherence between public policies; widely varying perceptions among stakeholders about how Thailand's forests should be conserved and managed; a lack of coherent support for communities and the private sector to manage forest resources; institutional uncertainty related to the administration of public forests; deficient information systems; and a lack of systematic strategies for human-resource development and extension (including processing industries) (ITTO 2006b). Effective land-use and land-tenure arrangements are needed in places where forest-dwellers and ethnic minorities claim ancestral land that is now in protected areas (Government of Thailand 2009).

ITTO (2006b) found many gaps and weaknesses in the management of Thailand's forests but formed the view that corrective actions could address many of these, stating that Thailand had accumulated "a wealth of knowledge and well-trained professional human resources, on which basis further progress towards the SFM goal can be made". ITTO has since funded a project to establish a national forest resources monitoring information system to provide change and trend data on timber and non-timber forest resources.

Silviculture and species selection. Various silvicultural systems, such as selection, shelterwood, coppice with standards and modified coppice, have been attempted in Thailand. Thailand has never had a systematically applied, long-term silvicultural management system, however, despite successful experiences in neighbouring countries, particularly Myanmar, with similar forest types. Moreover, the logging ban, in place since 1989, impedes silvicultural improvement in national forest reserves because treatment to liberate trees would involve harvesting (ITTO 2006b).

Another factor inhibiting silviculture is a lack of national-level forest inventories. Prior to the logging

1 www.forru.org.

ban, inventories were regional or local in scale and only data on teak were collected (ibid.). As part of moves to participate in REDD, Thailand recently commenced a preliminary mapping of tree volume involving a 'panel' approach for plot measurement whereby one-fifth of plots are re-measured each year. The sampling design comprises a single systematic sample of points on a 20 km x 20 km uniform grid, covering Thailand's entire land mass (there are a total of 1287 monitoring points, of which 425 are in forests). Data from sample plots are expected to provide valuable input for updating information on forest cover and deforestation (Government of Thailand 2009).

Prior to the logging ban, the five most important species in the timber market were *Dipterocarpus alatus* (29%), *Shorea obtusa* (12%), teak (8%), *Hopea* spp (8%) and *Xylia kerrii* (5%) (ITTO 2006a). Now, plantation species have taken the place of all but teak (Table 4), which is largely derived from 'semi-natural' forest.

Planted forest and trees outside the forest. The total extent of planted forest, including *Hevea brasiliensis* (rubber), was estimated by FAO (2010) at 3.99 million hectares and by ITTO (2009) at 4.88 million hectares; not all of this is in the PFE (as shown in Table 1). In 2005 the estimated annual rate of reforestation and afforestation was 27 300 hectares. Species planted include teak (see below), *Eucalyptus* spp, *Acacia mangium* and other *Acacia* spp, other broadleaved species, *Pinus merkusii* and other *Pinus* spp, and other conifers (ITTO 2006a). The most important plantation species for the timber industry is rubber; the country's large estate of this species (estimated by FAO 2010 to be 2.1 million hectares), planted originally for its latex, is increasingly being harvested for timber. Timber from agroforestry plots, home gardens, avenue trees and farm trees is also increasing in importance.

The RFD began planting teak in 1906 on an area of less than one hectare. By 1980, the annual area

Planted managed teak forest, Thailand.

planted was about 160 000 hectares, under the *taungya* system. The state enterprises (the Forest Industry Organization and the Thai Plywood Factory) also established teak plantations to feed the industry. In 1992 the government passed the Forest Plantation Act, allowing the private sector to establish plantations on degraded forest land. In 1994 the RFD launched a forest plantation promotion project to encourage and support private landowners and local farmers to establish forest plantations of commercial tree species and to help the country become more self-sufficient in timber.

Forest certification. As of September 2010, forests totalling 19 000 hectares were certified by the FSC (FSC 2010). In Table 5, 11 000 hectares of these are counted as natural forest (being semi-natural teak forests) and 8000 hectares are counted as planted forests.

Estimate of the area of forest sustainably managed for production. With logging activities banned in the natural-forest PFE, there is no natural forest area sustainably managed for timber production. However, semi-natural planted teak forest in which timber production is possible may be considered as natural forest. According to the Government of Thailand, 251 000 hectares of semi-natural forest are subject to management plans[a], in sharp contrast to the 16.4 million hectares

Table 4 Commonly harvested species for industrial roundwood

Species	Notes
Hevea brasiliensis (rubberwood)*	Used in furniture manufacturing.
Tectona grandis (teak)*	Expensive cabinet wood.
Eucalyptus spp*	Cheaper utility wood, pulpwood, cellulosic biofuel.
Acacia spp*	Cheaper utility wood.
Pinus spp*	Construction timber and utility wood.

* *Also listed in ITTO (2006). In the case of* Pinus *spp,* Pinus merkusii *was listed in ITTO (2006).*

Source: Government of Thailand (2010) and personal communications (see endnote b).

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*	0	-	-	-	-	1870	250	1
2010	**251****	**251**	**251**	**11**	**11**	**1900**	**8‡**	**8**

* *As reported in ITTO (2006a).*
** *State-owned semi-natural teak forest.*
‡ *May include forest not in the PFE.*

estimated by FAO (2010) (an area that is more than 4 million hectares greater than the total estimated PFE). The two estimates are difficult to reconcile, but in the absence of further information on the extent to which such management plans are current, the smaller estimate has been applied in Table 5 (the semi-natural forests being treated as natural). The 11 000 hectares of certified semi-natural forest is included in the total.

Timber production and trade. Each year more than 40 million tonnes of wood is produced and consumed in the form of fuelwood and charcoal[a] (although FAO 2010 reported a total woodfuel harvest of only 7000 m^3). The two main sources of industrial wood are eucalypt plantations and rubber plantations; estimated annual production in 2009 was 5.1 million m^3, the same as reported for 2005–2008 (ITTO 2011). No estimates were available of the volume of timber harvested illegally.

Thailand exported 1.62 million m^3 of sawnwood in 2009 (ITTO 2011), and the total value of wood-product exports – including paper products, fibreboard and wooden furniture – in that year was 100 000 million baht (about US$3.2 billion at 2010 exchange rates).[a]

Thailand is a net importer of primary timber products. In 2009 it imported 272 000 m^3 of industrial logs (down from 468 000 m^3 in 2004), 1.69 million m^3 of sawnwood (1.84 million m^3 in 2004) and 217 000 m^3 of plywood (ITTO 2011). In 2009 the total value of primary timber product imports was about US$376 million. By comparison, total primary timber-product exports were worth US$307 million (ibid.).

Non-timber forest products. At least five million people are thought to be critically dependent on NTFPs, which provide material needs, cash income and employment at levels which are significant to the rural and national economies (ITTO 2006b).

Thailand has twelve genera and about 60 species of bamboo. The most recent survey, in 1998, showed that bamboo covered a total area of 800 000 hectares. On the basis of an average annual yield of 0.1 tonnes per hectare green weight and assuming that this area has been maintained, Thailand's potential annual production of bamboo from natural sources is about 500 000 tonnes. Bamboo is used extensively as a substitute for timber in construction, scaffolding, ladders, bridges, fences and pulp-making. The unregulated removal of bamboo from forests has created a shortage, however, which is a serious constraint for artisans and small and medium-sized enterprises. Shortages of rattan – another important NTFP in Thailand used in furniture manufacture and also as a food – in natural forests have prompted the establishment of plantations: by 2006 nearly 5000 hectares of rattan plantation had been established on state lands (ibid.).

Lac is the resinous secretion of several species of insect (the most common species being *Laccifer lacca*) used as a varnish and dye. Thailand is the second-largest lac-producing country after India. Lac is collected from the branches of numerous tree species (on which it has been secreted) in the natural forests of Thailand's Northern and Northeast regions (the Northern Region accounts for 80–90% of total production) (ibid.).

The national parks system is of growing importance to Thailand's ecotourism industry. With most parks easily accessible by road, there exists excellent potential to expand the number of visitors who use them. There is particular potential for nature-based tourism in northeastern Thailand. National parks close to the Mekong River include sites of prehistoric, archaeological and natural significance. As the Mekong region increases in its exposure and popularity, the number of visitors to these parks is

expected to experience. Ecotourism projects have been attempted since the late 1990s in several of Thailand's national parks and wildlife sanctuaries, with varying success.

Forest carbon. Thailand has an approved Strategic Plan on Climate Change (2008–2012), which emphasizes land use and forests. Gibbs et al. (2007) estimated national-level forest biomass carbon stock at 1346–2215 MtC, and FAO (2010) estimated the carbon content in the living forest biomass at 880 MtC. The Government of Thailand prepared a readiness idea note for the Forest Carbon Partnership Facility and joined the REDD+ Partnership in 2010. A pilot REDD project is being implemented in the Tenasserim Biodiversity Corridor. This project, which started in 2006, covers the largest contiguous stretch of primary forest in Thailand; it is an internationally recognized site for biodiversity and a global priority area for tiger conservation, and it also contains considerable stocks of carbon. However, REDD+ is a controversial issue in Thai society because questions concerning the access of Indigenous people to protected forest lands have not yet been resolved (RECOFTC–ASFN 2010). In order to make broad progress on REDD+ it will be necessary to address Indigenous rights and community forestry and to ensure that local people receive adequate benefits from forest protection efforts.

Forest for protection

Soil and water. The forest area managed primarily for the protection of soil and water is estimated at about 1.33 million hectares (FAO 2010).

Biological diversity. Thailand is endowed with about 7% of the world's known flora and fauna. There are an estimated 12 000 vascular plant species, including 1140 orchid species, and 2145 non-vascular plant species. Thailand also has an estimated 4600 species of vertebrates and 83 000 invertebrates (Chen et al. 2011).

Fifty mammals, 30 birds, four amphibians, four arthropods and seven plants found in forests are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species (IUCN 2011). Fifteen plant species are listed in CITES Appendix I, 232 in Appendix II and one in Appendix III (UNEP-WCMC 2011).

Protective measures in production forests. As there is no timber production in natural forests, all natural forests are considered to be protection forests, although many are still harvested for NTFPs for local consumption.

Extent of protected areas. An estimated 8.85 million hectares of forest is designated for the conservation of biodiversity in Thailand, another 130 000 hectares are designated for 'social services' and a total of 9.43 million hectares of forest is within protected areas (FAO 2010). Thailand has set a target of 25% of the country's total land area in protected areas; in 2006 the coverage was about 20%. The protected-area network comprises 227 declared protected areas (covering 11.3 million hectares, not all of it forest) under the control of the DNP. Although extensive, the protected-area network contain disproportionate amounts of upland forest and very little lowland evergreen forest; nevertheless it is considered to be one of the best in Southeast Asia (ITTO 2006b). UNEP-WCMC (2010) estimated that about 10.2 million hectares of forest were in protected areas that conformed to IUCN protected-area categories I–IV, including 553 000 hectares with 10–30% canopy cover, 2.16 million hectares with 30–60% canopy cover and 7.43 million hectares with >60% canopy cover.

Protected-area advisory committees have been established to assist in the management of protected areas. These are multi-stakeholder bodies, the membership of which includes ethnic minorities, forest dwellers and women. They are working effectively in many protected areas, while others need strengthening (Government of Thailand 2009).

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
1346–2215	32	++	+++	+	+	++	+

+++ 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).

Estimate of the area of forest sustainably managed for protection. Data on the status of management in a large part of the protection PFE are unavailable. Of the total 103 gazetted national parks, the government had prepared master plans for 55 by 2006 (ITTO 2006b). Valid management plans existed for only 15 gazetted parks; another 45 areas had been proclaimed but not yet gazetted. Of the 55 wildlife sanctuaries, only 25 had management plans under preparation. Management plans have not necessarily led to improved protection as they have often lacked implementation (ibid.).

ITTO is providing support for the management of the Pha Taem Protected Forests Complex in northeastern Thailand as part of a wider transboundary biodiversity conservation area between Thailand, Cambodia and Laos. The project extends over an area of 174 000 hectares in Thailand and includes four protected areas and a fifth proposed protected area. ITTO (2006a) included this area in its estimate of sustainably managed protection forest. However, significant deforestation was observed in the Complex between 2002 and 2008 (from 66% cover to 62% cover), mostly in two of the protected areas and the proposed protected area (Trisurat & Gasana 2010). Recent conflict between Thailand and Cambodia in this area has affected project implementation. Therefore, the forests of only two of the protected areas, the Pha Taem National Park (approximately 31 800 hectares of forest) and the Yot Dom Wildlife Sanctuary (approximately 22 400 hectares of forest), are included in the estimate given in Table 7.

Another ITTO project supports the development of the buffer zone of the 348 000-hectare Kaeng Krachan National Park using participatory approaches. The approach to the management of this park is evolving towards a more participatory model (Suwanmanee 2009) and is thought to be consistent with sustainability.

Socioeconomic aspects

Economic aspects. The cessation of commercial harvesting in natural forests had reduced the contribution of forestry to GDP to about 0.1% by 2005 (ITTO 2006b). However, the wood-processing sector has increased production in recent years using timber obtained mostly from plantations, non-forest sources and imports, and the sector's contribution to GDP, therefore, is probably growing. Tourism is the country's primary source of foreign exchange and protected forests are a significant attraction. The government collected 45.7 million baht in forest-related revenue in 2007 (down from 131 million baht in 2002), including licence fees, forest improvement fees and royalties from timber harvesting (FAO 2010).

Livelihood values. Due to the logging ban, villagers are not allowed to fell or harvest any kind of living trees from natural forests for household or commercial purposes, although they have usufruct rights to NTFPs. They may, however, harvest plantation forests for timber and fuelwood, although a permit is required for teak and other 'reserved' species.

Forests have always been integral to rural life in Thailand and they play important social, economic and cultural roles. An estimated 1.2–2.0 million people live in and around protected areas (national parks and wildlife sanctuaries) and rely on forests for livelihoods. Another 20–25 million people live in or near national forest reserves and collect forest products from them, both for household consumption and to sell in markets for cash (ITTO 2006b).

Social relations. In Thailand, mistrust between authorities and communities has constrained implementation of community forestry as a key strategy for improving forest management (FAO 2009). The Community Forest Bill was expected to help community forestry to gain new prominence in Thailand and to resolve conflicts

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*	8260	5450	9320	-	522
2010	**10 000**	**10 200****	**1330**	**402**	**402‡**

* *As reported in ITTO (2006a).*
** *UNEP-WCMC (2010).*
‡ *Comprises the Pha Taem National Park, the Yot Dom Wildlife Sanctuary and the Kaeng Krachan National Park.*

between the national forestry administration and local communities, but activists are challenging it in the Constitutional Court (Government of Thailand 2009). It has been criticized for its potential to negatively affect more than 20 000 communities, which could be prevented from accessing and/or managing their current community forests because they are located within previously designated protected areas (Weatherby & Soonthornwong undated).

Despite various government policies aimed at encouraging it, less than 1% of the forest estate has been brought under community management. Key issues and constraints facing community forestry development include the following (ITTO 2006b):

- Authorities and many vocal NGOs have little trust or confidence in local communities as custodians of forests and fear that community forestry will contribute to further degradation of the remaining forests.
- The number of illegal immigrants is growing, especially in protected areas bordering Myanmar, Laos and Cambodia: it is feared that community forestry would give illegal immigrants use rights to forests and serve as a means for the immigrants to obtain Thai citizenship.
- Individual land-grant programs are transferring land to individual households in both protected areas and national forest reserves, possibly in areas that would otherwise be assigned as community forests.
- From the perspective of many villagers, who already have usufruct rights to forests, a formally registered community forest would appear to bring no additional direct benefits to them but, rather, would bring more responsibilities for forest protection and management.
- The lack of an appropriate regulatory framework has resulted in confusion about what can and cannot be done in a community forest, often contributing to frustration among, and frictions between, concerned parties. Field forestry staff often have to take personal risks to promote community forestry as later it may be determined that such activities were illegal.
- There is an inadequate framework for community forestry, including a lack of policy goals corresponding to local realities regarding environmental degradation, inappropriate resource use, the imbalance between the demand and supply of forest products, the longstanding ban on logging, and uncertainties in the use of plantations.

The Government of Thailand has officially recognized ten ethnic minority groups known as 'hill tribes', concentrated in 20 provinces in the northern regions of Thailand. Increasing pressure on land and in-migration, especially in the north, has led to the need for measures to protect watersheds and forests in those provinces. The success of such measures, including through REDD initiatives, will primarily depend on the active participation of the hill tribes, and their input is needed to improve REDD planning and implementation (Government of Thailand 2009).

Summary

Logging in natural forests has been banned since 1989 in Thailand, but the forests remain under pressure from encroachment, illegal logging, fire and other agents. The Community Forestry Bill, which was first drafted in the early 1990s, finally passed into law in 2007 but its implementation has been held up by a legal challenge. It has been criticized on the basis that it could prevent some communities from accessing existing community forests because they are inside protected areas. The country's 10th National Economic and Social Development Plan (2007–2011) contains several targets for the conservation of natural resources. The regulatory framework for community forestry is unclear, and there is a lack of trust between forest authorities and forest communities. Plantations (especially of rubberwood) and imports are supplying the country's thriving downstream-processing timber industry. National parks are of growing importance to Thailand's economically important tourism industry.

Key points

- Thailand has an estimated PFE of 12.2 million hectares (compared with 10.1 million hectares in 2005), comprising 251 000 hectares of semi-natural teak planted forest, 10.0 million hectares of natural protection forest (compared with 8.26 million hectares in 2005) and 1.90 million hectares of planted forest (compared with 1.87 million hectares in 2005).

- An estimated 11 000 hectares of semi-natural teak planted forest, and 402 000 hectares of the protection PFE, are under SFM.
- The Community Forestry Bill, which has finally passed into law, is under legal challenge.

Endnotes

a Government of Thailand (2010).

b Input by participants at the ITTO Workshop on Criteria and Indicators for the Management of Tropical Forests held in Chiang Mai, Thailand on 26–29 May 2009.

References and other sources

FAO (2009). Thailand Forestry Outlook Study. Asia-Pacific forestry sector outlook study II. Working Paper Series, Working paper No APFSOS II/WP/2009/22. FAO, Bangkok, Thailand.

FAO (2010). Global forest resources assessment 2010 country report: Thailand (available at http://www.fao.org/forestry/fra/67090/en/).

FSC (2010, website accessed September 2010). FSC certification database (searchable database available at http://info.fsc.org/PublicCertificateSearch).

Gibbs, H., Brown, S., Niles, J. & Foley, J. (2007). Monitoring and estimating tropical forest carbon stocks: making REDD a reality. *Environmental Research Letters* 2 (available at http://iopscience.iop.org/1748-9326/2/4/045023/fulltext).

Government of Thailand (2009). R-PIN submission. Revised submission 16 Feb 2009.

Government of Thailand (2010). Report of progress toward achieving sustainable forest management in Thailand. Submission to ITTO, Bangkok, Thailand.

Chen, H.K., Hewitt, J., Thang, H.C. & Agung Prasetyo, F. (2011). Scoping baseline information on timber trade and governance for Insular Southeast Asia Region (Brunei Darussalam, Indonesia, Malaysia, Philippines, Singapore) and Timor-Leste. FLEGT Asia Regional Programme, 26 February 2011 (Final Draft).

IPCC (2001). *Climate Change 2001: The Scientific Basis. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press, Cambridge, UK.

ITTO (2006a). *Status of Tropical Forest Management 2005*. ITTO, Yokohama, Japan (available at http://www.itto.int/en/sfm/).

ITTO (2006b). Achieving the ITTO Objective 2000 and sustainable forest management in Thailand. Report of the diagnostic mission. ITTC(XLI)/6. ITTO, Yokohama, Japan.

ITTO (2011, website accessed March 2011). Annual Review statistics database (available at http://www.itto.int/annual_review_output/?mode=searchdata).

IUCN (2011, website accessed March 2011). IUCN red list of threatened species (searchable database available at www.redlist.org).

Nalampoon, A. (2002). Thailand national forest policy review. Country report presented at the 19th session of the Asia-Pacific Forestry Commission, Ulaanbaatar, Mongolia, 28–30 August 2002.

RECOFTC–ASFN (2010, in prep.). Social forestry programs to support climate change mitigation and adaptation schemes in ASEAN countries: an overview. Centre for Peoples and Forest–ASEAN Social Forestry Network. Swiss Development Cooperation and ASEAN. December 2010.

RRI (2009). Who Owns the Forests of Asia? An Introduction to the Forest Tenure Transition in Asia, 2002–2008. Rights and Resources Initiative, Washington, DC, United States.

Spalding, M., Kainumu, M. & Collins, L. (2010). *World Atlas of Mangroves*. Earthscan, London, UK.

STCP Engenharia de Projetos Ltda (2009). Encouraging Industrial Forest Plantations in the Tropics: Report of a Global Study. ITTO Technical Series 33. ITTO, Yokohama, Japan.

Suwanmanee, A. (2009). Natural resource management policy implementation at the local level: tensions and contradictions in and around a Thai national park. Doctorate of Philosophy thesis, School of Earth and Environmental Science, Faculty of Science, University of Wollongong. Wollongong, Australia.

Trisurat, Y. & Gasana, J. (2010). Consequences of land-use change on transboundary biodiversity conservation: Emerald Triangle Protected Forests Complex: Thailand, Cambodia and Laos. Presentation at the International Conference on Biodiversity Conservation in Transboundary Tropical Forests. Quito, Ecuador, 21–24 July 2010.

UNDP (2009). *Human Development Report 2009*. United Nations Development Programme, New York, United States.

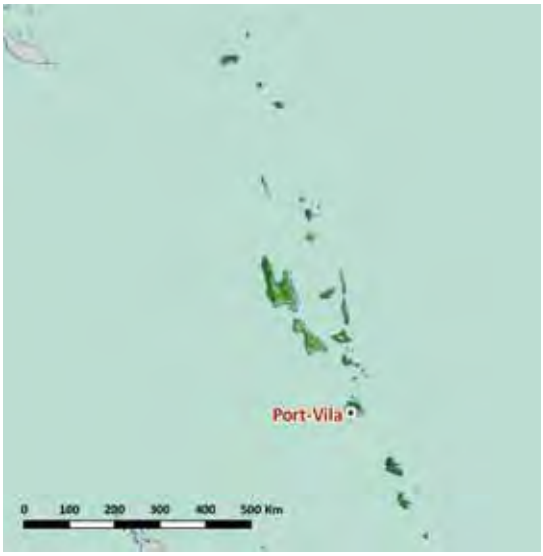
UNEP–WCMC (2010). Spatial analysis of forests within protected areas in ITTO countries. Data prepared for ITTO. UNEP–WCMC, Cambridge, UK.

UNEP-WCMC (2011, website accessed March 2011). UNEP-WCMC species database: CITES-listed species (searchable database at available at www.cites.org/eng/resources/species.html).

United Nations Population Division (2010, website accessed September 2010). World population prospects: the 2008 revision (searchable database available at http://esa.un.org/unpp/p2k0data.asp).

Weatherby, M. & Soonthornwong S. (undated). The Thailand community forest bill (available at http://www.rightsandresources.org/blog.php?id=34).

VANUATU



Forest resources

Vanuatu is an archipelago of volcanic islands and submarine volcanoes extending some 1300 km from north to south in the western Pacific Ocean. It comprises over 80 islands and has a total land area of 1.23 million hectares. The two largest islands, Espiritu Santo and Malekula, comprise nearly 50% of the total land mass. Vanuatu had a population in 2010 of about 246 000 people (United Nations Population Division 2010) and is ranked 126th out of 182 countries in UNDP's Human Development Index (UNDP 2009).

Vanuatu is vulnerable to a broad range of natural disasters. Earthquakes are frequent, although they often originate at considerable depth and are therefore not too destructive. The majority of the rural population (about 80% of the total) lives in a subsistence economy. FAO (2010) estimated the area of natural forests at 440 000 hectares (36% of the land area). There are also about 476 000 hectares of 'other wooded land', some of which may qualify as forest under FAO's definition. The estimate of forest and other wooded land in FAO (2010) is based on data from a forest inventory conducted in 1989–92.

Forest types. The aforementioned forest inventory estimated that forests and other wooded land comprised 205 000 hectares of mid-to-high forest, 239 000 hectares of low forest, 434 000 hectares of thickets, 45 000 hectares of scrub and 380 hectares of woodland. Despite its extensive coastline, Vanuatu does not host a large area of mangroves, due in part to the steepness of its shores and continuing volcanic activities; the total area of mangroves is estimated at about 2050 hectares (Spalding et al. 2010). The mid-to-high forest (canopy height in the range of 20–30 m) and low forest (canopy height in the range of 10–20 m) fall under the broad category of tropical evergreen forests, the main species being of the genera *Calophyllum*, *Campnosperma*, *Dillenia*, *Elaeocarpus*, *Endospermum* and *Gmelina*. The common species in the mangrove forests belong to the genera *Rhizophora*, *Avicennia*, *Lumnitzera*, *Sonneratia* and *Xylocarpus* (ITTO 2006).

Permanent forest estate. Vanuatu has no legally defined PFE. Since all land is owned by individuals or clans, a future PFE will need to be negotiated with and agreed by the respective landowners. The estimates given in Table 1 for 2005 represented the area of forest that could possibly comprise a PFE in the future. In this report, however, the production PFE is shown as zero, since there has been no apparent move to create a PFE. The 2005 estimate is repeated for the protection PFE, since this area has been created, at least in part, with the support of landowners.

Forest ecosystem health

Deforestation and forest degradation. Few data are available on the condition of Vanuatu's forests (Table 2). Using data of "unknown accuracy", the Government of Vanuatu (2008) estimated that about 1700 hectares of forest were cleared annually in the period 2000–2005. The drivers and extent of deforestation and forest degradation vary between islands, with most deforestation occurring on the four main islands of Espiritu Santo, Efate, Tanna and Erromango. An estimated 50% of all deforestation is due to subsistence land use.

Vulnerability of forests to climate change. The climate in Vanuatu varies from wet tropical in the northern islands to drier sub-tropical in the southern islands. The climatic-change patterns in temperature and rainfall are similar to those described for PNG. Recent studies have shown, for example, that the annual and seasonal ocean

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*	0.902	442	117	2.10	8.37	127
2010	**0.440**	**394****	**0**	**0**	**8.37**	**8.37**

* *As reported in ITTO (2006).*

** *Calculated using the ratio of forest with greater than 60% forest cover estimated by UNEP-WCMC (2010) (89%) and the estimated total natural forest area.*

Source: ITTO estimate based on ITTO (2006).

surface and island air temperatures in the southern Pacific have increased by 0.6–1 °C since 1910 (Government of PNG 2010). Over the period 1961–2003 there was a significant increase in the annual number of hot days and warm nights in the region. Climate-change projections indicate a warming trend for all small island states in the southern Pacific involving a mean annual increase of 1.98 °C by 2050 and 2.81 °C by 2080 (ibid.).

All island developing states are highly vulnerable to climate change and sea level rise owing partly to their small land masses surrounded by ocean and their location in regions prone to natural disasters. Vanuatu is subject to frequent cyclones. A total of 124 tropical cyclones affected the country between 1939 and 2005 (Government of Vanuatu 2007); on average, a cyclone causes significant forest damage once every five years.

The Government of Vanuatu established the National Advisory Committee on Climate Change as early as 1989. It finalized its NAPA in 2007 (ibid.). The forest sector is listed in the NAPA as a key sector to be addressed for climate-change adaptation, along with agriculture, fisheries, water and tourism. According to the NAPA the forest sector is vulnerable to the effect of climate variability; for example, cyclones regularly open up large gaps in the forest canopy and allow the invasion of the vine *Merremia*, which hinders regeneration. The sector also presents considerable opportunities: Vanuatu possesses excellent soils and a climate that is conducive to timber production. Challenges for the sector, as set out in the NAPA, include the development of an SFM plan, the replanting of logged-over areas, the promotion of commercial tree plantations and the expansion of agroforestry (ibid.).

SFM policy framework

Forest tenure. Under Vanuatu's Constitution, all lands, including forest lands, are vested in the Indigenous people as customary owners (Table 3). Only Indigenous citizens who have acquired their land in accordance with a recognized system of land tenure can own it in perpetuity. Land may be leased for a period of up to 75 years. Under the Land Leases Act, leases are administered by the government on behalf of the customary owners. This allows the government to oversee lease transactions in accordance with Article 79 of the Constitution, which requires government permission before land transactions may occur between Ni-Vanuatu (Indigenous people) and non-Indigenous citizens. Land-tenure disputes among tribal groupings are a common feature of Indigenous land-use planning (Government of Vanuatu 2008).

Criteria and indicators. No submission – either in the ITTO C&I reporting format or otherwise – was received from the Government of Vanuatu for this report.

Table 2 Forest condition

	PFE	Non-PFE	Total
	'000 ha		
Area of primary forest	-	-	-
Area of degraded primary forest	-	-	-
Area of secondary forest	-	-	-
Area of degraded forest land	-	-	-

Table 3 Forest area, by tenure

Ownership category	Total area	Of which PFE
	'000 ha	
State ownership (national, state or provincial government)	0	0
Other public entities (e.g. municipalities, villages)	0	0
Total public	**0**	**0**
Owned by local communities and/or Indigenous groups	440*	0
Privately owned by individuals, firms, other corporate	0	0

* *100% of the total forest area assumed to be under customary ownership.*

Forest policy and legislation. Article 7(d) of Vanuatu's Constitution states that "every person has the fundamental duty to … safeguard the natural wealth, resources and environment in the interest of the present generation and of the future generations".

In 1991 the government instituted its national forest program, an important outcome of which was the draft national forest policy of 1995, which was later issued as the formal Vanuatu National Forest Policy Statement of 1997. During its preparation the views of stakeholder groups, including national and provincial governments, chiefs, community leaders, churches and the forest industry, were sought. Consultative meetings and workshops were held in every province. The national forest policy contains an indicative program of action in all aspects of the management of Vanuatu's forests which, if fully implemented, would lead to a significant improvement in forest management (ITTO 2006). It also makes specific recommendations for the management of forests in the various islands.

In 2010 the Vanuatu Department of Forests (VDF) reportedly undertook a review of the national forest policy with the aim of addressing current and emerging issues such as forest products and trade, SFM and climate change. A draft revised policy was circulated in May 2010, and an endorsement of the new policy by the Vanuatu Council of Ministers was expected by the end of 2010 (Tudrau-Tamani 2010).

The principal forest law is the Forestry Act (2001), which superseded the Forest Act (1982). Other laws that support the implementation of the forest policy include the International Trade (Flora and Fauna) Act (1989), the National Parks Act (1993) and the Timber Rights Guarantees Act (2000). Under the provisions of these acts, several rules and regulations have been issued: e.g. a ban on log exports (1993), a code of logging practice (1996), mobile sawmill regulations (1996) and sandalwood regulations (1997).

Institutions involved in forests. The Ministry of Agriculture, Forestry and Fisheries is responsible for forestry. Within the ministry, the VDF, established in January 1980, is responsible for the management of natural forests through policy development, planning, protection, silvicultural principles and guidelines. It is also responsible for all reforestation, afforestation and small-scale sawmilling. In 2008 there were 19 staff (five of whom were women), including five with university degrees or an equivalent qualification (FAO 2010). This appears to be inadequate for policing adherence to forest-related rules and regulations; the VDF and other departments depend largely on the owners of the resource to come forward to report breaches of the regulations by concessionaires (ITTO 2006). In 2005, total public expenditure on the VDF was 48.5 million Vanuatu vatu and total revenue was 4.9 million Vanuatu vatu (FAO 2010).

The VDF maintains a policy of open cooperation with NGOs and collaborates closely with some programs carried out by them. NGOs such as the Foundation of the People of the South Pacific support and assist in training and extension programs. The Forestry Act (2001) provides a mechanism for wider and more consultative planning in forest management (ITTO 2006).

Status of forest management

Forest for production

Under the system of forest ownership existing in Vanuatu, the role of the government through the VDF is to provide guidance and support to customary owners in planning the use and development of their forest resources. The final decision on how to use the resource is the prerogative of the owners. Guiding regulations include the following:

- Harvesting quotas allocated to each of the four main islands (which are regarded as FMUs), based on estimated AACs.

- Minimum diameter limit set for each timber species.
- Periodic closure of harvesting in sandalwood areas.
- Licensing of operators to help ensure good logging practice.
- Selection logging to be practised.

Even though the importance of long-term forest management plans is emphasized in the Forestry Act (2001), as of 2005 no such plans had been prepared for any of the four main islands or for individual concessions (ITTO 2006). According to the Forestry Act, logging companies are required to prepare and submit a coupe harvesting plan, providing details of all operations, which must be approved by the VDF before logging commences. The national forest inventory estimated that the total forest area suitable for logging in Vanuatu was around 117 000 hectares, about 25% of the total forest resource, and the total forest growing stock was about 13 million m^3. The remainder of the forest was considered unsuitable due to steep slopes, dissected land forms and low sawlog volumes and for cultural reasons. The quality of the natural forest for commercial forestry is low: in over 50 000 hectares of harvestable natural forests, the expected timber yield is about 20 m^3 per hectare and even in the best parts of it the yield will not be more than 30 m^3 per hectare.

A harvesting plan is normally prepared through consultations involving representatives of the provincial government, the VDF, the Department of Environment, the Lands Department, resource owners' representatives and the logging company. The Code of Logging Practice has been developed in consultation with the industry that is designed to foster the application of sustainable forest harvesting to reduce damage, soil disturbance and canopy openings. A lack of monitoring and post-harvest surveying of logging operations means limited information on the quality of harvesting is available. Logging concession agreements are relatively short-term (5–10 years); in 2005, 7200 hectares were allocated for logging under eight separate concessions. The largest concessions were foreign-owned (by operators from Malaysia and New Zealand). The estimated annual sustainable timber yield from the 117 000 hectares of natural forest suitable for logging is 68 000 m^3 (ITTO 2006). In the period 2001–05 about 103 000 m^3 were harvested under a selective logging regime. In 2001–04 the average volume harvested was about 23 900 m^3, but there was a significant (although unexplained) fall in the harvest in 2005, to 7270 m^3 (Government of Vanuatu 2008).

Silviculture and species selection. There are no comprehensive guidelines for the silvicultural management of the production forests, although it is broadly suggested that selective logging with minimum diameter cutting limits be employed. About 20 species are generally recognized as marketable but the timber industry in Vanuatu concentrates on just a few species, mainly for domestic sale. Many species cut elsewhere in the Pacific are not used in Vanuatu. Besides the species listed in Table 4, commonly used species are *Syzygium* spp, *Myristica fatua*, *Elaeocarpus angustifolius*, *Antiaris toxicaria* and *Castanospermum australe*. In addition, *Agathis macrophylla* (kauri) is much sought-after for timber and has been an important export in the past. Easily accessible stands are now exhausted. *Santalum austrocaledonicum* (sandalwood), valued for the essential oil in its heartwood, is a major silvicultural challenge, in particular regarding its regeneration (ITTO 2006).

Table 4 Commonly harvested species for industrial roundwood

Species
Dysoxylum confertiflorum
Pterocarpus indicus (bluwota)
Intsia bijuga (natora)
Calophyllum neo-ebudicum
Endospermum medullosum (whitewood)

Source: ITTO (2006).

Planted forest and trees outside the forest. The area of planted forest in Vanuatu is about 2100 hectares, including about 300 hectares of privately owned *Endospermum medullosum*. The annual planting rate is reported to be 30–40 hectares. Agro-industrial plantations of *Cocos nucifera* (coconut), with an area of 215 000 hectares, are an important non-forest source of wood (ITTO 2006).

Planted forests tend to be established in small woodlots, generally of less than one hectare. *Pinus caribaea* and *Cordia alliodora* are the most important plantation species, and *Swietenia macrophylla* and *Tectona grandis* have been used

recently, together with agroforestry tree species. Currently, there is little logging for commercial purposes in planted forests. Considering the inadequacies of Vanuatu's natural forests for production purposes because of their quality, composition and distribution, planted forests will have to play a much larger role if future timber needs are to be met, but, to date, the sector has been short on planning and effective implementation. The national forest policy suggested an initial target of 20 000 hectares of planted forests by 2020. Trees outside the forest are mainly coconut and fruit trees in home gardens. Trees on farms and cattle ranches are important for meeting local needs for timber.

Forest certification. There have been no moves towards certification in the country.

Estimate of the area of forest sustainably managed for production. In the absence of long-term management plans, post-harvest care or recent information on improvements, production forests in Vanuatu cannot be considered to be managed sustainably (Table 5).

Timber production and trade. Total roundwood production in 2005 was estimated at 137 000 m^3, of which 105 000 m^3 was used as fuelwood (FAO 2010). The production of industrial logs in 2009 was estimated at 30 000 m^3, unchanged since 2002 (ITTO 2011). The 2009 log harvest yielded an estimated 14 000 m^3 of sawnwood, about 2500 m^3 of which was exported (ITTO 2011). Wood-processing units are small and of low technology. The exploitable forest resource is probably too limited and geographically dispersed to encourage the establishment of competitive international-scale mills. There are two significant-sized, fixed-site mills and several smaller mills, plus around 50 portable sawmills. The fixed-site mills generally have some form of wood-preservation treatment facility (ITTO 2006).

Forests protect the Cascades Waterfall, a tourist attraction near Port Vila, Vanuatu. © *istockphoto/H. Mette*

Non-timber forest products. Being the raw material to produce sandalwood oil, sandalwood (*Santalum album*, *S. austrocaledonicum*) is the most important NTFP in Vanuatu. About 70 tonnes were exported in 2000, much of it to Taiwan Province of China, with a total estimated value of 700 000 Australian dollars (Berry 2002, cited in Robson 2004). The estimated sustainable annual yield of sandalwood is 80 tonnes. An oil-extraction facility has recently been constructed for the domestic production of sandalwood oil. Other important NTFPs that are locally processed and exported include sago fruit shells, *Canarium* nuts and *Barringtonia* nuts. Bamboo, palm fibres, medicinal plants and live birds are important locally. Forest recreation is an emerging activity. There is an ecotourism facility in one of the forested protected areas (ITTO 2006).

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*	117	-	0	0	0	2.1	2.1	0
2010	**0**	**0**	**0**	**0**	**0**	**0****	**0**	**0**

* *As reported in ITTO (2006).*

** *2100 hectares of plantations have management plans but are not shown in the table because they are part of a PFE.*

Source: ITTO (2006).

Forest carbon. No forest carbon estimates for Vanuatu are available in the literature. Based on the estimated forest area and assuming the same carbon density found in similar forest ecosystems, the total forest biomass carbon stock could be in the range of 35–60 MtC. Although it appears that there is relatively little deforestation or forest degradation in Vanuatu at present, the pressure on forests could increase in coming years as the supply of roundwood from the Solomon Islands decreases. The Government of Vanuatu submitted a readiness plan idea note to the Forest Carbon Partnership Facility in 2008 and is a member of the REDD+ Partnership. Table 6 shows Vanuatu's current forest carbon potential.

Forest for protection

Soil and water. Much of the natural forest in the mountainous interior plays a primarily protective role. However, some of these forests have been degraded by grazing and, in places, by burning. In some areas, erosion and soil degradation are significant problems. No data are available on the extent or percentage of forest managed primarily for the protection of soil and water, although some areas are reserved for this purpose in coupe harvesting plans (ITTO 2006).

Biological diversity. Vanuatu's forests are relatively species-poor and structurally less complex than the forests of the Solomon Islands and PNG due to the geological youth of the archipelago, its isolation and frequent cyclones. The degree of endemism in the Vanuatu flora is not as great as in neighbouring countries, either; around 15–20% of trees and shrubs are thought to be endemic. Five mammals, six birds, one reptile and one plant found in forests are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species (IUCN 2011). Twenty-six plants are listed in CITES Appendix II (UNEP-WCMC 2011). Vanuatu has national conservation strategies for six commercial tree species (*Endospermum medullosum*, *Agathis macrophylla*, *A. silbae*, *Intsia bijuga*, *Pterocarpus indicus* and *Santalum austrocaledonicum*) (ITTO 2006).

Protective measures in production forests. The Code of Logging Practice has provisions for exclusion zones (e.g. steep slopes, environmentally sensitive and unstable soils and stream buffers), guidelines for establishing infrastructure (e.g. road standards) and operational controls.

Extent of protected areas. ITTO (2006) reported five forest protected areas totalling 8366 hectares. These comprise mid-to-high forest (6349 hectares – 3% of all mid-to-high forest), low forest (1717 hectares – 0.7% of all low forest) and mangrove forest (300 hectares – 12% of all mangroves) (ITTO 2006). According to UNEP-WCMC (2010), no forests are in reserves conforming to IUCN protected-area categories I–IV, but this may be due to the low resolution of UNEP-WCMC data, and the ITTO (2006) estimate is used in Table 7. The boundaries of protected areas are not demarcated on the ground but are mapped using customary land boundaries, which usually use physically prominent features such as trees, coastline, ridges and rivers; they are therefore known to most people living near the area (ITTO 2006). There is limited capacity in the country to implement the National Parks Act for the protection of these areas. Although the system of customary landownership makes it difficult to create new protected areas, more than 50% of existing protected areas were either initiated or supported by landowners and surrounding communities (ITTO 2006).

Estimate of the area of forest sustainably managed for protection. No information on the status of management in protected areas was available for this report (Table 7).

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	Importanceof forest fire/ biomass burning	Engagement in international REDD+ processes
35–60	89	+	++	+	+	+	++

+++ high; ++ medium; + low; biomass forest carbon estimated by ITTO; 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*	8.37	0	-	-	-
2010	**8.37**	**0**	**0**	**0**	**0**

* *As reported in ITTO (2006).*
Source: ITTO (2006), UNEP-WCMC (2010).

Socioeconomic aspects

Economic aspects. Forestry's contribution to GDP was about 7.7% (US$2.84 million) in 2000 (ITTO 2006). In 2007 the contribution of formal forestry and logging to Vanuatu's economy was 102 million Vanuatu vatu, which was 0.5% of GDP (Asian Development Bank 2009). An estimated 500 people are employed directly in the logging sector (ITTO 2006).

Livelihood values. Eighty percent of the population lives in rural areas and almost all people are engaged in some form of small-scale commercial or subsistence forestry activities (Asian Development Bank 2009). In addition to commercial forestry operations, fuelwood, herbal medicines, bush meat, edible nuts, thatch grass, and plants used for ceremonial purposes and the manufacture of musical instruments are all part of the subsistence needs of rural communities (ITTO 2006).

Social relations. The Forestry Act (2001) provides a mechanism for a broad consultative planning process comprising a management committee involving a provincial representative, a representative of the resource owner, and representatives of the VDF, the Environment Department and the Lands Department. The low level of literacy in Vanuatu makes it difficult for forest officers to fully explain forestry issues and terminology to landowners (ITTO 2006).

Summary

Vanuatu faces a number of development constraints, including its vulnerability to natural disasters, its small domestic market, and low existing business capacity. Notwithstanding these constraints, however, there is a strong traditional culture that promotes social stability, and the country has valuable natural resources, including its forests and woodlands. ITTO did not receive a submission from the Government of Vanuatu for this report, and relatively little recent information on the status of forest management was available. No formal PFE has been created in Vanuatu because all forests are under customary ownership. There appears to have been little change in the forest-policy environment since 2005, and no indications of an improvement in the approach to SFM.

Key points

- All lands, including forests, are customarily owned, and there is no formal PFE, although 8370 hectares of protected forests may be considered permanent.
- Production forests are not covered by long-term management plans and therefore cannot be considered sustainably managed. No estimate could be made of the area of protection PFE under SFM.
- The national forest policy contains an indicative program of action on all aspects of the management of Vanuatu's forests which, if fully implemented, would lead to a significant improvement in forest management.

References and other sources

Asian Development Bank (2009). Vanuatu Economic Report 2009: Accelerating Reform. Asian Development Bank, Mandaluyong City, Philippines.

Berry, A. (2002). Vanuatu country report. In Proceedings of SPC Regional Workshop on Sandalwood Research, Development and Extension in the Pacific Islands and Asia. 7-11 October 2002, Noumea, New Caledonia.

FAO (2010). Global forest resources assessment 2010 country report: Vanuatu (available at http://www.fao.org/forestry/fra/67090/en/).

Government of PNG (2010). Pilot program for climate resilience. proposal for Papua New Guinea Phase 1 activities. Submitted to the Strategic Carbon Funds, World Bank, May 2010 (available at http://www.climateinvestmentfunds.org/cif/sites/climateinvestmentfunds.org/files/Papua%20New%20Guinea%20Phase%201%20Proposal.pdf).

Government of Vanuatu (2007). National implementation programme for action. National Advisory Committee on Climate Change, GEF and UNDP, Port Vila.

Government of Vanuatu (2008). readiness plan idea Note. 29 July 2008. Government of Vanuatu, Port Vila, Vanuatu.

ITTO (2006). Status of Tropical Forest Management 2005. ITTO, Yokohama, Japan.

ITTO (2011, website accessed March 2011). Annual Review Statistics Database (available at http://www.itto.int/annual_review_output/?mode=searchdata).

IUCN (2011, website accessed March 2011). IUCN Red List of Threatened Species (searchable database available at www.redlist.org).

Robson, K. (2004). Experiences with sandalwood in plantations in the South Pacific and north Queensland. Paper presented at Prospects for high-value hardwood timber plantations in the 'dry' tropics of northern Australia, Mareeba, 19th – 21st October 2004.

Spalding, M., Kainumu, M. & Collins, L. (2010). *World Atlas of Mangroves*. Earthscan, London, UK.

Tudrau-Tamani, A. (2010). Vanuatu forest policy undergoes review. All headline news (available at http://www.allheadlinenews.com/articles/7019008722?Vanuatu%20Forestry%20Policy%20Undergoes%20Review#ixzz0wH8A4rKN).

UNDP (2009). *Human Development Report 2009*. United Nations Development Programme, New York, United States.

UNEP-WCMC (2010). Spatial analysis of forests within protected areas in ITTO countries. Data prepared for ITTO. UNEP-WCMC, Cambridge, UK.

UNEP-WCMC (2011, website accessed March 2011). UNEP-WCMC species database: CITES-listed species (searchable database at available at www.cites.org/eng/resources/species.html).

United Nations Population Division (2010, website accessed March 2010). World population prospects: the 2008 revision (searchable database available at http://esa.un.org/unpp/p2k0data.asp).