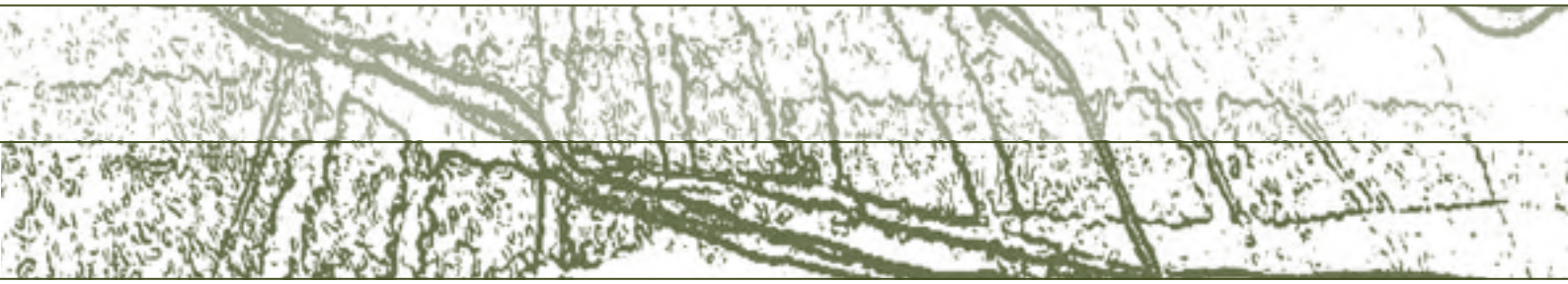

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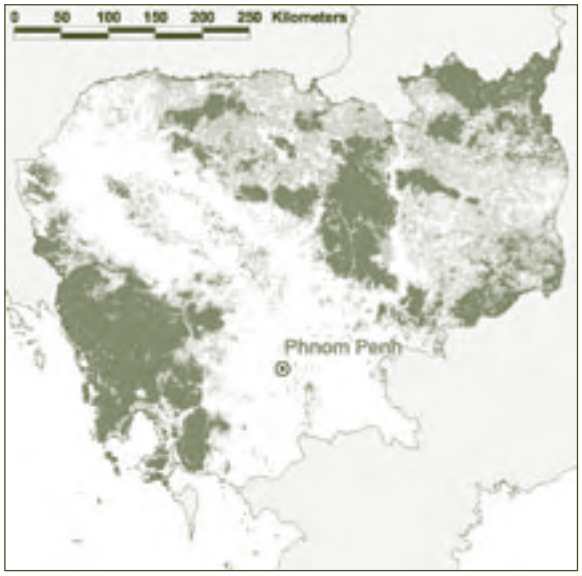

*For legend see page 58

Forest resources

Cambodia has a land area of 18.1 million hectares and a population of 12.6 million people. The country is dominated by a large alluvial central plain, through which courses the Mekong River and in the centre of which lies Tonle Sap Lake. Mountains and plateaux surround the central plain except in the southeast. Only a few points exceed 1,000 m in elevation; these are located primarily in the extreme northeast of the country, the highest peak being Phnom Kchual (1,843 m). The climate is typically tropical and subject to monsoons. Cambodia has a relatively large forest resource: FAO (2005a) estimated forest cover at 9.33 million hectares; the estimate of the Forestry Administration (FA) of the Ministry of Agriculture, Forestry and Fisheries (MAFF) is 11.1 million hectares[b].

Forest types. Cambodia's lowland tropical moist forest covers the northeastern part of the country bordering Laos and Thailand. This forest type is dominated by Dipterocarpaceae, with five species – *Shorea hypochra*, *Anisoptera costata*, *A. glabra*, *Dipterocarpus costatus* and *Hopea odorata* – almost always present; *Parkia streptocarpa*, *Heritiera javanica* and *Syzygium cinereum* are other common species. Medium-altitude closed forest is found in the hilly country around the Gulf of Thailand and east of the Mekong River. The dominant trees, which can reach a height of 20 m, include oaks such as *Lithocarpus* spp, *Quercus cambodiensis* and *Castanopsis cambodiana*. Closed deciduous forests and open forests are mixed and found in the northwestern part of the country; common species include *Lagerstroemia* spp, *Xylia dolabriformis*, *Vitex* spp, *Anogeissus pierrei*, *Grewia paniculata*, *Terminalia* spp, *Ceiba pentandra*, *Pterocarpus pedatus* and *Irvingia oliveri*. Closed semi-deciduous forests occur where the dry season lasts three to five months and vary considerably in appearance and floristic composition. Secondary forest formations include bamboos and trees such as species of *Diospyros, Lagerstroemia* and *Cratoxylon,* as well as *Grewia paniculata*, *Combretum quadrangulare* and *Dipterocarpus intricatus.*

Dynamics of forest resource change. The rate of deforestation in Cambodia between 1990 and 2000 was an estimated 56,000 hectares per year (FAO 2005a). A significant but unestimated area of forest has been degraded by shifting cultivation, encroachment, development of agro-industries, illegal logging, over-harvesting and forest fire, as well as by the use of chemicals during periods of war. Deforestation is expanding rapidly in the country's closed forest area and will have a major impact on efforts towards SFM[c]. Fires during the drier months of the year have reportedly become more common in the past ten years[c].

Table 1 PFE

Estimated total forest area, range (million hectares)	Total closed natural forest ('000 hectares) Source: FAO 2001	PFE ('000 hectares)[d]			
		Production		Protection	Total
		Natural	Planted		
9.33–11.1	5,500	3,460	17	4,620	8,097

Permanent forest estate. Cambodia's 2003 forest law (see below) establishes a comprehensive formal system for the designation of the PFE, but this is yet to be fully implemented, nor have the forests been clearly demarcated. Table 1 presents an ITTO estimate of the extent of the PFE. This varies from that provided by the FA, which puts the total PFE at 11.1 million hectares[b] (the same as the estimated total forest area). The estimate of natural production PFE comprises the current attributed concession area.

Planted forests. Estimates of the area of planted forests vary. FAO (2005a) estimated 90,000 hectares and the Department of Forestry and Wildlife (DFW 2003) 82,000 hectares[a], while the government of Cambodia (2004) reported that 13,000 hectares of plantations had been established between 1985 and 2004 on bare and degraded land. The higher estimates may include rubber plantations, some of which are harvested for timber; these cover an estimated 29,000 hectares[b]. In this report the area of planted forest is estimated to be 17,000 hectares[c].

Institutional arrangements

Forest tenure. According to Article 10 of the 2003 Law on Forestry, the PFE consists of permanent forest reserves (owned by the state) and private forests. Permanent forest reserves comprise three categories: production forests, protection forests and conversion forest lands; the latter are classified as permanent forest reserves until the government decides to use the land for other purposes. Private forests are to be maintained by their owners, who have the right to harvest and sell the products derived from such forests. Any individuals who plant trees on private land or on state forest land where they have been granted user rights have the right to maintain, develop, harvest and sell forest products (Article 46). For local communities, the state recognizes and ensures their user rights for the purpose of traditional customs, beliefs, religion and living (Article 40). In recent years, Cambodia has followed the global trend of favouring various forms of decentralized forest management. Numerous pilot projects are under way to strengthen the ability of local communities to manage forests. Many of these build on a long tradition of local forest management by rural people. Other programs target communities who were displaced or whose traditional practices were disrupted during periods of armed conflict.

SFM policy framework. Cambodia's 2003 Law on Forestry incorporates a framework for SFM in its articles 8 and 9, which state that SFM will be conducted in a manner consistent with the National Forest Sector Policy and this 2003 law.

Forest policy and legislation. In October 1998, the National Assembly adopted the government's 'policy platform', which provided for specific actions to establish SFM, including the re-drafting of forest laws and guidelines. In January 1999, the National Assembly decided to crack down on illegal logging, banned the conversion of forest land for other purposes, and decided to retain 10–20% of the AAC from concession forests to meet the domestic demand for timber. In July 2002, the government adopted a national forest policy with the following objectives: (i) to conserve and sustainably manage the country's forest resources; (ii) to establish the remaining forest reserves as PFE; (iii) to promote the maximum involvement of the private sector and the participation of local people; (iv) to establish a coordinated multi-stakeholder process for forestry development; and (v) to promote programs of forestation on arable lands and farms.

The 2003 Law on Forestry replaced Decree No 35 of 1988; it defines the framework for management, harvesting, use, development, conservation and protection of the forest. The major objective is to ensure SFM and customary user rights of forest products for local communities. A number of guidelines and codes serve to regulate forest management, such as: 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. Uncertainty over the best approaches to solving forest problems led to the undertaking of a major independent forest-sector review, which was completed in 2004. It made numerous recommendations, which the government is now considering. An ITTO diagnostic mission in 2004, which examined obstacles to the attainment of SFM in the country[b], also made a wide range of recommendations.

Meanwhile, the forest sector lingers in a state of uncertainty as the government continues to contemplate the future of industrial concessions and other issues relevant to the forest sector. A model forest concession agreement, prepared with the technical assistance of the World Bank and the Asian Development Bank (ADB), is being used in the renegotiation of contracts between the government and forest concessionaires. The forest-sector reforms, however, are very new and have not yet become effective; the enforcement of existing policies, laws and regulations is weak[b].

Institutions involved in forests. The FA was established in 2003 within MAFF, replacing the DFW. The FA is the sole agency responsible for managing the forest estate; however, national parks and equivalent reserves, including those containing forest, are under the jurisdiction of the Ministry of the Environment and there appears to be some overlap in responsibility. The system of provincial and district forest offices under the direct authority of provincial and district officials was abandoned in 2000. With the new structure operational in 2005, the government decentralized ministerial functions to lower authorities through four regional forest inspectorates[c]. In addition, the Forest Research Institute has been re-established under the responsibility of the FA. Global Witness, an international NGO, was contracted to act as an independent monitor of the Forest Crime Monitoring Project; in 2003 this function was transferred to the Swiss-based company SGS and Global Witness officials were allegedly denied further entry to Cambodia (Global Witness 2005). A GIS unit within the FA has completed the Year 2000 Forest Resource Interpretation project. There are awareness programs for biodiversity conservation, reduced impact logging (RIL) and certification. A forestry training centre was inaugurated in 2003 and serves as the FA's vocational training centre.

The present reforms stipulate greater participation of grassroots organizations and of civil society generally in the forest sector. Wildlife and biodiversity conservation is being promoted by international conservation NGOs and community forestry programs by NGOs such as Concern and Oxfam. In 2003, the Cambodian Timber Industry Association was created to respond to these reforms and to assist member companies to attain the capacity to meet the stringent technical and regulatory requirements.

Status of forest management

Forest for production

Before 1970, the forests of Cambodia were managed in a very conservative manner. Forests were classified into forest reserves managed for specific objectives such as production, wildlife conservation, research and preservation. Subsequent political developments caused this system to disappear; 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 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[b]. 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[c].

Between 1994 and 1997, the government granted 36 commercial forest concessions covering about 7 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

Table 2 Some commonly harvested species for industrial roundwood (2002–2004)[b,c]

Timber species	Remarks
Dipterocarpus alatus (chhoeuteal tan)	Sawnwood, veneer, plywood
Anisoptera glabra (mersawa, phdiek)	Sawnwood, veneer, plywood
Hopea odorata (koki)	Sawmilling, construction (bridges, boats)
Shorea vulgaris (choë(r) chông)	Sawmilling, construction (housing)
Tarrietia javanica	Sawnwood (decorative, furniture)

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. However, the stipulations were not adequately met. The total official harvest of industrial roundwood was reduced substantially to 123,000 m^3 in 2001 compared to about 700,000 m^3 in 1997 (ITTO 1999, 2005), although it is likely that much more than this was actually harvested.

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 issued a *Declaration on the Suspension of Forest Concession Logging Activities*, which suspended all logging activities in concessions starting from January 2002 until new forest concession management plans could be prepared and approved. 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 FA closed, and sometimes destroyed, 1,351 illegal sawmills and 653 small wood-processing plants[b]. Some concessionaires have prepared new management plans according to the model. However, as of October 2005, all the concessions remained suspended because they were yet to conduct environmental and social impact assessments, which must be incorporated into the plans.

Silviculture and species selection. The model forest concession agreement and the SFM guidelines require that the forests be 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. However, little silvicultural effort is currently applied to regenerate previously logged forests (FAO 2005b). A full list of species extracted from natural forests and their respective share in the total is not available; this also varies depending on locality. An indicative list of important timber species is given in Table 2; others include *Pterocarpus pedatus, Shorea* spp, *Terminalia* spp, *Eugenia* spp, *Lagerstroemia* spp, *Irvingia* spp, *Xylia dolabriformis* and *Pentacme* spp.

Planted forest and trees outside the forest. Teak is the single most important planted species, covering 7,000 hectares, followed by 9,000 hectares of other broadleaved species (*Acacia auriculiformis, Hopea odorata, Eucalyptus camaldulensis* and *Dipterocarpus alatus*) and 1,000 hectares of *Pinus merkusii*[c].

Forest certification. No forests have yet been certified in Cambodia. As a first step, the government is considering certification as part of its package of measures to achieve SFM.

Estimate of the area of forest sustainably managed for production. No forests in Cambodia's natural-forest production PFE can be considered to be sustainably managed (Table 3). Since all logging is suspended, there is effectively no legal forest management in the production PFE, although there may be significant illegal logging[b].

Table 3 Management of the production PFE ('000 hectares)

Natural					Planted		
Total	Allocated to concessions/ under licence	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
3,460	3,370 (suspended)	150	0	0	17	7	0

Timber production and trade. Estimated total roundwood production in 2003 was 9.68 million m^3, of which fuelwood accounted for 9.56 million m^3 (FAO 2005b). In 1990, Cambodia's forest policy emphasized exports. Royalties and taxes on timber were reduced to encourage local processing for export. The legal export of logs was discontinued in 1996; at the same time, processing technology improved, the conversion factor reaching 0.6. Recorded wood production fell when forest concessions were cancelled or suspended; in 2003, industrial log production was an estimated 125,000 m^3 compared to 291,000 m^3 in 1999 (ITTO 2004, 2005). Some timber is still legally available from government-approved land conversion activities. However, an ITTO diagnostic mission in 2004 reported allegations that the granting of land-conversion permits, for example for rubber estates, had not followed legal procedures and had sometimes been motivated by the access it gave to the timber resources on the land to be cleared[b]. The mission was informed that timber was still available in major towns and prices were reported to have remained stable. It was apparent, then, that the effect of the logging ban had been to stimulate a significant illegal timber industry[b]. The decline in legal production is reflected in apparent trade: the export of sawnwood fell from 10,000 m^3 in 1999 to 2,000 m^3 in 2003, and that of plywood and veneer from 83,000 m^3 to 20,000 m^3 in the same period (ITTO 2004, 2005).

Non-wood forest products. Although many rural people depend on NWFPs to supplement subsistence needs and generate income, no data are available to quantify their economic importance. Potentially marketable products include *Aquilaria crassna*, the seeds of *Strychnos nux-vomica*, the fruits of *Cinnamomum* and *Diospyros*, resin and rattan. Bamboo shoots are eaten and wildlife is important as a protein source.

Forest for protection

Soil and water. There are laws, rules and regulations (eg the 2003 forest law, Royal decrees 1993 and 1999 and sub-decrees nos 75, 76 and 77 (2002)) addressing the role of forests in the protection of soil and water. The five-year National Environmental Action Plan (1998–2002) also had provisions in this regard. Nearly 40% (4.2 million hectares) of the designated PFE is intended to be managed primarily for the protection of soil and water[a].

Biological diversity. The government of Cambodia estimates that 125 species are endangered[a]. Twenty-eight mammals, 26 birds, 15 reptiles, three amphibians and 32 plants are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species; of these, 21 mammals, 20 birds and three amphibians are found in forests (IUCN 2004). Three plants are listed in CITES Appendix I and 40 in Appendix II (CITES 2005).

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. According to UNEP-WCMC (2004), 3.36 million hectares of forest are in protected areas that conform to IUCN protected-area categories I–IV, including 1.20 million hectares of deciduous/semi-deciduous broadleaved forest and 897,000 hectares of lowland evergreen broadleaved rainforest. There are 23 protected areas in IUCN categories I and II and 71 in categories III and IV[a]. Protected areas are of four main types: national parks, wildlife sanctuaries, protected landscapes and multiple-use areas.

Estimate of the area of forest sustainably managed for protection. No information was available for this report on the management status of the protection PFE (Table 4).

Table 4 Management of the protection PFE ('000 hectares)

Total	Attributed to IUCN categories I–IV	Allocated for soil and water	With management plans	Sustainably managed
4,620	3,360	4,200	n.d.	n.d.

Socioeconomic aspects

Economic aspects. Badly shaken by decades of internal conflict, Cambodia's economy is gradually improving. The recorded contribution of forestry to GDP fell from 5.4% in 1998 to 2.1% in 2001; after the logging ban in 2002 it fell effectively to zero. These figures are misleading, however, because there is no accounting for illegal activities or subsistence and traditional uses. No recent information is available on employment, income, recreational facilities and other benefits.

Livelihood values. The recorded production of fuelwood is close to 10 million m^3, but considerable quantities probably remain unrecorded. This applies to all forest products in subsistence use. No quantitative data are available on the role of NWFPs in maintaining livelihoods, although this role is considerable.

Social relations. The participation of indigenous people and local communities in forest management is recognized by law. The country's community forestry program has increased in scope and size since 1992. A sub-decree on community forestry provides for an increase in the number (and area) of community forests and encourages local communities to participate in SFM. An area of 64,900 hectares of forest has been set apart for local community use. There are 159 community forestry sites involving 34,100 families[a]. The participation of indigenous people is also promoted by facilitating improved market access for their products.

Summary

Deforestation is expanding rapidly in Cambodia. Nevertheless, the country has a large forest resource with the potential to sustain a robust timber industry and contribute enormously to national development. But the recent history of Cambodian forestry has been turbulent, and the timber sector is in disarray. The concession system has been suspended, yet unauthorized timber production apparently continues. The implementation of recent reforms, and increased law enforcement, are urgently required.

Key points

- Cambodia's significant reserves of high-value production forests present an important economic resource, the sustainable use of which would be of considerable benefit to the country.
- Cambodia has an estimated 8.10 million hectares of PFE, comprising 3.46 million hectares of natural production forest, 4.62 million hectares of protection forest and 17,000 hectares of industrial timber plantations. However, data on Cambodian forests are often inconsistent and unreliable.
- No part of the production PFE is considered to be under sustainable management; insufficient information was available to estimate the area of protection PFE so managed.
- A significant but unestimated area of forest has been degraded by shifting cultivation, encroachment, the development of agro-industries, illegal logging, over-harvesting and forest fire, as well as by the use of chemicals during war.
- The Forestry Administration was created in 2003, replacing the Department of Forestry and Wildlife; it has responsibility for managing the forest estate, although there may be some overlap in roles with the Ministry of Environment for forests in national parks and related reserves.
- Forest-sector reforms have been developed but are yet to be implemented effectively; the enforcement of existing policies, laws and regulations is weak.
- The management of forest concessions has been poor; the government cancelled some licences and, in 2002, suspended all remaining forest concessions until they fully complied with requirements. One apparent effect of this ban has been to stimulate a significant illegal timber industry.

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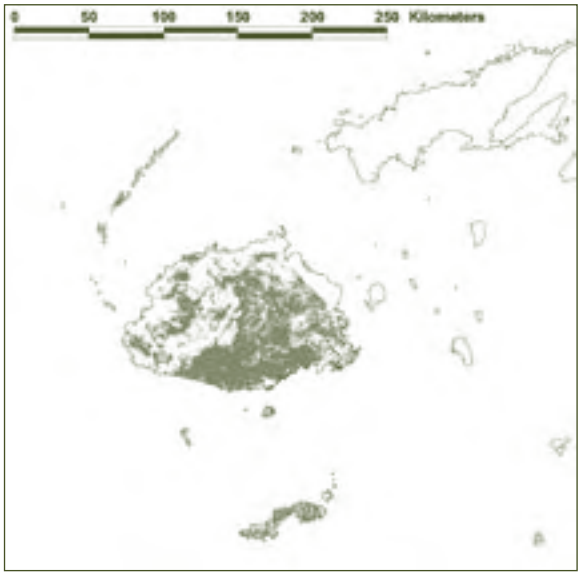

*For legend see page 58

Forest resources

Fiji has a population of about 900,000 people. It is located in the South Pacific and comprises more than 300 islands with a total land area of approximately 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 volcanic in origin and mountainous, rising to 1,323 m at Tomaniivi (Mt Victoria). The eastern sides of Viti Levu and Vanua Levu receive an annual rainfall of over 2,500 mm and support tropical rainforest, while the western portions receive less than 1,700 mm annually and support a higher proportion of (mainly secondary) grass and savanna. Estimates of total forest area (including planted forests) include 815,000 hectares (FAO 2005), 853,000 hectares (Jiko 2003) and 930,000 hectares[b].

Forest types. The predominant forest type is tropical moist forest, usually called rainforest in Fiji. Small areas of remnant rainforest occur in the grasslands, which themselves are mainly the result of repeated burning of the drier parts of tropical moist forests, leaving remnants of the original forest type and a fringe of deteriorating shrubland at the interface of the forest and grassland. There is also a significant area (around 42,000 hectares) of mangrove forest.

Dynamics of forest resource change. Most of the remaining natural forest in Fiji is on steep and broken mountainous country and difficult to access. During the 1990s, annual deforestation averaged 2,000 hectares, or 0.2% (FAO 2005), mainly in the drier parts of the two main islands. Forests are subject to periodic wind damage of varying intensity, including cyclonic; the existing forest structure can be partly attributed to this.

Permanent forest estate. There is no formally designated PFE in Fiji, and statistical information on forest area differs according to source and even within the same source. Some 240,650 hectares of natural forest have been described as protection forest (Jiko 2003), mainly on the grounds that these areas are too steep to log with present techniques. A classification into multiple-use natural forests, protection forests, nature and forest reserves, and plantation forest was being considered by the authorities in early 2005. The estimate of PFE contained in Table 1 comprises protection forests (as per Jiko 2003) and planted forests, as these are deemed to be effectively committed to permanent forest use. Another 331,000 hectares of logged natural forests could be considered for inclusion,

Table 1 PFE

Estimated total forest area, range (million hectares)	Total closed natural forest ('000 hectares) Source: FAO 2001	PFE ('000 hectares)			
		Production		Protection	Total
		Natural	Planted		
0.82–0.93	747	0[d]	113[b]	241	354

but the degree of 'permanence' of these forests is unclear. Thus, at present there is no natural-forest production PFE in Fiji.

Planted forests. Fiji has a successful plantation program. The large-scale planting of pine and hardwoods by government began in the 1960s and, by now, some 13% of the country's forests are planted. In 2003, there were an estimated 52,900 hectares of hardwood plantations (mainly *Swietenia macrophylla* – mahogany), 46,300 hectares of pine and 14,300 hectares of mixed plantations[b,d].

Institutional arrangements

Forest tenure. Communal groups (*mataqali*) own 89% of the unexploited forests and 84% of all Fijian forests, including planted forests; the remaining 16% of forests are privately or state-owned. The Native Land Trust Board (NLTB), which was set up in 1940, deals with local resource management and administers all customary land with the consent of landowning units. The Board is chaired by the Minister for Fijian Affairs and its members are nominated by the Great Council of Chiefs; it also includes one or two government representatives.

SFM policy framework. Fiji's commitment to SFM is demonstrated by its adherence to the Forest Principles of the 1992 Earth Summit and membership of ITTO.

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 Forest Decree of 1992 updated the Forest Act of 1953. A review of the forest policy has just been completed; its findings will now be the subject of stakeholder consultations with a view to arriving at a more broad-based policy.

The National Forestry Action Plan (NFAP) prepared in 1989 was a classic investment plan. It led to the identification of 29 projects that were presented to donors in May 1990; 25 have been, or are being, implemented. The Strategic Forestry Plan, 2002–2005, which supplements the NFAP, has the following objectives: (i) to provide an appropriate institutional and physical infrastructure to support the development of the forestry sector; (ii) to ensure the sustainable development and management of forest resources; (iii) to promote community-owned and -managed forest-processing and value-adding facilities based on indigenous forests and community-owned plantations; and (iv) to promote the production and export of value-added timber products.

Institutions involved in forests. There are four 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, 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; Fiji Pine Limited (FPL), a public company wholly owned by government and landowners which is responsible for pine plantation establishment, management, utilization and marketing; and the Fiji Hardwood Corporation Limited (FHCL), a government-owned subsidiary responsible for the hardwood plantations in the process of becoming a government-landowner company similar to FPL. 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. The Forestry Extension Division of the Forestry Department provides landowners with technical advice and assistance in the implementation of SFM.

Regional and global NGOs play a role in developing, applying and disseminating forest-related information to the community because of their networking strength at the local level. Such organizations include the South Pacific Action Committee for Human Ecology and the Environment (SPACHEE), the Foundation for the Peoples of the South Pacific (FSP), Greenpeace, WWF and the Wainimate Group.

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. Around 0.29 million hectares, which is about 40% of the total natural forest area, has been allocated

Table 2 Some commonly harvested species for industrial roundwood (2002–2004)[b]

Timber species	Remarks
Swietenia macrophylla (mahogany)	From planted forests, popular and versatile decorative timber
Pinus caribaea (Caribbean pine)	From planted forests, bulk of it used to make woodchips
Myristica spp (kaudamu)	Natural forest species, used in sawmilling
Endospermum macrophyllum (kauvula)	Construction and joinery timber
Agathis vitiensis (dakua makadre)	Decorative timber, also for veneers and plywood

to concessions and long-term licences[b] (see below). Each licence applies to gross areas of land that include a mosaic of production, non-commercial and protection forest[b]. Royalties are collected by the Forestry Department and passed on in full to the landowners, except for an administration levy deducted by the NLTB. The Forestry Department also levies fees on the licence-holders for log-scaling, regeneration costs and so on. To further the sustainable management of its forests, the Fiji government has formulated a national code of logging practice to give practical guidance to those involved in logging; this prescribes operational, safety and environmental standards. The code is now being revised to include RIL and other silvicultural practices designed to enhance forest regeneration.

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 pre-payment 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 Forest 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[b].

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 breast height. Twenty-two species are included in an 'obligatory list' and these must be felled irrespective of market demand. Despite the provisions in the licence agreements, pre- and post-harvest silvicultural prescriptions do not receive proper attention[b]. 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). Table 2 shows the main species harvested, including from plantations.

Planted forest and trees outside the forest. The main softwood plantation species is *Pinus caribaea var. hondurensis* (Caribbean pine), mostly under the management of FPL and located mainly in the drier zones of Viti Levu and Vanua Levu. There are about 45,000 hectares of this species in plantations; the target is 75,000 hectares. 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

Table 3 Management of the production PFE ('000 hectares)

Natural					Planted		
Total	Allocated to concessions/ under licence	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
0	n.a.	n.a.	n.a.	n.a.	113	90	0

hectares. The ownership of what are now the Fiji Pine Trust 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[b]. The main planted hardwood species, mahogany, is managed by FHCL. Mahogany plantations also began in the early 1950s and the expansion of establishment had grown to around 1,000 hectares a year by the mid 1960s. However, the program virtually stopped in 1971 because of widespread attack by the ambrosia stem borer. It resumed after a few years with the development of successful containment measures, and annual planting rates climbed to around 3,000 hectares. By now there are about 53,000 hectares of plantations of this species; the aim is to establish a total estate of about 100,000 hectares[b].

Forest certification. No forest has so far been certified in Fiji, but the 66,981 hectares of forest plantations managed by FHCL are currently undergoing assessment by the Rainforest Alliance SmartWood program for certification under the FSC umbrella.

Estimate of the area of forest sustainably managed for production. No natural forest is contained in the nominal production PFE; moreover, none of the concessions in natural forest are thought to be sustainably managed[b]. Of the 113,000 hectares of planted forest in the nominal PFE, about 90,000 hectares are considered intact[b]. Most of these forests have management plans, and at least 5,000 hectares, consisting of part of one concession, are being operated under a reasonable degree of sustained-yield management[b].

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 is thought to be around 50%[b]. Industrial roundwood production in 2003 was 380,000 m^3, of which 260,000 m^3 was softwood from pine plantations (ITTO 2005); this was down somewhat from 470,000 m^3 total industrial roundwood production in 1999 (ITTO 2004). In 2003, Fiji produced 84,000 m^3 of sawnwood (up from 64,000 m^3 in 1999), 8,000 m^3 of veneer and 8,000 m^3 of plywood, and it exported 9,000 m^3 of sawnwood, 2,000 m^3 of veneer and 6,000 m^3 of plywood (ITTO 2004, 2005). As with most other aspects of forestry, Fiji's wood-processing industries are comparatively more advanced than those in other Pacific Island nations. Despite the increasing role of plantations, two-thirds of processed products (sawnwood and plywood/veneer) are still based on raw material from natural forests. No data are available on the production and trade of mahogany, since harvesting only began in 2003.

In 2001, pine woodchips accounted for 58% of forest products' export earnings, followed by sawnwood and wood-based panels. A small amount of high-quality furniture is also exported, along with small quantities of sandalwood and logs and slabs of *Samanea saman* (rain tree). According to an ITTO diagnostic mission, Fiji is a timber-surplus country and export markets are the key to the sustainability of the forestry sector[b].

Non-wood forest products. NWFPs 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 from the 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*

Table 4 Management of the protection PFE ('000 hectares)

Total	Attributed to IUCN categories I–IV	Allocated for soil and water	With management plans	Sustainably managed
241	3	18	37	55[d]

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

Forest for protection

Soil and water. Land-use practices pay attention to the need for soil and water conservation. Some 241,000 hectares of forest are classified as protection forests, mainly located on steep land with slopes over 30 degrees and with shallow unstable soils.

Biological diversity. There are an estimated 455 species of amphibians, birds, ferns, mammals, palms, reptiles and trees in Fiji (FAO 2001). Five mammals, 14 birds, six reptiles, one amphibian and 66 plants are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species; of these, two mammals, eleven birds and one amphibian are found in forests (IUCN 2004). Forty-one plants are listed in CITES Appendix II (CITES 2005). *Santalum yasi* is the most endangered tree species in dry forests, being limited to a small relict population. Little political attention has so far been paid to the protection of forests for their biological diversity, but the rural land-use policy for Fiji now being considered by government may address the issue.

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 still damage the soil. Policy and codes of practice are exemplary; implementation is seriously at fault[b].

Extent of protected areas. The total extent of the protection PFE is an estimated 241,000 hectares, although only a fraction of this is formally designated as protected area. According to UNEP-WCMC (2004), about 3,000 hectares of forest are in protected areas that conform to IUCN protected-area categories I–IV, 900 hectares of which are lowland evergreen broadleaved rainforest. Environmental management is integrated into planning and development. The main concerns in conservation areas are the control of encroachment and the maintenance of boundaries. Issues in 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. The estimated area of protection PFE under SFM is at least 55,000 hectares (Table 4). This comprises 37,000 hectares of legally designated protected areas, all of which have management plans, and 18,000 hectares of mangrove forests that were set aside in 1999 as soil and water protection forest.

Socioeconomic aspects

Economic aspects. Timber is Fiji's third-largest export commodity, accounting for 2.5% of GDP (ADB 2003) and providing employment for about 3,000 people[b]. In 2003, the export of sawnwood, plywood and veneer was worth an estimated US$7 million; significant export income was also earned from woodchips and a small quantity of value-added products (ITTO 2005). The mahogany plantations have enormous value-adding potential. The forest sector is an important generator of government revenue, and the royalties paid to customary owners provide a significant proportion of rural income.

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* must agree to the proposal to the satisfaction of the NLTB[b]. The government is promoting community participation in the development of woodlots by landowners; about 100 hectares of woodlots are developed each year. Work in landowner awareness by the Forestry Department is being complemented by an ITTO project on landowner training and education in SFM. There have been tensions over control of the mahogany resource.

Summary

Timber is Fiji's third-largest export commodity and the sector still has considerable growth potential. However, land-use conflicts arising from the pattern of ownership have contributed to the degradation of the forest resource, particularly in natural forest, and have often been viewed as a major constraint to SFM. Other constraints include a lack of convincing evidence for the financial potential of the natural resource (and therefore the continued conversion of forests to various types of non-forest use), an inability to control the standards of logging in natural forests, and inadequate product supply and market research. Fiji's substantial mahogany plantation estate, if well managed and marketed, will be a significant driver of development.

Key points

- Because of the special conditions of land ownership there is no formal PFE, but some forests have equivalent status; an estimated 354,000 hectares may be regarded as a nominal PFE.
- None of the natural production forest (none of which is considered part of the PFE) is considered to be sustainably managed.
- Generally, the standard of logging is low. At least 55,000 hectares of protection PFE are estimated to be managed sustainably.
- Fiji has 55,000 hectares of plantation of the high-value species *Swietenia macrophylla* (mahogany) and there are plans to continue to expand this estate. Harvesting began in 2003; how the mahogany resource is managed and marketed will have a large bearing on the future success of the Fijian timber industry.
- Fiji also has a significant softwood plantation resource, which currently supplies about two-thirds of industrial timber.
- With some additions, Fiji continues to use its forest policy developed in 1950 as the basis of forestry, but implementation is guided by the priority now given to forest development based on exports. A review of the policy was completed recently.
- Apart from the conservation and expansion of forest cover, the forest policy focuses mainly on the efficient processing and manufacture of value-added products and training in forest industries.
- Fiji is a net exporter of wood products, including pine chips, sawnwood and wood-based panels. There is a small export trade of high-value finished products. The expansion of the export of these could make a significant contribution to the economy, particularly when mahogany timber is put on the international market.
- The forest area designated as 'protected' within IUCN categories I–IV is 3,000 hectares, although an area of 241,000 hectares has been broadly described as protection forest.

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INDIA

*For legend see page 58

Forest resources

India has the world's second-largest population, with about 1.1 billion people, and a land area of 316 million hectares. Over 40% of the population lives below the poverty line as defined by the World Bank (with an income of US$2 per day or less). Systematic, consistent and accurate information on the geographic extent and physical condition of the country's tropical forest is lacking. According to FAO (2005a), the area under effective forest cover in India is 64.1 million hectares (20% of the land area), of which 31.5 million hectares (49%) is under natural forest cover and agroforestry. On the other hand, FSI (2003) estimated the forest area at 76.8 million hectares, although this probably includes significant areas with no forest cover. These estimates include substantial areas of forest north of the Tropic of Cancer and, therefore, not tropical by the ITTO definition.

India was the only country for which information was not available for this report through at least one of a C&I report, an ITTO mission and/or a national workshop on the ITTO C&I, although both a mission and workshop are planned for 2006. Much of the information contained in this profile has therefore been obtained from secondary sources and personal communications.

Forest types. About 60% of India's forest estate is categorized as closed and 40% as open (FAO 2001). Tropical moist forests account for about 13% of the total forest area. Tropical wet evergreen forests occur in the south, the 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). Mangrove and swamp forests are common in southern India.

Dynamics of forest resource change. During the 1970s, India's annual rate of deforestation was 1.3 million hectares (IIFM 2002). In the 1990s, the situation is said to have changed to one of net gain through extensive afforestation. According to FAO (2001), while natural forest was lost at an annual rate of 1.90 million hectares during the 1990s, the area under planted forest increased at an annual rate of 1.93 million hectares. The net gain shown in forest area is somewhat artificial, however, because of the inclusion of rubber plantations, farm woodlots and home gardens as forests, which hitherto were considered to be outside the definition of forest. Continuing deforestation and the practice of moving the boundaries of government forests have made the security of forest resources tenuous.

Table 1 PFE

Estimated total forest area, range (million hectares)	Total closed natural tropical forest ('000 hectares) Source: derived from FAO 2001	PFE ('000 hectares)[d,*]			
		Production		Protection	Total
		Natural	Planted		
64.1–76.8*	22,500	13,500	32,600	25,600	71,700

* Tropical and non-tropical

Permanent forest estate. According to the Ministry of Environment and Forests (MOEF 1999), 13.5 million hectares of India's forests are categorized as production forest, 10 million hectares as protection forest, 15.6 million hectares as national parks and wildlife sanctuaries, and 25 million hectares as social forest. The area of natural-forest PFE is therefore estimated to be 39.1 million hectares, comprising 25.6 million hectares of protection forest and 13.5 million hectares of production forest[d]. Separate data for the tropical forest PFE are not available; the estimate of PFE in Table 1, therefore, covers India's entire forest estate, including subtropical and temperate forests.

Planted forests. In 2000, there were an estimated 32.6 million hectares of planted forests (FAO 2005). About 25% of all plantations (8 million hectares) are in private, communal and non-forest public land (MOEF 1999). Fifty per cent of plantations established since 1980 are in an agroforestry environment, with varying intensities of management (ibid.). The planting rate in 1990–2000 was estimated to be 1.51 million hectares per year (FAO 2001). Private planting is believed to exceed public planting. India also has an estimated 560,000 hectares of rubber plantations (ibid.).

Institutional arrangements

Forest tenure. All legally constituted forests are under the ownership and control of state governments. With farmers and households increasingly engaged in tree-growing, a new and important category of private forest owners (of farm forests, home gardens and agro-industrial plantations) is emerging.

SFM policy framework. India has not yet established a comprehensive SFM framework for the different kinds of forestry taking place in the country. A set of C&I for sustainably managing the dry-zone forests of India has been 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 (PD 37/00).

Forest policy and legislation. The national forest policy dates from 1988 and there have been no major changes since. The policy stresses: the maintenance of environmental stability and the restoration of ecological balance; the conservation of the country's natural heritage and biodiversity; improved soil and water conservation; increasing forest cover through massive afforestation and social forestry programs; providing for the basic needs of rural and tribal populations; increasing forest productivity; improving the efficiency of forest product utilization; and minimizing the pressure on existing forests. The policy stipulates that industrial wood needs should be met increasingly by farm forestry. In tune with these policy objectives, India formulated a national forestry action program (MOEF 1999), but this has not yet been put into full operation.

The guiding legislation still current in India is the Indian Forest Act of 1927 (amended in 1951). While policies have undergone changes, the legislation has not changed correspondingly and it continues to focus on the prevention of offences. Other national legislation relevant to forestry includes: the Mines Act of 1952; the Wildlife (Protection) Act of 1972, which has been recently amended; the Forest Conservation Act of 2003; the Environmental Protection Act of 1986; and the Biological Diversity Act (2002).

Within the country's federal structure, forestry is a 'concurrent subject'; both state and national governments are jointly responsible for the sustainable management of the forest resource. State governments generally have the freedom to manage the forest resources on the basis of forest management plans. However, under the Forest Conservation Act of 2003 (Paragraph 6), state governments must obtain prior approval from the national government for any forest clearance for non-forestry purposes.

Institutions involved in forests. At the national level, forestry falls under the purview of the MOEF; there are also forest departments at the national and state levels with defined functions and responsibilities. While at the national level the role of the Forest Department is mostly 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 the forested states of

India 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 effect, most of them function as extensions of the forest departments. A number of specialized institutions are linked directly to the MOEF. 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 Forest Survey of India.

The National Afforestation Programme (NAP), initiated in 2000, amalgamates all the previous centrally sponsored forest programs except parks and wildlife conservation. The NAP is implemented in a decentralized manner through forest development agencies (FDAs). FDAs, which are different entities 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 program of the NAP has effectively been taken up in all states of India since 2002.

Joint forest management (JFM), which was formally introduced by the 1988 national forest policy, is implemented through the involvement of local communities at the village level and through FDAs at the district level. JFM is a forest management strategy by which the 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. JFM has spread throughout the country, covering over 17 million hectares of forest (IIFM 2002). Around 63,000 VFCs in 27 states are engaged in the protection and regeneration of degraded forests in return for certain usufructuary rights and other benefits. Constitutional Amendment No 73 provided for the transfer of ownership of NWFPs to *Gram Sabhas/Panchayats* (village assemblies) in states with sizeable tribal populations. One criticism of JFM was that it covered only the protection and maintenance of degraded forests. To correct this, in January 2000 the government of India issued a circular concerning the extension of JFM to better-stocked forests. Moreover, it provided for the mandatory (50%) involvement of women in JFM activities.

India has many national- and state-level NGOs involved in forestry, wildlife conservation, environmental protection and community development. They 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. It has been reported that 72% of all India's forests were under prescriptions of working plans in 2000, up from 54% in 1980 (FAO 2001). Nearly 10 million hectares of the production PFE are thought to be currently under such plans, almost half of which have been so managed for more than 30 years[d].

The management of government forest land is the direct responsibility of the public forest administrations. All or most technical operations are undertaken by the state forest departments, employing a permanent or temporary labour force, or through specific job contracts or partnership arrangements. 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. Ninety per cent of forest-based products are manufactured in the private sector. During the last 30 years, several innovative arrangements for greater community participation have been introduced, including JFM, community forestry, out-grower tree-farming, company-community partnerships and cooperative enterprises.

Table 2 Some commonly harvested tropical timber species for industrial roundwood (2002–2004)*

Timber species	Remarks
Eucalyptus spp	For pulp, board and cheap timber
Acacia spp	Pulp and rural construction timber
Dalbergia sissoo	Average quality timber used in woodworking
Tectona grandis	High-quality, high-price timber
Shorea robusta	Quality construction wood

* Source: ITTO 2004a, 2004b

Illegal logging, forest encroachment, the poaching of animals and other illegal activities thrive due to weaknesses in control (Ahmed 1997). Policy and legal instruments are not supported by effective enforcement. Logging is banned in many natural forests, but there are no adequate measures to enforce the ban, thus leading to further forest degradation (ibid.).

Silviculture and species selection. Several different silvicultural systems are followed in India, including a selection system, a shelterwood system, clearfelling and artificial regeneration with valuable species, coppicing, afforestation with exotics to reclaim grasslands, line and block plantations in farms, and agroforestry systems. Table 2 shows five important tropical timber species in production and trade. Other common species include *Hevea brasiliensis* (rubber), *Terminalia paniculata, T. tomentosa, Grewia* spp, *Xylia xylocarpa, Adina cordifolia, Artocarpus integrifolius, Pterocarpus* spp, *Gmelina arborea* and *Lagerstroemia lanceolata.*

Planted forest and trees outside the forest. Of the estimated planted forest area of 32.6 million hectares, nearly 45% is accounted for by fast-growing (and short-rotation) species of *Eucalyptus* (E. grandis, E. tereticornis) and *Acacia* (A. auriculiformis, A. mearnsii, A. nilitica) (FAO 2001). Teak accounts for about 8%; other common hardwood species are *Albizia* spp, *Azadirachta indica, Casuarina equisetifolia, Dalbergia sissoo* and *Gmelina arborea*. Pines and other conifers make up about 10% of the planted forest estate and the remainder are other broadleaved species. While impressive in area, the performance of 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).

Since the mid 1980s, most of the plantations have been established under social forestry schemes on community and private land outside the forest area. In recent years, the national forest policy has directed the forest-based industry to obtain their raw material from local private sources. This has prompted some large pulp-and-paper companies to promote farm forestry through the extension of technology for establishing clonal plantations, and a buyback guarantee for the pulpwood produced (outgrowing schemes). A large number of tree-farming and agroforestry enterprises have sprung up all over the country. Private tree-planting now covers an area of over 6 million hectares (Saigal et al. 2002).

Forest certification. There are no formal bodies or systems for forest certification. The certification of products manufactured with wood from non-forest sources (eg rubberwood) by external certification bodies/agencies is reportedly taking place, but details are not available.

Estimate of the area of forest sustainably managed for production. Close to 10 million hectares of the production PFE are being managed under regular working plans, of which at least 4.8 million hectares can be considered to be sustainably managed[d]. This area comprises forest reserves that have been managed according to working plans for more than 30 years. In addition, an area of about 8.15 million hectares of planted forests are intensively managed for timber production.

Table 3 Management of the production PFE ('000 hectares)

Natural					Planted		
Total	Allocated to concessions/ under licence	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
13,500	13,500	9,720	0	4,800[d]	32,600	8,150	0

Timber production and trade. About 50% of India's wood supply is provided by non-forest sources. The rest is accounted for by imports and supply from public forests, mainly forest plantations. India's official total roundwood production in 2003 was 296 million m^3, of which 277 million m^3 (94%) was fuelwood (FAO 2005b). Total production of tropical logs was an estimated 14.0 million m^3 in 1999 and 13.5 million m^3 in 2003 (ITTO 2004a, 2005). Tropical sawnwood production declined by an estimated 12% in the period 1999–2003, from 6.8 to 6.0 million m^3, while the production of tropical veneer jumped from 15,000 m^3 in 1999 to 246,000 m^3 in 2003, and tropical plywood from 300,000 m^3 to 1.76 million m^3 (ITTO 2004a, 2005).

India is the world's third-largest importer of (particularly tropical) logs, importing 2.69 million m^3 in 2003, up from to 1.98 million m^3 in 1999 (ITTO 2004a, 2005). These logs come mainly from Malaysia, Myanmar and, increasingly, from Africa. The value of imports of all primary forest-based products in 2003 was US$596 million, of which US$567 million was tropical (ITTO 2005). According to a recent report (ITTO 2004b), the Indian timber market is highly disorganized, reducing timber's competitiveness against substitute products.

Non-wood forest products. NWFPs such as bamboo (eg *Melocanna baccifera* – muli), thatching materials and medicinal plants are essential components of the livelihoods of many local communities. Some NWFPs, such as latex, bamboo, gums, sandalwood, resins and aroma chemicals, support value-added processing, niche marketing and export trade. NWFPs contribute over 75% of total forest export revenue in India and add significantly to the income of about 30% of rural people. Recently a national bamboo mission was launched to establish about 5 million hectares of bamboo plantations. A national medicinal plant board and state medicinal plant boards have been set up to promote the sustainable management and trade of medicinal plants.

Forest for protection

Soil and water. The federal government 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. Data on the extent of forests managed primarily for soil and water protection are not available.

Biological diversity. India is one of the twelve mega-biodiverse countries, hosting 7% of the world's biodiversity and supporting 16% of major forest types. Eighty-nine mammals, 83 birds, 26 reptiles, 66 amphibians and 247 plants are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species; of these, 56 mammals, 48 birds, one reptile, 62 amphibians and two plants are found in forests (IUCN 2004). Thirteen plants are listed in CITES Appendix I and 484 in Appendix II (CITES 2005).

Protective measures in production forests. India's 1988 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.

Extent of protected areas. Protected areas in India cover about 15.6 million hectares, comprising 83 national parks, 447 wildlife sanctuaries and 23 tiger reserves (Ahmed 1997). The condition of several protected areas is poor because of fire, grazing and inadequate management; most are not covered by management plans (MOEF 1999). The straying of some animals from protected areas – notably tigers, elephants and some grazing mammals – causes

Table 4 Management of the protection PFE ('000 hectares)

Total	Attributed to IUCN categories I–IV	Allocated for soil and water	With management plans	Sustainably managed
25,600	3,060	n.d.	n.d.	n.d.

tensions in communities living adjacent to such protected areas. According to UNEP-WCMC (2004), 3.06 million hectares of tropical forests are in protected areas that conform to IUCN protected-area categories I–IV, of which deciduous/semi-deciduous broadleaved forest accounts for 1.72 million hectares and lowland evergreen broadleaved rainforest 334,000 hectares.

Estimate of the area of forest sustainably managed for protection. Insufficient information was available to estimate the extent of the protection PFE managed sustainably.

Socioeconomic aspects

Economic aspects. Forestry's contribution to GDP fell from about 2.9% in 1981 to 1.7% in 1991 and to around 1% in 2001 (FSI 2003). This figure excludes the contributions of forest-based industries (which are counted under manufacturing). It is estimated that about 7.5 million people, mostly in rural and tribal settings, are in forest-related employment (ibid.).

The lack of a system of forest resource accounting is a major deficiency. For example, the value of forest-provided benefits – including wood products, fuelwood and charcoal, non-wood construction material, forest grazing and forest fodder, food and medicinal plants – was estimated to be US$43.8 billion annually in the 1990s (National Forestry Action Plan, reported in FSI 1999), against a reported GNP share of forestry of US$2.9 billion in 1993.

Livelihood values. About 400 million people in India live below the poverty line. Many live in mountain, upland and ecologically fragile areas, and forestry is often one of the main sources of employment and income. A new concept (initiated in the states of Madhya Pradesh and Chhattisgarh) is the 'people's protected area' (PPA). PPAs are based on a sustainable livelihood approach allied with biodiversity conservation and involve conservation and development combined with the non-destructive and sustainable harvesting of NWFPs.

Social relations. Local rights govern the use of forest resources by rural and tribal communities living in and near the 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 in people's participation and it has the support of the national forest policy. But the program has several constraints that call for attention. For example, a general complaint is that government officials still play an overpowering role in decision-making and their dominance in the governing bodies makes people's participation less effective (Saigal et al. 2002).

Summary

In India, state forest departments are custodians of the public forest resource and act as the forest authorities. Timber production is shifting away from natural forests, stimulating the development of community-based approaches. All forest states have set up forest development corporations, which are responsible for production within the public forest estate. Increasingly, some responsibilities for and benefits from the forests are being shared with local communities. For example, joint forest management, which usually involves an agreement between the forest department and a village to jointly protect and manage forest land, has become widespread. 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. However, several components of SFM are still missing, including an accurate inventory of resources, the classification of land by capability and function, efficient utilization and sustained investment.

Key points

- The estimated 39.1 million hectares of India's natural-forest PFE comprises 13.5 million hectares of production forest and 25.6 million hectares of protection forest. Not all of this PFE is tropical.
- There are also 32.6 million hectares of planted forest in the PFE.
- While there was a net positive change in the area of forest during the 1990s, natural forest continues to be lost or degraded.
- In production forests, India follows a system of preparation and periodic revision of working plans.
- Information on the extent and management of forests is fragmentary at best, and often unreliable.
- Nevertheless, it is estimated that at least 4.80 million hectares of natural-forest production PFE (tropical and non-tropical) are being managed sustainably; insufficient information was available to estimate the area of protection PFE so managed.
- The condition of several of the protected areas is poor because of fire, grazing and inadequate management.
- 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, increasingly, they depend on non-forest and external sources. The country has become a major importer of tropical timber, particularly logs.

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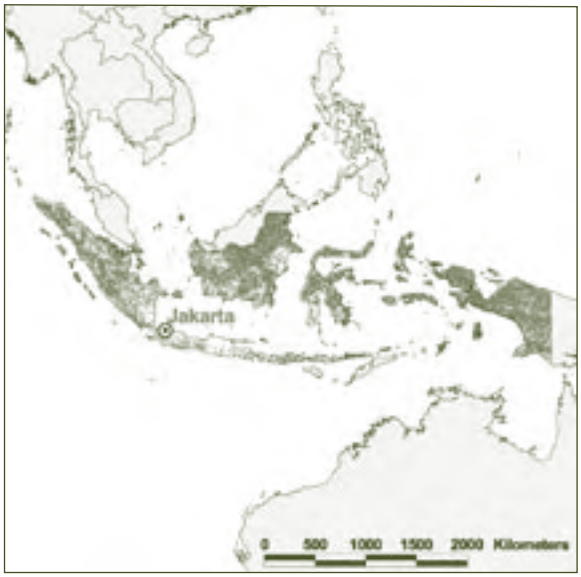
INDONESIA



*For legend see page 58

Forest resources

Indonesia is a 5,200-km-long chain of some 17,000 islands straddling the equator in the heart of Southeast Asia. Its 220 million people live on a land area of about 188 million hectares. Indonesia is very diverse in geology and biology and the home of many cultures. It also has a considerable range of climates, from equatorial – with rainfall evenly distributed throughout the year – in Kalimantan, Sumatra and West Irian, to those with a pronounced dry season (such as in Java and the Moluccas). Soils range from the rich volcanic soils of Java and Madura to the leached lateritic soils of Kalimantan. Equally varied are population densities, land-uses and forest practices. In Java, for example, with 950 persons per km^2, home gardens and trees outside forests supply a significant portion of wood demand. In Kalimantan, on the other hand, the population is sparser, and large-scale commercial forestry in natural forest is often the norm. Estimates of forest area range from 105 million hectares (FAO 2005a) to 120 million hectares[a]; given the political, social, economic and environmental changes that have taken place in Indonesia in recent years it is likely that both these over-estimate the current extent of forest in the country.

Forest types. About 88% of forest cover is classified as tropical moist forest. For the purposes of management, six types are distinguished: mixed hill forests, sub-montane/montane and alpine forests, savanna/bamboo/deciduous/monsoon forests, peat swamp forests, fresh water 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.

Dynamics of forest resource change. There has been a rapid loss of forest cover in the last 40 years; the average annual loss between 1990 and 2000 was an estimated 1.3 million hectares (1.2%) (FAO 2005a).

In the last 20 years, periodic serious fires have affected large areas of forest, especially in Kalimantan and parts of Sumatra. These have been 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.

Permanent forest estate. The forests of Indonesia have been classified by function as production, protection and conservation forests; forests earmarked for conversion are available for wood production until converted to other uses. About 44% of the forest area is reported to be production forest, 27% protection, 8% conversion and 21% conservation. According to official sources[a] (see also Chrystanto & Justianto 2002), the area of PFE is

Table 1 PFE

Estimated total forest area, range (million hectares)	Total closed natural forest ('000 hectares) Source: FAO 2001	PFE ('000 hectares)[d]			
		Production		Protection	Total
		Natural	Planted		
105–120	100,382	46,000	2,500	22,500	71,000

112.2 million hectares, comprising 109.7 million hectares of natural forests (protection forest 33.5 million hectares, conservation forest 20.5 million hectares and production forest 55.7 million hectares) and 2.5 million hectares of plantations. However, these figures are probably based on old records and represent the area allocated to the PFE but not necessarily the extent of forest within that area. Table 1 shows an ITTO estimate of the current PFE. An estimated 81% of the external boundaries of the official PFE have been demarcated[a].

Planted forests. The area of planted forests in 2000 was estimated by FAO (2001) to be about 6.4 million hectares, but only 2.5 million hectares of these appear to be productive timber plantations[a,b]. The total area is classified as: industrial forest plantations (*hutan tanamaan industri* – HTI), non-industrial (protective) forest plantations, social forestry, and enrichment planting. There are also plantations of agro-industrial crops that may become increasingly important in timber supply, including 3.48 million hectares of rubber (FAO 2001).

Institutional arrangements

Forest tenure. Article 5 of the 1999 Forest Law (see below) sets out two types of forest tenure: state and titled. A titled forest is a forest 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 of 1999. In the past, land settlement and the designation of forest were arbitrary, leaving unsettled a large number of claims by individuals and communities over traditional rights, ancestral domains and tenure.

SFM policy framework. Indonesia demonstrates its commitment to establishing SFM through its membership of many 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[a].

Forest policy and legislation. For many years, the legal and policy framework of Indonesia's forestry 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. It also provides for forestry decentralization and community participation. Other relevant policy and legal instruments include: Law No 5/1990 on the conservation of natural living resources and their ecosystems, Law No 24/1992 on spatial planning and Law No 23/1997 on environmental management. The Forest Strategic Plan (*Renstra*) (2001–2005) aims to: (i) improve the quality and productivity of the forest resource; (ii) reduce the rate of forest resource degradation; (iii) implement SFM; and (iv) increase the contribution of the forest resource to the national economy and to community prosperity.

In 2001, Indonesia established a working group to develop a national forest program. It has engaged in wide consultations but has not yet adopted a common program for the management and conservation of its forests.

Institutions involved in forests. Forest management is generally undertaken by private companies, although six state enterprises currently operate about 12% of the country's concession area. Before decentralization, the Ministry of Forestry (MoF) in Jakarta 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 MoF, coordinated all technical aspects of forestry in the provinces. At the district level there were also two agencies dealing with forestry; one was responsible to the district government and the other was a sub-office of the provincial forest service. This dual control system came to an end in 1999 with the enactment of laws 22 and 25; MoF now has a much reduced role in the field, and authority over forest management is vested in the provinces and particularly the districts (*kabupaten*). Several national-level departments also have a forestry role, such as the departments of trade and industry, agriculture, transmigration and forest settlement, and mines and energy. An Inter-departmental Committee on Forestry was established in October 2000 to coordinate long-term policy and planning.

Decentralization in forestry covers forest production, the servicing of forestry businesses and the protection of forests dedicated to ecosystem and

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

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), WWF Indonesia and the Association of Indonesian Forest Concessionaires, an industry body.

Status of forest management

Forest for production

All production forests within the PFE are covered by management plans[a]. However, efforts to manage these forests sustainably are undermined by (among other things) the large discrepancy between the timber requirements of the existing wood industry and the estimated sustainable timber supply. At a policy level, the national AAC was reduced from 22 million m^3 in the 1990s to 5.6 million m^3 in 2004, but much timber still comes from illegal sources[a,b]. Any reduction of timber production will further widen the divergence between timber supply and demand.

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 natural forests began to be harvested on a large scale in 1969 once the government began issuing forest concessions. Under the concession system, the management and extraction of public forest resources can be undertaken by state companies, companies owned by regional administrations, national private companies, cooperatives or foreign private companies with Indonesian legal status. The concession system is also used for raising and managing forest plantations (HTIs) and for other forestry enterprises. There are two categories of concessions for logging in natural forests: forest concession rights (*hak pengusahaan hutan* – HPH), and forest products collection rights *(hak pemungutan hasil hutan* – HPHH); the latter ceased to be issued after July 1989. HPH rights are for large concessions and run for periods of up to 20 years, recently increased to 55 years for natural forests and 100 years for plantations under Governmental Regulation No 34 (2002). After decentralization, HPHHs were revived in the form of log exploitation permits (*izin pemanfaatan kayu* – IPK). 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 based on 'supply-push'[b]. In 2001, there were 354 HPHs and 102 HTIs covering 39.3 million hectares[a].

In general, Indonesian forest management needs urgent strengthening. Many of the concessions do not have clearly demarcated boundaries, and forest fires, illegal land clearance and shifting cultivation are widespread. Illegal logging is now recognized as one of the most critical problems of forestry and the forest industry in Indonesia[a]; according to some reports, the volume of illegal logging exceeds legal production[b].

Under the concession system, the value of timber harvested by the concessionaires is realized by the government as stumpage/royalty and other charges or levies. For the whole of Indonesia the rent capture (often a reflection of efficiency) in logging concessions during 1997–98 was 24–36% (average 30%), leaving 64%–76% to the concessionaires[b]. Because log exports have been prohibited since 1985 and rough-sawn timber exports since 1992, the main avenue for timber companies to capture rent is through the export of plywood. The same top five companies that dominate in concession holdings have obtained a similar market share in the plywood factories.

Decentralization has tended to add to the confusion surrounding Indonesian forest management. For example, many local governments do not fully recognize nationally designated land-uses such as concession areas. Instances have been reported in which small-scale operators have been granted forest concessions that overlap concessions designated by the national government; moreover, the capacity of local government to administer forest policies is often limited (Rukmantara 2003).

Table 2 Some commonly harvested species for industrial roundwood (2001–03)[b,d]

Timber species	Remarks
Shorea spp (meranti)	Dipterocarpaceae, used for sawn timber and plywood
Dipterocarpus spp (keruing)	Dipterocarpaceae, used for sawn timber and plywood
Dryobalanops spp (kapur)	Dipterocarpaceae, used for sawn timber and plywood
Anisoptera spp (mersawa)	Dipterocarpaceae, used for sawn timber and plywood
Tectona grandis (teak)	From planted forests

Silviculture and species selection. Indonesia's forests contain about 4,000 tree species, 267 of which are traded[a]. The most important are trees of the Dipterocarpaceae family. Table 2 shows five of the most important harvested species; others include species of *Koompassia, Palaquium, Dyera, Calophyllum inophyllum* and *Octomeles sumatrana. Gonystylus bancanus* (ramin), a highly priced wood which was extensively logged in the past, is now listed in CITES Appendix II. The silvicultural system originally prescribed for logging in concession areas was 'Indonesian selective cutting' (*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 (eg residual stand inventory, post-harvest tending and enrichment planting)[b]. In 1989, MoF introduced the Indonesian Selective Cutting and Planting System (*Tebang Pilih Tanam Indonesia* – TPTI), which placed greater importance on natural regeneration and enrichment planting. A further modification, the Selective Cutting and Strip Planting System (*Tebang Pilih Tanam Jalur* – TPTJ), was introduced in the 1990s. It is thought that the TPTJ should be able to deliver both increased wood production and enhanced environmental conservation if properly implemented.

Planted forest and trees outside the forest. 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*. Many species are also planted in homesteads and farms.

There is an apparent discrepancy in information on the extent of concessions allocated in plantations. According to one source there were 176 approved HTI concessions in 2000 with a land allocation of 7.76 million hectares[b], while another reported that the 102 HTIs in 2001 covered an area of 2.50 million hectares[a]. The overall performance of HTIs has not been satisfactory, although of a higher standard in the case of pulpwood[b]. A recent evaluation of 65 HTIs recommended the continuation of only 30 (MoF 2003).

Forest certification. A system of timber certification has been developed through the Indonesian Ecolabelling Institute (*Lembaga Ekolobel Indonesia* – LEI). Established in 1993, LEI has devised C&I for the auditing of forest management in logging concessions and the ecolabelling of products from these concessions. LEI has also recently developed chain-of-custody certification and a log audit system in an effort to stamp out illegal logging and related irregularities. This system is to be implemented through accredited certification bodies. LEI has also developed C&I for planted forests, community-based forest management (CBFM) and 'legal origin verification'. In addition, LEI has developed a joint certification program (JCP) with the FSC. As of October 2005, an area of 274,598 hectares of mostly natural forest had been certified under JCP and the FSC (FSC 2005). Under the certification scheme for CBFM, two forests were certified as of October 2005 and three others were under assessment, although the area of forest covered by these was unreported[a]. One forest-based business (PT Uniseraya) had gained a chain-of-custody certificate under the LEI scheme and 29 under the FSC[a]. Certificates of legal origin verification, which use a log-tracking system to verify the source of timber, had been awarded to two companies in Riau[a].

Table 3 Management of the production PFE ('000 hectares)

Natural					Planted		
Total	Allocated to concessions/ under licence	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
46,000	43,200*	18,400	275	2,940	2,500	2,500	0.152

* 94% of production forests are allocated to concessions, although a considerable number of concessions were under suspension at the end of 2004

Estimate of the area of forest sustainably managed for production. MoF is undertaking a review of concessions and their compliance with the Indonesian C&I. During 2002–2004, 38 HPHs covering 4.20 million hectares were assessed and 25 of these covering 2.94 million hectares evaluated to have good to very good compliance; a further 53 HPHs were being assessed in 2005, but results were not available for this report (MoF 2005). To avoid possible double-counting, all the certified forest concessions are assumed here to be included in the figure of 2.94 million hectares and are therefore not added to the estimate of sustainably managed forest given in Table 3. The 98,000-hectare PT Hutanindo concession in Central Kalimantan, which is working with the Tropical Forest Trust (with ITTO support) to achieve a 'sustainable standard of forestry' and the 1.52-million-hectare Malinau (Bulungun) forest are considered to be well managed; however, these are also excluded from the estimate of sustainably managed forest in Table 3 because of the possibility of double-counting. If the assessment that 70% of concessions surveyed showed good to very good compliance to the Indonesian C&I was extrapolated to the entire production PFE, about 32 million hectares would be thus assessed.

Timber production and trade. Total wood production in 2003 was estimated to be about 120 million m^3, consisting of 34 million m^3 of industrial wood and 86 million m^3 of fuelwood (FAO 2005b). ITTO (2004, 2006 in prep.) gives the total industrial log production in 2003 as 25.0 million m^3, down from 33.2 million m^3 in 1999; however, the volume of illegal logging may exceed the official cut[b]. The annual area allocated for timber production is 367,450 hectares, comprising 252,780 hectares (69%) of natural forest and 114,670 hectares (31%) of plantations, contributing 85% and 15% respectively to log production[a].

In 2000, the wood-based industry contained 4,400 sawmills (installed capacity 19 million m^3), 120 plywood mills (installed capacity 11.1 million m^3), 39 particleboard mills, 102 blockboard mills, 13 chipmills, two MDF units, 81 pulp and paper mills (installed capacity 5.23 million tonnes of pulp and 9.12 million tonnes of paper), and a large number of secondary processing units[b]. The output of wood-based primary processing industries in 2003 was: wood residues – 388,000 m^3; sawnwood – 6.25 million m^3; wood-based panel products – 7.33 million m^3; wood pulp – 5.48 million tonnes; and paper and paperboard – 6.99 million tonnes (FAO 2005b). Indonesia is a net exporter of forest products. In 2003, the recorded export value of primary wood products (logs, sawnwood, veneer and plywood) alone was about US$1.8 billion, down from US$2.9 billion in 1999 (ITTO 2002, 2005). Exports are mainly directed towards Japan, Taiwan Province of China, China and South Korea; Japan is the main importer of Indonesian plywood. The wood-industry sector in Indonesia is undergoing restructuring. It suffers from over-capacity, a wood-supply deficit, unsustainable forest harvesting, a low level of capacity utilization, low efficiency and low competitiveness, among other problems[b].

Non-wood forest products. A wide range of NWFPs 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. One important forest service among many is carbon storage: the total carbon stored in the forests of Indonesia is estimated to be 92.5 billion tonnes[a].

Table 4 Management of the protection PFE ('000 hectares)

Total	Attributed to IUCN categories I–IV	Allocated for soil and water	With management plans	Sustainably managed
22,500	14,400	16,000	5,000[a]	1,360[d]

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. With about 1.3% of the earth's land surface, Indonesia contains an estimated 10% of the world's plant species, 12% of mammals, 16% of reptiles and amphibians, and 17% of birds. Some 58,175 species have been identified[a]. One hundred and forty-six mammals, 122 birds, 28 reptiles, 33 amphibians and 387 plants are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species; of these, 61 mammals, 113 birds, 31 amphibians and 16 plants are found in forests (IUCN 2004). Thirty plants are listed in CITES Appendix I and 1,023 in Appendix II (CITES 2005).

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 forest law and Decree No 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. Some 400 protected areas covering about 22.5 million hectares of forest (12.4% of land area) have been designated and gazetted as nature reserves, national parks, wildlife sanctuaries, forest parks, etc. Many of the protected areas are thought to be degraded, due largely to illegal activities[b]. According to UNEP-WCMC (2004), 14.4 million hectares of forest are in protected areas that conform to IUCN protected-area categories I–IV, including 4.05 million hectares of lowland evergreen broadleaved rainforest, 2.84 million hectares of upper montane forest, 2.13 million hectares of freshwater swamp forest, and a sizeable 3.03 million hectares of unclassified forest.

Estimate of the area of forest sustainably managed for protection. The management of the area of the protection PFE (Table 4) is, for the most part, problematic. Management plans have been prepared for the Betung Kerihun and Kayan Mentarang national parks on Borneo, which together cover about 2.18 million hectares of forest, and their management is being greatly strengthened under two ITTO projects implemented by WWF Indonesia and MOF's Directorate General of Forest Protection and Nature Conservation; a recent evaluation of the Kayan Mentarang project reported considerable progress and a positive outlook for the park. Management plans have also been prepared for some other national parks and efforts made to implement them (WWF Indonesia, pers. comm.). However, in general there is little information on the management status of the protection PFE. Therefore, the estimate given in Table 4, which comprises the Kayan Mentarang National Park only, is probably conservative[d].

Socioeconomic aspects

Economic aspects. Forests and forest industries make a substantial contribution to Indonesia's socioeconomic development. About 0.61% of the labour force (nearly 500,000 people) is directly employed in the forestry sector[a]. In 2000, forestry contributed 1.17% of GDP (about US$15 billion)[a], although this figure may not include the downstream-processing sector.

Livelihood values. An estimated 36 million people make use of forests and forestry for their livelihoods, some 4 million of whom are tribal families who depend entirely on natural forests for their income[a]. Rural poverty is an important cause of illegal logging and unsustainable use.

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

Summary

Indonesia's forest resource base is still vast, but it faces many threats that put its long-term sustainability in jeopardy. These include illegal logging; forest fires; deforestation through land encroachment; wasteful logging and processing; structural deficiencies and inefficiencies in forest industries; the indebtedness of forestry enterprises; unsettled land claims; inefficiencies in public forest administration, in particular in the process of decentralization; an inadequate base of human resources; inadequate monitoring and evaluation; and a lack of effective governance. On the other hand, significant progress has been made in the establishment of certification systems and information on the management of concessions is becoming increasingly available.

Key points

- The estimated 68.5 million hectares of Indonesia's natural-forest PFE comprises 46.0 million hectares of production forest and 22.5 million hectares of protection forest. There are also about 2.50 million hectares of productive timber plantations.
- The security and integrity of the PFE are affected by several factors, of which forest fire and encroachment are among the most important.
- Illegal logging in the PFE (both production and protection) is widely held to be a major problem.
- The Ministry of Forestry is undertaking a review of concessions and their compliance with the Indonesian C&I. This process has shed light on the status of management in the production PFE.
- It is estimated that at least 2.94 million hectares of natural-forest production PFE and 1.36 million hectares of protection PFE are being managed sustainably.
- Some 12% of the land area of Indonesia has been designated as protected areas. However, information on the management of a large part of the protection PFE is scarce.
- Forestry is undergoing a process of decentralization that has proven difficult partly because of a lack of capacity at the decentralized levels of administration and partly because of disharmony in the policies of central and local governments.
- C&I for SFM have been developed for the country and a certification regime designed. About 275,000 hectares have so far been certified.
- The prescriptions for the management of production forests are conceptually sound but implementation has been weak. Over-capacity and structural imbalances in the wood-processing sector have exacerbated the situation.

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MALAYSIA

*For legend see page 58

Status of forest resources

Malaysia has a land area of 32.9 million hectares and a population of about 25 million people. It is a federation of 13 states and comprises two distinct regions – Peninsular Malaysia, with eleven states, and the states of Sarawak and Sabah (East Malaysia) in Borneo. Estimates of the total natural forest area include 19.3 million hectares (FAO 2001) and 19.5 million hectares[a]. Sarawak is the most forested state, with 75% forest cover; Sabah has 60% and Peninsular Malaysia 45%. With the inclusion of tree crops such as rubber, oil palm and coconut, the percentage of tree cover in Malaysia is 75.5%[a].

Forest types. Malaysia's forests are generally moist tropical forests, those in the lowlands and lower parts of the hills being dominated by Dipterocarpaceae. Of the estimated 17.1 million hectares of dipterocarp forests, 5.40 million hectares are in Peninsular Malaysia, 7.92 million hectares in Sarawak and 3.83 million hectares in Sabah[a]. There are also 1.54 million hectares of peat swamp forest, 1.12 million hectares of which are in Sarawak. Mangrove forests cover about 567,000 hectares; more than half are in Sabah[a].

Dynamics of forest resource change. The average annual loss of forest during the 1990s was an estimated 237,000 hectares (1.2%) (FAO 2005), largely attributable to planned land-use change[a].

Wildfire damaged an estimated 164,000 hectares of forest in the five-year period to 2003; data on damage caused by encroachment, shifting agriculture or premature re-entry to logged areas were unavailable for this report[a].

Permanent forest estate. In 2003, the area of natural-forest PFE was 14.39 million hectares (44% of land area), comprising 3.21 million hectares (22.3%) of protection forest and 11.18 million hectares (77.8%) of production forest (Table 1). These forest lands are gazetted in accordance with the National Forest Act 1984 in Peninsular Malaysia and the relevant state forest ordinance/enactment in the states of Sabah and Sarawak. Peninsular Malaysia contains 4.85 million hectares (34%) of the PFE, Sabah 3.6 million hectares (25%) and Sarawak 6.0 million hectares (41%)[a]. The area of gazetted PFE increased from 12.6 million hectares in 1990 to 14.4 million hectares today[a]. Strong measures of surveillance, enforcement and deterrent punishment are in place to ensure the integrity and security of the PFE. Some 79% of the PFE boundaries have been surveyed and demarcated and are being maintained[a].

Planted forests. At the end of 2003, the total area of planted forest for marketable timber amounted to 263,000 hectares, of which 183,000 are inside the PFE[a]. There are also about 5.27 million

Table 1 PFE

Estimated total forest area, range (million hectares)	Total closed natural forest ('000 hectares) Source: FAO 2001	PFE ('000 hectares)[a]			
		Production		Protection	Total
		Natural	Planted		
19.3–19.5	19,148	11,200	183	3,210	14,593

hectares of commercial agricultural plantations – including oil palm, rubber, cocoa and coconut (MTC 2004). Many of these, especially rubber, are used for wood production in addition to agricultural use.

Institutional arrangements

Forest tenure. An estimated 98% of natural forest and 69.2% of forest plantations are state-owned; the remaining area is privately owned[a]. The special rights of indigenous communities are provided in the Aboriginal Peoples Act 1954. In Sarawak, forests cleared by native communities for agriculture before 1958 are recognized as Native Customary Rights Land.

SFM policy framework. A national forestry policy (NFP) was adopted in 1978 as a framework for SFM; this was revised in 1992 in response to growing concern for the conservation of biological diversity, the sustainable utilization 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.

Forest policy and legislation. Under the federal constitution, land-use falls within the jurisdiction of the states. Each state is empowered to enact laws, formulate its forest policy and manage its forests. The federal National Forestry Act (1984) establishes the general rules on forestry and each state is empowered to enact laws and regulations in line with those rules. The federal government also provides advice and technical assistance, maintains experimental stations and funds research and training. The National Forestry Council (NFC), established in 1971, serves as a forum for coordination between the federal and state governments to discuss and resolve 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 be dedicated as PFE; the permanent forests be managed in accordance with the principles of sound forest management; and the efficient harvesting and utilization of forest products and the development of forest industries be promoted.

The legislative framework is defined in the National Forestry Act (1984) and the Wood-based Industries Act (1984). The National Forestry Act was amended in 1993 to include more stringent penalties for certain forest offences, particularly illegal logging. Provision was also made for the police and armed forces to enforce the act. The National Forestry Act is adopted for implementation by all the states and is complemented by relevant laws dealing with land and water conservation, environmental quality, wildlife protection, the management of national parks, biodiversity conservation, and the rights of indigenous communities.

New incentives were introduced in 2002 and 2003 to attract investment by the private sector and encourage its greater involvement in SFM. These included: pioneer status to private plantation ventures with 100% exemption from income tax for ten years; incentives to concessionaires to carry out R&D and the development of human resources; a reduction in royalty rates for RIL, enrichment planting and fire management; and differential royalty rates for lesser-known species.

Institutions involved in forests. The forestry departments are responsible for the planning, management and administration of forest resources. The Forestry Department Headquarters, Peninsular Malaysia, is responsible for forestry-sector planning, forest management, forest development and operational studies, the provision of technical advice and services, and staff training. The 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 such as the Forest Research Institute of Malaysia (FRIM), the Malaysian Timber Industry Board (MTIB), the Malaysian Timber Certification Council (MTCC), and university forestry faculties.

Responsibility for forestry and timber at the federal level resided with the Ministry of Primary Industries until March 2004. Following the most recent general election, the Forestry Department, FRIM and the departments of Environment and Wildlife

were placed under the new Ministry of Natural Resources and Environment (NRE). Consequently, the implementation of the NFP, the National Policy on Biological Diversity (1998) and matters relating to the upstream activities of the forest sector are placed under the jurisdiction of NRE. Timber and other downstream activities of the sector, including processing, manufacturing, marketing, trade, exports and international cooperation (including ITTO) are under the responsibility of the Ministry of Plantation Industries and Commodities, which replaced the Ministry of Primary Industries. This division of responsibilities poses a coordination challenge.

Within each state the consultative committees at the village, *Mukim* and district levels strengthen the participation and involvement of local communities.

The public is well aware of the importance of wildlife and environmental quality. Stakeholders including environmental NGOs, social groups and forest-worker movements are active in forestry and forest-related initiatives. The forest industry is also strongly involved at both 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. The silvicultural and harvesting regulations for the different forest types specify the detailed steps to be followed. These include codes of forest practice, forest harvesting guidelines and standard road specifications. RIL and helicopter logging are being conducted with emphasis on reducing environmental impact and (for the latter) on timber harvesting in terrain and conditions that preclude ground-based systems; in Sabah some 2,000 personnel from both the Forestry Department and the private sector have received training in RIL operations[a]. Peninsular Malaysia has adopted a Forest Management Policy and Strategy, and Sarawak and Sabah have policies of managing their forests sustainably. Forest divisional management plans are regularly prepared to run for about 10–15 years.

At present, 14 million hectares, representing 73% of all forests in Malaysia, including all peat swamp forests, 81% of the inland forests and 23% of the mangrove forests, are covered by forest management plans (up from 2.5 million hectares in 1980)[a].

Forest management implementation. All timber harvesting and related management operations are carried out by contractors operating on the basis of either a long-term logging agreement or a short-term licence. Large concessions are normally granted under legally binding agreements. These concessions are often tied to wood-based industries and some of them cover periods of up to 30 years. Logging is controlled by the respective state forestry department through its local offices; a total of 8,344 forestry-related personnel were employed in the public sector in 2000[a]. Size limits, intensity of extraction, logging sequence, methods of treatment, transport routes, standards of road construction, etc are generally stipulated in the logging licences. In Sabah, new opportunities for joint activities between government and the private sector have been made possible through a recent initiative under which the state government established 27 FMUs to be managed sustainably. Each FMU is about 100,000 hectares in size and management agreements with private companies offer secure tenure for 100 years. The FMUs are generally in forests that have been logged or are being logged. The private sector is invited to participate in the management of these FMUs according to scientifically based management plans approved by the Sabah Forestry Department. Data on the total number of active logging concessions and their sizes were not made available for this report. The Matang mangrove forests in Peninsular Malaysia have been managed sustainably for more than 100 years.

Silviculture and species selection. The silvicultural system used for managing Malaysian dipterocarp 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 Selective Management System (SMS) was introduced in 1978 as logging moved into the hill dipterocarp forests and as advances in the technology of wood-processing rendered marketable many species that were previously not so. This allows harvesting to be carried out on a 25-year cycle; the minimum

Table 2 Some commonly harvested species for industrial roundwood (2001-2003)*

Timber species	Remarks
Shorea spp (meranti)	Used in sawmilling and plywood
Anisoptera spp (mersawa)	Used in sawmilling and plywood
Dipterocarpus spp (keruing)	Used in sawmilling and plywood
Dryobalanops spp (kapur)	Used in sawmilling and plywood
Hevea brasiliensis ('Malaysian oak')	From rubber plantations. Much is exported as finished products

* With the exception of *H. brasiliensis*, each of these is made up of a group of species with similar timber characteristics

cutting size prescribed is 60 cm diameter for dipterocarps and 45 cm for non-dipterocarps. Only merchantable trees (up to about ten trees per hectare) are allowed to be harvested. Post-harvest treatments concentrate on: (i) assessing the condition of the crop after logging; and (ii) measures for rehabilitation/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 50,000 hectares more had been enriched with native species.

More than 120 species are used for timber production. Besides those listed in Table 2 these include, from native forests, *Hopea* spp (merawan), *Gonystylus bancanus* (ramin), *Intsia palembanica* (merbau), kedondong (*Canarium* spp, *Santiria* spp), *Pterocarpus* spp (angsana), *Terminalia* spp (talisai), and, from planted forests, *Acacia mangium, Tectona grandis* (teak), *Toona ciliata* and *Gmelina arborea*.

Planted forest and trees outside the forest. The establishment of significant-sized forest plantations started in 1957 with teak, which was only successful in areas with a distinct dry season. Since then the program has been widened to include other fast-growing species such as *A. mangium, G. arborea, Paraserianthes falcataria, Eucalyptus deglupta*, *Pinus* spp and *Araucaria* spp. FAO (2001) estimated the area of plantations to be: *Acacia* – 180,000 hectares, *Eucalyptus* – 19,000 hectares, teak – 12,000 hectares, other broadleaved species – 12,000 hectares, and conifers – 47,000 hectares. In the past ten years, rubber has been planted for latex and timber, particularly in Peninsular Malaysia, and finished products of rubberwood have captured a lucrative export market. Rubber plantations are managed on a rotation of about 25 years; about 20,000 hectares are currently being replanted annually. In Sarawak, 1.0 million hectares have been set aside since 1998 as licences for planted forests for the development for forest plantations of exotic and native tree species. Trees are also widely planted in orchards, urban areas, recreational areas and along highways.

Forest certification. The MTCC was established as an independent body in 1998; it develops and implements standards for timber certification through multi-stakeholder consultations, establishes and implements a system to oversee and monitor the certification scheme, establishes networks and cooperates with other national and international bodies concerned with timber certification, and facilitates arrangements for mutual recognition. By 2004, the forests of eight states covering 4.67 million hectares in Peninsular Malaysia (including 171,000 hectares of plantations) and 60,000 hectares in Sarawak had been independently assessed and awarded the national certificate of forest management. Another 650,000 hectares are being examined for possible certification[a]. In addition, as of October 2005 the FSC had certified three FMUs totalling 77,242 hectares, of which 64,808 hectares are natural forests and 12,434 hectares are planted forests (FSC 2005). The MTCC is actively cooperating with the FSC and the PEFC to seek their endorsement.

Estimate of the area of forest sustainably managed for production. The entire PFE allocated for timber production is covered by forest management plans[a].

Table 3 Management of the production PFE ('000 hectares)

Natural					Planted		
Total	Allocated to concessions/ under licence	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
11,200	6,790[a]	11,200	4,620	4,790[d]	183	183	183

Of the harvested PFE, management guidelines were implemented on an estimated 3.96 million hectares in Sarawak and Peninsular Malaysia over the five-year period to 2001, although post-harvest surveys had been conducted on only 201,000 hectares of that area[a]. In the absence of a comprehensive evaluation of the extent to which such management plans are being implemented effectively, the area of natural-forest production PFE being managed sustainably is estimated to be at least 4.78 million hectares[d], corresponding to the total area certified by the MTCC and the FSC and the 162,000-hectare Bintulu Model Forest in Sarawak (Table 3).

Timber production and trade. Total Malaysian industrial log production was 21.5 million m^3 in 2003, down slightly from 22.2 million m^3 in 1999 (ITTO 2004, 2005); in 1990 the estimated total industrial log production was 39.1 million m^3 (ITTO 1995). Log exports fell from 6.74 million m^3 in 1999 to 5.47 million m^3 in 2003 (ITTO 2004, 2005), continuing the downward trend evident since 1990, when exports were an estimated 20.3 million m^3 (ITTO 1995). Sawnwood production fell from 5.24 million m^3 in 1999 to 4.77 million m^3 in 2003 (ITTO 2004, 2005).

The main wood-based industries are sawmilling, wood-based panel products, wood moulding and furniture manufacture. Others include secondary and tertiary processing industries such as timber treatment, the prefabrication of wooden houses, and furniture and parquet manufacture. The government aims to make Malaysia a major producer of high value-added, wood-based products in the world market. The supply of raw materials at competitive prices, relatively low labour costs and strong international prices have created favourable conditions for the growth of forest industries in Malaysia over the past ten years.

Malaysia earned US$2.47 billion from the export of primary wood products in 2003; plywood accounted for 43% of this, followed by sawnwood (27%) and logs (21%) (ITTO 2005). In the last few years, the average annual traded value (international and domestic) of all wood products has reached about US$4.5 billion[a]. The share of furniture and woodworking in international trade has also been increasing; it reportedly reached about 35% of the total of all forest product exports in 2002[a].

Non-wood forest products. Malaysia has given priority to the development of commercial NWFPs. Small-scale, rural-based industries using forest produce such as rattan and bamboo are common. Besides rattan and bamboo, marketed NWFPs include damar and copal gum, *Dyera costulata* (jelutong latex), nipah sugar, *Aquilaria* spp (gharu wood), illipe nuts and oil, and *Palaquium* spp (gutta percha). More recent is the development of aromatic plants, health products and medicines based on plant and animal species from natural forests.

Forest for protection

Soil and water. The forest area managed for the protection of soil and water is about 4.21 million hectares, or about 13% of the land area[a], of which about 3.21 million hectares fall within the PFE; this latter number comprises forest managed primarily for biodiversity and environmental conservation and is the total area of the protection PFE. No logging is allowed in sensitive and catchment areas.

Biological diversity. Malaysia is one of the twelve mega-diverse countries. It is estimated to have 12,500 species of flowering plants and more than 1,100 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

Table 4 Management of the protection PFE ('000 hectares)

Total	Attributed to IUCN categories I–IV	Allocated for soil and water	With management plans	Sustainably managed
3,210[a]	1,400[a]	3,210	3,210[d]	3,210[d]

than 300 freshwater fish and 1,200 butterflies. Of Malaysia's estimated 19,335 forest-dependent species, 72 mammals, 542 birds, seven amphibians and 29 butterflies are considered endangered[a]. Fifty-one mammals, 45 birds, 22 reptiles, 45 amphibians and 688 plants are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species; of these, 30 mammals, 42 birds, 45 amphibians and 15 plants are found in forests (IUCN 2004). Twenty-three plants are listed in CITES Appendix I and 889 in Appendix II, including ramin (CITES 2005). There are both *in situ* and *ex situ* conservation measures to protect endangered species.

Protective measures in production forests. In areas under selective logging, elaborate standards have been specified for the protection of water courses, construction of bridges and water crossings, establishment of stream buffers, and the alignment of skid trails, etc. The use of chemicals for the poison girdling of trees has been discontinued[a].

Extent of protected areas. Of the total PFE, 3.21 million hectares are classified as protection forest. Outside the PFE, other protected areas that have been gazetted/proposed as national parks and wildlife and bird sanctuaries contain forest amounting to an estimated 2.15 million hectares, making a potential total protected forest area of 5.36 million hectares (16.3% of Malaysia's total land area). According to UNEP-WCMC (2004) 1.40 million hectares of forest are in reserves classified in IUCN protected-area categories I–IV, including 730,900 hectares of lowland evergreen broadleaved rainforest, 174,000 hectares of lower montane forest and 29,600 hectares of freshwater swamp forest. Seven hundred thousand hectares of forest protected areas are located in Sarawak; the two largest areas are supported by ITTO projects (Lanjak-Entimau Wildlife Sanctuary with 187,000 hectares and the extended Pulong Tau National Park covering 165,000 hectares). The long-established 434,000-hectare Taman Negara National Park straddling the states of Pahang, Terengganu and Kelantan in Peninsular Malaysia is also worth citing. Additionally, there are 135 virgin jungle reserves with a total area of 115,000 hectares scattered within the PFE to preserve samples of the full range of forest types.

Estimate of the area of forest sustainably managed for protection. The area of protection PFE under sustainable management is estimated to be 3.21 million hectares (Table 4), the total area of protection PFE. Protected forest areas outside the PFE may also be so managed but data were not available for this report.

Socioeconomic aspects

Economic aspects. Forests and forest industries play an important role in the Malaysian economy, although there has recently been a decline in their contribution to GDP, from 5.3% in 1996 to 4.4% in 2000[a]. About 337,000 people (3.3% of the labour force) were directly employed in the forest-based sector in 2003[a], up from 177,000 in 1990. Much of this increase can be attributed to the expansion of the secondary processing industry.

Livelihood values. Forests are still important for the livelihoods of many indigenous communities, particularly tribal communities in Sarawak and Sabah. De Beer and McDermott (1996) estimated that about 700,000 people in Sarawak and Sabah obtained at least part of their livelihood from the forest; some Penan were still nomadic and almost entirely dependent on forest produce. The rights of indigenous communities for the subsistence use of forest products are officially recognized. Sago palm (*Eugeissona utilis* and *Metroxylon* spp), meat, fish, wild honey and mushrooms are regularly collected, as are medicinal plants, dart poison, birds' nests, rattan and bamboo.

Social relations. The rights of local people regarding the use of forest resources are recognized by the 1957 Land Code, the 1956 Land Ordinance and

other laws. Logging in forest areas claimed by indigenous communities has sometimes created conflicts between timber operators and local communities, particularly in Sarawak and particularly for the nomadic Penan people. These claims are being addressed through the legal system but remain one of the obstacles to mutual recognition between the MTCC and FSC certification schemes.

Summary

Malaysia's forests are generally well managed, although there are differences between Peninsular Malaysia, which has the strongest approach, and Sabah and Sarawak; however, all regional forestry administrations are committed to achieving SFM. The forest sector plays an important role in the Malaysian economy and is a significant employer. Already a major producer of value-added, wood-based products in the world market, this part of the sector is likely to continue to grow. A large part of its furniture manufacturing is based on rubberwood, which is grown in plantations, while much of the harvest from natural forests is still exported as plywood, sawnwood and logs. Well-organized and resourced forestry 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's PFE comprises 11.2 million hectares of natural production forest, 183,000 hectares of plantations and 3.21 million hectares of protection forest.
- At least 4.79 million hectares of natural-forest production PFE are estimated to be under SFM; the estimated area of protection PFE so managed is 3.21 million hectares.
- Deforestation within the PFE is insignificant, but there is degradation in some forest areas.
- Malaysia is a federation and forestry is under the jurisdiction of the states. Thus, the implementation of the national forest policy requires a cooperative approach by the state and federal authorities, which is done primarily through the National Forestry Council.
- At the federal level, the division of responsibilities between the Ministry of Natural Resources and Environment and the Ministry of Plantation Industries and Commodities poses a coordination challenge.
- Managing relations between indigenous communities and concession companies needs further attention.
- All timber harvesting and related management operations are carried out by contractors operating on the basis of either a long-term logging agreement (concession) or a short-term licence.
- In Sabah, FMUs of 100,000 hectares each have been established and 100-year forest management agreements offered to forestry companies.
- Certification of forest management is well advanced in Peninsular Malaysia and is expected to increase in Sabah and Sarawak.
- There is a well-established protected-area system in place covering 16.3% of the total land area. Nevertheless, there is a need to establish better coordination between the federal government and the states in wildlife management and environmental conservation.

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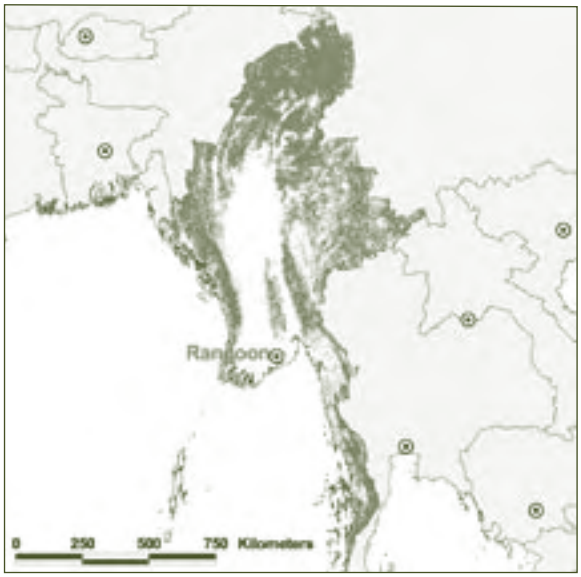
MYANMAR



*For legend see page 58

Forest resources

Myanmar has a land area of 67.7 million hectares and a population of 49.5 million people. It lies between India and Bangladesh to the west and Thailand and China to the east and stretches from a latitude of 7° north in the Kra Isthmus to 20° north and the peak of Hkakabo Razi (5,881 m) in the Himalayas. Rainfall varies from 500 to 5,000 mm and there is a marked dry season. The total forest area in Myanmar is estimated to be 34.4 million hectares ([a], FAO 2005a).

Forest types. Because of its wide geographical spread, Myanmar's forests are very varied. Important forest types are: evergreen (16% of total forest cover), mixed deciduous forest (40%), dry forest (10%), deciduous dipterocarp forest (5%), hill and temperate evergreen forest (26%) and tidal swamp forest (4%)[a]. Some of Myanmar's forests lie outside the tropics.

Dynamics of forest resource change. Myanmar lost an estimated 5.2 million hectares of forest between 1990 and 2000, an annual deforestation rate of 520,000 hectares (1.4%) (FAO 2005a). There has also been apparent degradation of remaining forests; the average volume of woody material in the growing stock fell from 145 m^3 per hectare in 1990 to 33 m^3 per hectare in 2000, and the quantity of above-ground biomass fell from 217 tonnes per hectare to 57 tonnes per hectare during the same period (FAO 2001).

Permanent forest estate. The natural-forest PFE comprises an estimated 13.0 million hectares (Table 1); 62% of the PFE's boundaries have been demarcated[a]. Within the PFE, 9.7 million hectares are designated as production forest, 8.3 million hectares being mixed deciduous and 1.4 million hectares evergreen forests[a].

Planted forests. The area of planted forests in 2000 was an estimated 710,000 hectares, 35% of which (291,000 hectares) was teak (*Tectona grandis*) (FAO 2001). Agro-industrial plantations include 110,000 hectares of rubber (*Hevea brasiliensis*) (ibid.).

Institutional arrangements

Forest tenure. All forests are owned by the state; nevertheless, private and communal tenure systems also exist (FAO 2001). They are designated as reserved forests and public or unclassified forests; commercial timber and non-timber products are extracted from both classes. 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".

Table 1 Tropical PFE

Estimated total forest area (million hectares)	Total closed natural tropical forest ('000 hectares) Source: derived from FAO 2001	PFE ('000 hectares)[a,*]			
		Production		Protection	Total
		Natural	Planted		
34.4	32,700	9,700	710	3,300	13,710

* Excludes Myanmar's non-tropical forest

SFM policy framework. Myanmar has undertaken some actions to define a framework for SFM. For example, it developed C&I for SFM in 1996 based on the ITTO C&I.

Forest policy and legislation. Myanmar, formerly known as Burma, 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 was in use until 1992, when a new forest law was promulgated; this emphasizes the importance of the participation of people in the conservation and sustainable utilization of forest resources. Other regulations such as the Forest Rules, 1995, and the National Code of Practice for Forest Harvesting, 1998, also help guide forest management. A new national forest policy was developed in 1995; it emphasizes the need to adopt SFM, establish protected areas for wildlife protection and biodiversity conservation, undertake sound land-use planning, privatize the wood-based industry, and promote people's participation and community forestry.

The mobilization of funds for forestry development is mainly the responsibility of government. Despite having a long-term national forest action plan and district forest management plans, few resources have been allocated to enable programs to be implemented. Official overseas development assistance is low: US$126 million in 2003 (UNDP 2005).

Institutions involved in forests. The Ministry of Forestry has the primary responsibility for implementing the forest policy, for the administration and management of the forestry sector and, since January 2005, for environmental protection (Global Witness 2005). The minister 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. Various government agencies and government-sponsored NGOs play a role in forest management: the Planning and Statistics Department; the Forest Department; the Myanmar Timber Enterprise (MTE); the Dry Zone Greening Department; the National Commission on Environment Affairs; the Forest Resource, Environment, Development and Conservation Association; the Forest Joint Venture Corporation Ltd; and the Timber Merchants' Association. 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. In January 1995, the government formed a privatization commission to oversee the process of privatization and to ensure its successful implementation.

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

Participation by civil society takes place through government-sponsored NGOs such as those listed above. Others, such as farmers' and women's income generation groups are being formed. This last initiative aims to benefit social well-being by raising off-farm incomes and helping advance SFM. International environmental NGOs are not active in Myanmar, nor are independent national advocacy NGOs.

Status of forest management

Forests for production

The total number of FMUs in Myanmar is 62, out 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[c]. 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 sometimes felled and extracted green. The Forest Department selects mature trees for harvesting while the MTE

Table 2 Some commonly harvested tropical timber species for industrial roundwood (2001–03)[a]

Timber species	Remarks
Tectona grandis (teak)	30–40% of logs produced
Xylia dolabriformis, X. kerri (pyinkado)	Associate of teak, found in varying proportions
Pterocarpus macrocarpus (padauk)	Associate of teak
Terminalia tomentosa (htauk kyant)	Associate of teak, found in varying proportions
Millettia pendula	From planted forests

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 elephants[a]; they have been shown to do less damage to the forest than machines, and wastage is less. Mechanical extraction is not favoured as it is not considered economically feasible under the Myanmar Selection System (see below); it 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.

The area harvested annually has, over the past five years, averaged about 411,000 hectares; 52% of logging areas are under management plans or harvesting schemes[a]. 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. At present, timber extraction is concentrated on only a few 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: timber theft and the illegal logging of trees for commercial use; the extension of pasture land and swidden agriculture; and over-harvesting for firewood and charcoal. The political situation in remote areas creates an environment that allows wasteful and unplanned logging and possible illegal cross-border trade. The Forest Department is undertaking remedial measures to conserve the natural forests – such as updating district-level forest management plans, surveys, boundary demarcation, fire protection, logging codes, forest reservation, and establishment of a PFE and community involvement, but lacks adequate resources, particularly to exercise control in remote areas (Global Witness 2003). Logging in Kachin state, on the border with China (and outside the tropics) has reportedly had serious environmental impacts (Global Witness 2005).

Silviculture and species selection. Silvicultural management of the natural forests dates back to 1856, when the Myanmar Selection System, a selection system for harvesting teak and other valuable hardwoods, was devised. If the prescriptions of this system were followed, trees of harvesting size would be marked selectively within the limits of the AAC calculated for each felling series according to the principles of sustained yield management. In accordance with the prescriptions of the system, various silvicultural treatments such as improvement felling, natural regeneration felling, thinnings in natural regeneration of teak, climber cutting, fire protection, etc are carried out in order to improve the naturally regenerating teak forests, protect the immature stock and assist it to attain a healthy maturity. 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 such tending is carried out is not reported[a].

Of 1,286 recorded tree species, 70 are commercially valuable (Global Witness 2005). In addition to the species listed in Table 2, commonly used timber

Table 3 Management of the production PFE ('000 hectares)

Natural					Planted		
Total	Allocated to concessions/ under licence	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
9,700	n.a.	9,700[a]	0	291*	710	0	0

* Semi-natural teak forests

species include *Adina cordifolia, Anogeissus* spp, *Bridelia retusa, Dalbergia oliveri, Dipterocarpus* spp, *Homalium tomentosum* and *Lagerstroemia flos-reginae.*

Planted forest and trees outside the forest. Myanmar has a long tradition of raising planted forests; teak plantations were introduced in 1856 under a *taungya* system, and teak remains the main planted species in commercial timber plantations. Other commercial planted species include: *Xylia kerri* (pyinkado), *Gmelina arborea*, *Pterocarpus macrocarpus* (padauk), pines, acacias and eucalypts. The annual forest plantation program is now fixed at around 37,000 hectares (Forest Department 1999); Myanmar's 1995 forest policy stipulates that natural forests will not be cleared to make way for plantations, only supplemented by them. Tree-planting on a moderate scale is done to enrich degraded forest areas and there is some planting to complement natural regeneration. Since 1997, joint-venture and foreign companies have been allowed to establish their own plantations to meet the needs of their industries (ibid.). Timber from farm trees, home gardens and rubber plantations is also important in domestic timber supply.

Forest certification. So far no forests have been certified in Myanmar. There is a committee for timber certification, but information on its status and activities was not available for this report.

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[a], but information on the extent to which these management plans are implemented was not available. In mid 2005, 470,000 hectares of FMUs were actively managed for timber production[c].

Insufficient information was available to estimate the area of natural-forest PFE being sustainably managed, but the 291,000 hectares of semi-natural planted teak that are considered to be so managed are treated as natural forest in Table 3.

Timber production and trade. Roundwood production in 2003 was an estimated 39.8 million m^3, of which 35.6 million m^3 (90%) was fuelwood (FAO 2005b). Production statistics indicate an increase in the harvesting of Myanmar's forests. ITTO (1999, 2004, 2006 in prep.) estimated the total industrial tropical log production in 2003 at 4.24 million m^3, up from 3.35 million m^3 in 1999 and 2.30 million m^3 in 1994. An estimated 1.0 million m^3 of sawnwood was produced in 2003, up from 298,000 m^3 in 1999. An estimated 1.28 million m^3 of logs were exported in 2003, up from 980,000 m^3 in 1999 and 602,000 m^3 in 1994 (ibid.). Major export destinations are China, Thailand and India (ITTO 2006 in prep.).

The value of Myanmar's exports of primary timber products amounted to US$345 million in 2003, of which logs contributed US$269 million (78%) (ITTO 2005). According to import data for China (ITTO 2003), 514,000 m^3 of tropical logs were imported from Myanmar in 2001, although Myanmar reported an export volume to China of 3,240 m^3 in the same year. Myanmar's policy is to reduce log exports gradually so as to promote downstream processing. However, due to a lack of infrastructure and appropriate technology, a complete ban on log exports is not likely for quite some time. Myanmar also exports downstream-processed, value-added products such as parquet and furniture.

Non-wood forest products. Many NWFPs are used locally and marketed. The most important are bamboo and rattan; others, such as cutch tree (extracted

Table 4 Management of the protection PFE ('000 hectares)

Total	Attributed to IUCN categories I–IV	Allocated for soil and water	With management plans	Sustainably managed
3,300[a]	195	6,560[a]	n.d.	n.d.

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[a].

Forest for protection

Soil and water. The estimated area of forest managed primarily for soil and water conservation is 6.56 million hectares[a]. The catchments of 123 dams are protected; tree-planting has been carried out in some of these to prevent land degradation[a]. Local people are involved in protection works.

Biological diversity. Myanmar is one of the most biologically diverse countries in mainland Southeast Asia, with 7,000 plant species, 1,347 large tree species, 96 bamboo species and 841 identified species of orchid (Forest Department 2000). Forty mammals, 49 birds, 26 reptiles and 38 plants are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species; of these, 26 mammals, 37 birds and one plant are found in forests (IUCN 2004). Nine plants are listed in CITES Appendix I and 182 in Appendix II (CITES 2005).

The 1992 forest law and the 1995 national forest policy both emphasize a balanced approach to conservation and development and highlight environmental and biodiversity conservation. Consequently the old Wildlife Protection Act (1936) was replaced by the Protection of Wildlife, Wild Plants and Natural Areas Law in June 1994 in order to carry out biodiversity and environmental conservation more effectively. Further, Myanmar Agenda 21 has incorporated *ex situ* and *in situ* measures to protect biodiversity, including endangered species of flora and fauna[a].

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

Extent of protected areas. The total area of protection PFE is an estimated 3.30 million hectares[a]. According to UNEP-WCMC (2004), 195,600 hectares of forest are in protected areas that conform to IUCN protected-area categories I–IV. The national forest policy has set a short-term goal of increasing the coverage of protected areas to 5% of the land area and a long-term goal of 10% (Global Witness 2005).

Estimate of the area of forest sustainably managed for protection. No details are available about the management status of the protection PFE (Table 4).

Socioeconomic aspects

Economic aspects. About 30,600 people are employed by the government in the forest sector, including 1,400 professionals and 29,200 technical staff. Of these staff, 11,000 are in the Forest Department, 19,300 in MTE and about 300 in the Dry Zone Greening Department[a]. Overall, some 500,000 people are thought to be dependent on the forestry sector for employment; the contribution of forestry to GDP was an estimated 1% in 1997–98[a].

Livelihood values. Some 38 million people are dependent on the forest for at least part of their livelihood; they have access to about 6.7 million hectares made available through the 'local supply working circle'[a].

Social relations. In order to promote and facilitate community participation in managing the forests, 'community forestry instructions' were issued in late 1995. These emphasized the management of forests by rural communities through the protection of natural forest and the establishment of forest nurseries and forest plantations so as 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. More than 259 agreements have been made between the Forest Department and social groups[a]. However,

community forestry has a number of problems – especially with regards to tenure and the security of agreements reached with government agencies. Cross-border illegal timber trade has reportedly fueled 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

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. Timber production almost doubled in the ten years to 2003, and the Forest Department lacks sufficient resources to fully implement the silvicultural system or enforce regulations, particularly in remote border areas. Community forestry also faces a number of challenges, such as the lack of decentralization in forestry administration. Nevertheless, about half the country is still forested and SFM remains within reach, given the surmounting of political, administrative and economic obstacles.

Key points

- Myanmar has an estimated 13.0 million hectares of natural tropical forest in its PFE, of which 9.70 million are designated for production and 3.30 million for protection. Myanmar also has about 710,000 hectares of planted forests, 35% of which are teak.
- Many of Myanmar's forests are becoming degraded, exacerbated by a lack of law enforcement, particularly in remote regions.
- At least 290,000 hectares of semi-natural teak forest in the production PFE are being managed sustainably, but insufficient information was available to assess the management of the bulk of the production PFE. Nor could an estimate be made of the extent to which the protection PFE is so managed.
- A well-tested silvicultural system exists for Myanmar's teak forests, but the extent to which it is being implemented is unclear.
- The Ministry of Forestry has primary responsibility for implementing the national forest policy, which was instituted in 1995.
- Some of the most significant obstacles in the way of implementing SFM are institutional. These include chronic budget shortages affecting the Forest Department, very limited private-sector involvement, insufficient well-trained personnel, and a lack of effective participatory processes.
- Total production of industrial roundwood was an estimated 4.24 million m^3 in 2003.
- Myanmar has established protected areas and prepared plans for expanding the protected area system and for improving biodiversity conservation, but no information was available on implementation.

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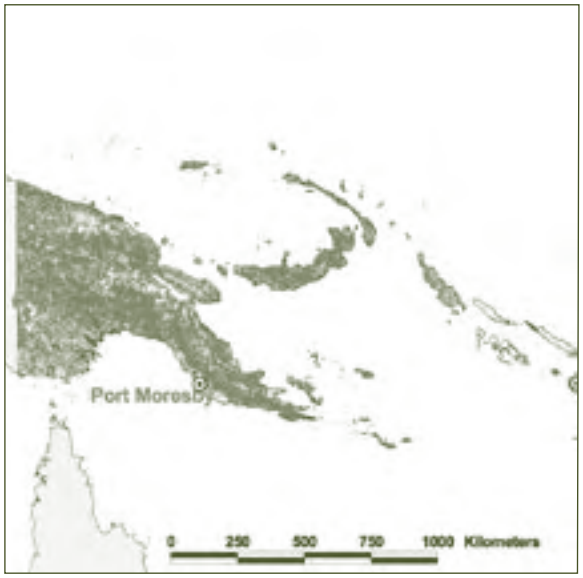
PAPUA NEW GUINEA



*For legend see page 58

Forest resources

Papua New Guinea (PNG) has a land area of 46.3 million hectares and a population of 5.5 million people. It 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; to the south it is separated from Australia by the Torres Strait. A spine of mountains, the Owen Stanley Range, runs east to west; the country's highest peak is Mt Wilhelm, rising to 4,510 m above sea level. On both sides of the mountain chain are fertile plains, flooded deltas, mangrove swamps and broad sandy beaches.

PNG's forest area was an estimated 30.6 million hectares in 2000, which is 67.6% of the total land area (FAO 2005a), evenly distributed across the country. PNG has the largest area of forest among the island countries of the South Pacific.

Forest types. The forests are varied, stretching from sea-level to the tree line at an altitude of over 4,000 m. Forests can be broadly classified into: rainforest (80%), moist forest (4%), savanna and woodland (5%) and montane forest (11%)[a]. The rainforests may be sub-divided into coastal, lowland and hill forests. Typical tree species are: in the coastal-littoral forests, *Terminalia* spp, *Melaleuca* spp and *Pterocarpus* spp; in the lowland rainforest, species of *Alstonia*, *Calophyllum* and *Pometia*; in the hill rainforests, species of *Canarium*, *Celtis* and *Hopea*; and in the mountains, species of *Araucaria*, *Agathis*, *Lithocarpus* (oaks) and *Nothofagus* (southern beech). Another important species is *Eucalyptus deglupta.*

Dynamics of forest resource change. Forest cover declined at an estimated annual rate of 113,000 hectares (0.4%) between 1990 and 2000 (FAO 2005a).

Permanent forest estate. The determination of a PFE is difficult under the customary land ownership that applies in PNG. The estimates given in Table 1 are based on the areas set aside by the government for timber development or reserved for protection[a].

Planted forests. The area of forest plantations at the end of 1999 was an estimated 58,000 hectares, comprising government plantations of 22,800 hectares and private plantations of 35,200 hectares (PNG Forest Authority 2002). Given that the present rate of planting is an estimated 4,000 hectares per year[a], the current total area might be about 80,000 hectares. There are also about 20,000 hectares of *Hevea brasiliensis* (rubber) (FAO 2001).

Table 1 PFE

Estimated total forest area (million hectares)	Total closed natural tropical forest ('000 hectares) Source: FAO 2001	PFE ('000 hectares)			
		Production		Protection	Total
		Natural	Planted		
30.6	30,150	8,700[a]	80[d]	1,700[a]	10,480

Institutional arrangements

Forest tenure. Customary land ownership is guaranteed by the PNG constitution and is the key factor influencing the use of the forest. Ninety-seven per cent of the land is held as communal or clan commons; there is also individual/private ownership of land. There are a large number of clans and tribes, speaking more than 800 languages. 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 actively in decisions concerning the management of their forest land.

SFM policy framework. PNG's national forest policy was approved in 1991. The country has also adopted ITTO's C&I as a monitoring tool for SFM.

Forest policy and legislation. The main objectives of the national forest policy are: (i) the management and protection of the nation's forest resources as a renewable natural asset; and (ii) the utilization of the nation's forest resources to achieve economic growth, employment, greater Papua New Guinean participation in industry, and increased viable onshore processing. Parallel to the development of this policy, the National Forests and Conservation Action Plan was prepared and officially approved in 1996. Three sub-policies linked to the national forest policy were released in 2003: an ecoforestry policy; a reforestation policy; and a downstream-processing policy.

The legal authority for the various recommendations of the national forest policy and the measures to achieve them are contained in the following instruments: the Forestry Act (1991, as amended in 2000); the National Forestry Development Guidelines (1993); 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 Forestry Plan (1996); Procedures for Exporting Logs (1996); and Forestry Regulation (1998). PNG has established a number of regulatory instruments to support SFM; there are, however, some 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).

Institutions involved in forests. The PNG Forest Authority was created in 1991 under the provisions of the Forestry Act. It succeeded the former Department of Forests, the 19 provincial forest divisions and the Forest Industry Council and was established as a statutory corporation with regulatory and administrative responsibility for the management of the forest sector throughout the country. In 2001, it had a total staff of over 600, including about 430 with diplomas or university degrees[a]. The Forest Authority comprises the National Forest Board (NFB) and the National Forest Service (NFS), and a number of regulatory and administrative responsibilities have been delegated to the provincial level. The Board operates through a system of specialist advisory committees and provincial forest management committees which are serviced by the NFS. The PNG Forest Research Institute is a specialized agency falling under the purview of the PNG Forest Authority. The PNG Forest Industries Association is an incorporated national association representing and promoting the interests of the PNG forest industry. Monitoring and surveillance of the log trade is carried out under contract by SGS of Switzerland. 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.

A 'landowner company' (LOC) concept was developed as part of the national forest policy in order to increase national participation in forestry. However, many of the LOCs have been plagued by mismanagement and in-fighting between different landowner factions, with the result that many have become alienated from the people they were supposed to represent. LOCs, as licence holders, contract foreign companies to conduct logging. It was expected that these companies would train the landowners and make them capable of running their own businesses, but such a development has not yet taken place. The main problems are the lack of education and business knowledge on the part of most landowners, difficulties in successfully structuring the LOCs due to the complex land tenure system, and the proliferation of landowner groups (Filer & Sekhran 1998).

A number of international NGOs (eg WWF, Conservation International, The Nature Conservancy) and national NGOs and religious bodies are active in the area of social welfare *vis-à-vis* forestry. 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 a forest management agreement (FMA) between the customary owners and the government. The National Forest Development Guidelines issued in 1993 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, subject to environmental protection standards, and with opportunities provided for meaningful participation by the customary owners, while maintaining future development options. 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 to the state or concessionaires the responsibility of forest management. 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. Through an FMA the PNG Forest Authority secures a commitment from the resource owners to follow recommended forest management practices while simultaneously offering investors access to the forest for a minimum of 35 years. Implementation may involve the state in issuing a timber permit, under which it manages the forest on behalf of the customary owners for the duration of the FMA. The management roles of the state, including timber harvest and construction of infrastructure, can be implemented through an investor with the consent of the customary owners through an FMA. Management responsibility can also be delegated to legally established LOCs. The FMA should specify the returns due to the landowner.

As of 2003, the PNG government had acquired timber rights from the customary owners for about 5.0 million hectares of forest (generally through 50-year timber lease arrangements)[a]. The rights acquired are normally allocated to foreign developers who have the necessary financial capabilities.

There are, however, concerns about the manner in which timber concessions are awarded and controlled, particularly about area approval, resource inventory, the determination of the appropriate cutting cycle, the management of fragile forests and conservation set-asides, and the treatment of landholder involvement[c]. It is difficult to ensure the integrity and security of the PFE, since landowning (and land-claiming) communities do not recognize rigid boundaries and controls. Local villagers are expanding their shifting cultivation into natural forest, including parts subjected to logging or opened up by the construction of new roads. All state-acquired timber concessions are supposed to be implemented according to RIL prescriptions, but post-harvest surveys have not been carried out in the majority of these forests, and the remoteness of many operations means that monitoring is often lacking[a]. In general, a lack of resources is constraining the achievement of SFM by limiting the extent of field visits that can be made for monitoring purposes and also by reducing staff in the Forest Authority and the Department of Conservation and Environment[a].

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

Table 2 Some commonly harvested species for industrial roundwood (2001–02)[c]

Timber species	Remarks
Pometia pinnata (taun)	The relative abundance of the species varies from locality to locality. No data are readily available about their relative importance at the national level.
Intsia bijuga (kwila)	
Eucalyptus deglupta	
Calophyllum spp	
Anisoptera thurifera	

before 1991 into line with the new requirements will require a substantial reduction in the permitted harvest levels and smaller projects to be consolidated into larger, economically sustainable projects.

The tropical forests of PNG consist of a heterogeneous mixture of some 200 tree species. Based on quality and market acceptability, these species have been categorized into four groups for fixing royalties and charges. In addition to those listed in Table 2, 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* (Table 2).

Planted forest and trees outside the forest. *Eucalyptus deglupta*, an indigenous species, is the main planted tree, along with *E. grandis, Acacia mangium, Tectona grandis, Terminalia brassii, Pinus caribaea, P. patula, Ochroma lagopus* and *Octomeles sumatrana*.

Forest certification. PNG has a national FSC working group and has developed national certification standards. The extent of FSC-certified forest area in PNG so far is one area of 19,215 hectares consisting of semi-natural and mixed plantation forest, and natural forest (FSC 2005).

Estimate of the area of forest sustainably managed for production. Management plans have been prepared for an estimated area of just under 5 million hectares of production forest[a], at least 1.5 million hectares of which are considered managed sustainably and are expected to undergo certification in the near future[c] (Table 3).

Timber production and trade. In 2003, PNG produced an estimated 7.2 million m^3 of roundwood, of which about 76% (5.5 million m^3) was fuelwood for domestic use (FAO 2005b). Total industrial tropical log production was an estimated 2.30 million m^3 in 2003, up from 2.10 million m^3 in 1999 (ITTO 2004, 2005) and well below the estimated sustainable yield[a] of 4.7 million m^3. The forest industry is predominantly based on log exports; an estimated 2.02 million m^3 of tropical logs were exported in 2003 (up from 1.98 million m^3 in 1999) (ITTO 2004, 2005), which makes PNG the world's second-largest exporter of tropical logs after Malaysia. PNG earned US$126 million in 2003 from exports of tropical timber, US$109 million of which were from logs (ITTO 2005).

The national forest policy anticipates increased domestic processing of forest products to create employment, facilitate the transfer of technology and promote the export of value-added products. However, little progress has been made so far in this regard. The principal export markets for logs in 2003 were China (62% of all log exports), Japan (20%) and Korea (9%) (ITTO 2005).

Non-wood forest products. The people of PNG make use of many NWFPs for their livelihoods and consume wild meat, wild tubers, medicinal plants and other produce on a daily basis. Butterflies, live birds, eagle wood, *Santalum* (sandalwood) and rattan products are important sources of local income. An average 13 tonnes of sandalwood are exported each year[a]. Despite the significant value of and community dependence on NWFPs, there appear to be no firm government policies towards them.

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

Table 3 Management of the production PFE ('000 hectares)

Natural					Planted		
Total	Allocated to concessions/ under licence	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
8,700	5,600	4,980[a]	19*	1,500[c]	80	n.d.	0*

* The single area of mixed semi-natural, plantation and natural forests has been counted as 'natural' here

soil resources, but these are not always strictly followed. 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 2,000 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). Fifty-eight mammals, 33 birds, ten reptiles, ten amphibians and 142 plants are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species; of these, 22 mammals, 29 birds, ten amphibians and one plant are found in forests (IUCN 2004). Seven plants are listed in CITES Appendix I and 254 in Appendix II (CITES 2005).

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 are 33 government-declared protected areas in wildlife management areas, national parks and nature reserves[a]. According to UNEP-WCMC (2004), 362,200 hectares of forest are in protected areas that conform to IUCN protected-area categories I–IV, including 322,000 hectares of lowland evergreen broadleaved rainforest.

Estimate of the area of forest sustainably managed for protection. Details are scanty about the system of protected areas and their condition. Insufficient information was available for an estimate to be made of the area of protection PFE managed sustainably.

Socioeconomic aspects

Economic aspects. Forestry contributed US$334 million to PNG's GDP in 2001[a], which was about 76% of total GDP. Recent information on employment provided by the forestry sector was not available for this report[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[a]. However, it has been observed 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).

Livelihood values. About 80% of the PNG population is rural and uses forests to meet 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 made available for this report.

Social relations. Customary landowners participate in the processes by which the Forest Authority purchases timber rights but are not much involved in the subsequent management and development of the resources[a]. The purchase of rights usually involves payments or royalties and levies to landowner groups, which 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[c].

Table 4 Management of the protection PFE ('000 hectares)

Total	Attributed to IUCN categories I–IV	Allocated for soil and water	With management plans	Managed sustainably
1,700	362	n.d.	n.d.	n.d.

Summary

Two-thirds of PNG is under forest cover and the official timber harvest is well below the estimated national sustainable timber yield. On average, each citizen has rights over about 6.4 hectares of forest. However, the majority of people still live in extreme poverty. The challenges are substantial if SFM is to be achieved. Key among them would appear to be: reducing the social and cultural disruption of logging; increasing the benefits to local development of forest management; and increasing the allocation of resources to the monitoring of logging activities and the implementation of forest policies at the national level.

Key points

- Customary land ownership is guaranteed by the PNG constitution and is the key factor influencing the use of the forests; 97% of the land is held as communal or clan commons.
- The determination of a PFE is difficult in PNG given its land-tenure system. Nevertheless, ITTO estimates that the country has about 10.5 million hectares of forest that might be considered permanent; these include 8.7 million hectares of forest over which timber rights have been acquired (production PFE), 1.7 million hectares allocated for protection and about 80,000 hectares of timber plantations.
- At least 1.5 million hectares of natural-forest production PFE are estimated to be managed sustainably. No estimate could be made of the extent to which the protection PFE is so managed.
- The PNG Forest Authority was established in 1991 by the Forestry Act as a statutory corporation with regulatory and administrative responsibility for the management of the country's forests.
- A 'landowner company' concept was developed as part of the 1979 national forest policy in order to increase national participation in forestry. However, this has not been wholly successful.
- PNG is a major exporter of tropical logs, shipping out an estimated 2.02 million m^3 in 2003 to China, Japan and other mostly Asian destinations.
- 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.
- Customary landowners participate in the processes by which the Forest Authority purchases timber rights but are not much involved in the subsequent management and development of the resources.

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PHILIPPINES

*For legend see page 58

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 and comprising over 7,000 islands. It has a land area of 30 million hectares and a population of 82 million people. Most of the land in the Philippines is mountainous; 53% of the country is classified as uplands, being 18% or more in slope. While close to 16 million hectares of the land is categorized as forest land, estimates of the actual forested area in the country include 5.4 million hectares[a], 5.79 million (FAO 2005) and 7.2 million hectares[a], of which 0.8 million hectares might be regarded as primary forest[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%). On the basis of vegetational characteristics, forests have been further classified as various types of dipterocarp forest (61%), mossy forest (18%), pine forest (5%) and others including beach forest and mangrove (15%)[a].

Dynamics of forest resource change. Deforestation occurred at an annual rate of about 316,000 hectares in the 1980s, caused by land conversion, shifting cultivation, forest fires and over-logging[a]. Deforestation decreased somewhat to about 89,000 hectares (1.4%) annually during the 1990s (FAO 2005). Much of the remaining forest is heavily fragmented.

The forests of the Philippines are subject to typhoons and other wind damage. Floods have caused widespread damage and large numbers of casualties in recent years. Regular fires occur in many forest areas.

Permanent forest estate. The country's land resources are classified into forest lands and alienable and disposable (A&D) lands. All lands in the public domain of 18% in slope or greater are classified as forest lands. The Department of Environment and Natural Resources (DENR) reported in 2005 that the extent of the PFE was 15.9 million hectares, comprising areas above the stipulated 18% slope limit; however, based on an interpretation of LANDSAT images from 2001–2003 only an estimated 6.24 million hectares of these are actually forested[a], including an estimated 1.54 million hectares in protected areas and about 4.7 million hectares in production forests (Table 1).

Under the present land classification system, the information available on forest land and A&D land is often confusing. Also, land statistics in the

Table 1 PFE

Estimated total forest area, range (million hectares)	Total closed natural forest ('000 hectares) Source: FAO 2001a	PFE ('000 hectares)			
		Production		Protection	Total
		Natural	Planted		
5.4–7.2	5,288	4,700	274	1,540	6,514

Philippines tend to be imprecise and changeable, as new ways of estimation supersede older ones. Most forests are found on forest land, 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 forest lands have slopes less than 18%. Loopholes in the existing system of land laws, the lack of demarcation of the PFE and other categories of land, and the status of extensive stretches of land as open access have affected the integrity and security of the forest. Forty-five per cent of the external boundaries of the PFE are reportedly demarcated[a].

Planted forests. No clear figures on the extent of planted forests are available; estimates range from 274,000 hectares[a] to 753,000 hectares (FAO 2005). An estimated 25,600 hectares were established in 2002, of which 4,900 hectares were planted by the private sector[b]. There are an estimated 97,000 hectares of rubber plantations (FAO 2001a).

Institutional arrangements

Forest tenure. The government holds title to a large part of the forest land; data on the actual extent were not available for this report. Considerable portions of the forests (excluding protected areas) are also held by the private sector, communities and people's organizations, and by indigenous people with various kinds of tenure. A 1995 Presidential Executive Order granted tenure and user rights over certain denuded forest lands and forests to communities; in recent years, the allocation of forest resource user rights has changed significantly (see 'Forest for production').

SFM policy framework. The 1987 constitution, which reflected a general reorientation of natural resource management policies in favour of co-production, installed CBFM as the main framework for forest resource management. Today, communities are the main implementers of SFM strategies and programs.

Forest policy and legislation. The foundation of forest policy is Presidential Decree 705 of 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 forest lands. The code was drawn up when the major thrust was on the massive commercial harvesting of the vast state-owned natural forests by large corporations. Now, the focus has shifted towards small-scale CBFM, covering planted forests as well as natural forests. The drafts of a new national land-use code and an SFM act have been due to be considered by the legislature for several years. The current code and subsequent laws and regulations have not been fully harmonized. Some recent forestry-related laws and administrative instructions include the Republic Act 7586/1992 on a National Integrated Protected Area System; Executive Order 263/1995 on Community-Based Forest Management as a National Strategy for Sustainable Development of the Country's Forests; the Indigenous People's Rights Act 1997 (Republic Act 8371); and Executive Order 318/2004 on Promoting Sustainable Forest Management in the Philippines (which provides guidelines on how to harmonize and implement forestry reforms).

A Master Plan for Forestry Development (MPFD) was prepared in 1990 but not really implemented. It was reviewed, revised and updated in 2003 with the support of UNDP/FAO. The government is now in a position to take appropriate action to implement the revised MPFD and create an environment to attract investment for forestry development.

Institutions involved in forests. DENR is the government agency responsible for the management of forests and protected areas. From 1904 to 1987, the Bureau of Forestry (BFD) was responsible under different departments. With the issue of Executive Order 192 of 1987, most regulatory functions of the BFD were devolved to field offices known as environment and natural resources offices (ENROs), and BFD became the Forest Management Bureau (FMB), a bureau of DENR with recommendatory powers. There are two other forestry-related bureaux within DENR: the Protected Areas and Wildlife Bureau and the Ecosystem Research and Development Bureau.

In respect to decentralization, the Philippines Local Government Code of 1991 conferred certain central government powers relating to taxation, budgeting, planning and management on local government units.

In forestry, DENR devolved some of its functions to the regional level and reassigned some 1,000 staff members to local authorities. DENR was also expected to transfer budgets, assets and records for the Department's devolved functions and programs, but there has been only limited progress in this regard (Ferguson & Chandrasekharan 2005).

Many elements of Philippine civil society participate in forest management and development. A number of international and national NGOs are involved in forestry, particularly in CBFM and environmental conservation. Some of the national NGOs involved in forestry are: Tanggol Kalikasan, the Philippines Association for Inter-cultural Development, HARIBON, and Environmental Science for Social Change.

Status of forest management

Forest for production

The administration of forest lands is principally the responsibility of the state. The private sector began to be involved in forestry in the late 1920s, extracting and exporting Philippine mahogany (dipterocarp species) worldwide. At the height of these operations in the 1970s, the private sector held more than two-thirds of the public forest lands for timber extraction in concessions.

No other Asia-Pacific country was deforested as extensively as the Philippines in the period after World War II. Even though timber licence agreements (TLAs), the system for allocating logging rights, stipulated that logging operations should be conducted according to a system of selective logging, and there were detailed guidelines for forest management, these 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 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[b].

The legal basis of the TLA system changed under the 1987 constitution, resulting in some dramatic reductions in the awarding of concessions. However, TLA holders were allowed to continue to operate until the expiry date indicated in the original agreement, subject to certain requirements. The policy implemented over the past 15 years has been to reduce, phase out or cancel the areas under TLAs 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. An important element in the new policies was the encouragement of private-sector participation in forest plantations. TPSAs then evolved into 'industrial forest management agreements' (IFMAs), 'socialized industrial forest management agreements' (SIFMAs) and community-based forest management agreements (CBFMAs), all of which encourage investment in maintaining the forest growing stock through a performance bond. These new instruments take into account the provisions of the Indigenous People's Rights Act, according to which indigenous people have the right to title over their ancestral lands. It also means that they have a say in the management of these lands. TLAs will all be phased out by 2006 and CBFM arrangements are becoming the norm.

Under CBFM, organized communities operate within allowable-cut limits set by the government. They harvest timber and other forest products to sell, use for their own needs, or process. The sale of timber, rattan, bamboo and other forest products has provided additional income for upland communities. As of December 2003, CBFM projects covered 5.97 million hectares (FMB 2005); the 13 active TLAs covered 544,000 hectares in February 2005. Forestland grazing management agreements covered 473,000 hectares in December 2003, SIFMAs 35,400 hectares and agroforestry lease agreements 147,000 hectares (ibid.).

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. Species from natural forests not listed in Table 2 but of commercial importance

Table 2 Some commonly harvested species for industrial roundwood (2001–03)[c]

Timber species	Remarks
Shorea squamata (mayapis)	Used in the sawmilling and plywood industries
Parashorea plicata (bagtikan)	Used in the sawmilling and plywood industries
Calophyllum spp (bitanghol)	Used in the sawmilling and plywood industries
Albizia falcataria	From secondary forest stands and planted forests
Gmelina arborea	From planted forests

include *Dipterocarpus grandiflorus* (apitong), *Cleistocalyx operculatus* (malaruhat), *Pterocarpus indicus* (narra), *Shorea polysperma* (tangile) and *Ficus nota* (tibig). Natural hardwoods are in short supply and plantation woods such as *Gmelina arborea, Eucalyptus* spp and *Acacia mangium*, along with imported timber, are increasingly being used.

Planted forest and trees outside the forest. Species most commonly used in plantations are *Eucalyptus* spp, which account for 25% of all plantations, and *Tectona grandis* (teak) (5%). Forest plantations include those developed by the government in regular reforestation projects, by communities in CBFM projects, 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 the plantations, but it is 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. An IFMA is a production-sharing contract entered into between DENR and a qualified applicant for a period of 25 years; the period may be renewed for another 25 years, consistent with the principle of sustainable development and in accordance with an approved comprehensive development and management plan. In December 2003, there were 201 IFMAs and industrial tree plantation lease agreements covering a total area of 714,000 hectares (FMB 2005). In addition, trees are raised in farms, homesteads, road margins and in agroforestry systems.

Forest certification. No forest in the Philippines is known to be independently certified as well managed.

Estimate of the area of forest sustainably managed for production. Given the uncertainties that the phasing out of TLAs is bringing, the extent of SFM is difficult to gauge. Certainly, some of the TLAs have been active for more than 30 years and the forests are now in their third cut, and some CBFM arrangements also show promise. The total area of PFE under management plans is 910,000 hectares[a]; 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 76,000 hectares, comprising a forest concession managed with ITTO assistance in Surigao del Sur.

Timber production and trade. The production of industrial roundwood in the Philippines peaked at 11.2 million m^3 in 1974 (FAO 2001b); in 1977 there were some 325 sawmills and 70 wood-based panel manufacturing units (ibid.). By 2003, tropical industrial roundwood production had fallen to 503,000 m^3 (ITTO 2005). Correspondingly, the number of processing units and their production has also fallen: in 2003 there were 31 active regular sawmills with an annual log requirement of 539,000 m^3 and 50 plywood and veneer manufacturing units (FMB 2005). Many of the functioning mills have retooled and modified their operations to suit present conditions. Sawmills and woodworking mills mostly rely on plantation wood of *Gmelina arborea, Eucalyptus deglupta, Albizia falcataria, Pinus radiata* and *Pinus caribaea.* The first three of these are mostly produced locally and the last two are mostly imported.

The Philippines imports a significant volume of timber – 356,000 m^3 of logs, 338,000 m^3 of sawnwood and 93,000 m^3 of veneer in 2003 (ITTO 2005).

Table 3 Management of the production PFE ('000 hectares)

Natural					Planted		
Total	Allocated to concessions/ under licence	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
4,700	n.d.*	910	0	76	274	274	0

* Recent and continuing changes in the forest allocation system mean that even recent figures may be out of date

Non-wood forest products. No reliable figures on the production and trade of NWFPs were available for this report. NWFPs produced and marketed in the Philippines include resins, tannin, honey, medicinal plants, bamboo, rattan, nipa shingles, *Agathis celebica* (almaciga), etc. The allowable cut for rattan was 21.0 million linear metres in 2003 (FMB 2005). Much raw material for the NWFP industry is imported from other Southeast Asian countries and is further processed in the Philippines.

Forest for protection

Soil and water. 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. The area of forest managed primarily for soil and water conservation is not known[a].

Biological diversity. The Philippines is rich in biodiversity, containing an estimated 24,300 forest-dependent species of mammals, birds, reptiles, amphibians and fish[a]. A total of 50 mammals, 72 birds, eight reptiles, 48 amphibians and 215 plants are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species; of these, 31 mammals, 65 birds, 48 amphibians and 21 plants are found in forests (IUCN 2004). Thirteen plants are listed in CITES Appendix I and 196 in Appendix II (CITES 2005).

Protective measures in production forests. Wood production from natural forests is progressively being reduced and efforts are being made to increase the area under planted forest.

Extent of protected areas. To conserve the diversity of ecosystems and species, 327 protected areas have been established with a total area of 6.85 million hectares (not all of which are forested)[a]. According to UNEP-WCMC (2004), 1.54 million hectares of forest are in protected areas that conform to IUCN protected-area categories I–IV, including 246,000 hectares of lowland evergreen broadleaved rainforest and 825,000 hectares of unclassified forest.

Estimate of the area of forest sustainably managed for protection. Insufficient data were available to estimate the area of the protection PFE being managed sustainably.

Socioeconomic aspects

Economic aspects. The contribution of the forest sector to GDP was 1.6% in 1975, 0.14% in 1999 and 0.05% in 2002[a]. An estimated 23,400 people are employed in forest-related government positions, 22,500 of whom have university degrees[a]; no reliable data on the total forest-sector workforce were available for this report.

Livelihood values. An estimated 18–20 million people are dependent on 7.2 million hectares of forest lands (not all of which are forested) for subsistence uses and traditional and customary lifestyles[a].

Social relations. Indigenous people play a crucial role in CBFM implementation in areas they claim as ancestral domain. DENR formulated guidelines and undertakes the identification, delineation and recognition of ancestral land and domain claims through Department Administrative Orders 93/02. DENR further provides specific guidelines on the management of certified ancestral domain claims. However, there remains considerable uncertainty about the future of all ongoing and new CBFM projects under indigenous peoples' tenure[a].

Table 4 Management of the protection PFE ('000 hectares)

Total	Attributed to IUCN categories I–IV	Allocated for soil and water	With management plans	Sustainably managed
1,540	1,540	n.d.	n.d.	n.d.

The Philippines has been experimenting with people's participation for more than 30 years. CBFM has now 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.

Summary

The Philippines has lost a substantial part of its natural forest, and timber production has declined dramatically over the last three decades. Many of the problems associated with the large-scale destruction of the forest resource can be linked to a combination of land and concession tenure issues, and the lack of ability or will to enforce the conditions of the concessions. Moreover, many of the rural poor did not have land tenure and often settled illegally on forest land. Considerable efforts have recently been put into the development of community forestry, but the success of this approach in restoring the country's degraded landscapes, particularly on steep slopes, and in increasing rural incomes, remains to be proven.

Key points

- An area of 15.9 million hectares has been defined legally as forest land (land with greater than 18% slope), but the estimated natural-forest PFE under actual forest cover is only about 6.24 million hectares, comprising 4.70 million hectares of production forest and 1.54 million hectares of protection forest. There are also an estimated 274,000 hectares of plantation.
- At least 76,000 hectares of natural-forest production PFE are estimated to be sustainably managed. No estimate could be made of the extent to which the protection PFE is so managed.
- While commercial-scale concessions (using what are called 'timber licence agreements' – TLAs) have been the main mechanism for allocating logging rights in the past, forest management is now being conducted largely under community-based approaches; TLAs will be completely phased out by 2006.
- The contribution of the industrial forest sector to the national economy has declined dramatically in recent years and stood at only 0.05% of GDP in 2002.
- On the other hand, an estimated 18–20 million people are dependent on forest lands (not necessarily forested) for subsistence uses and traditional and customary lifestyles.
- DENR is the government agency responsible for forest management and protected areas; a degree of administrative decentralization has been pursued in recent years.
- The Philippines is a net importer of timber.
- The Philippines has a large number of endangered species. In its protected-area network of 6.85 million hectares, the estimated extent of forests is 1.54 million hectares.

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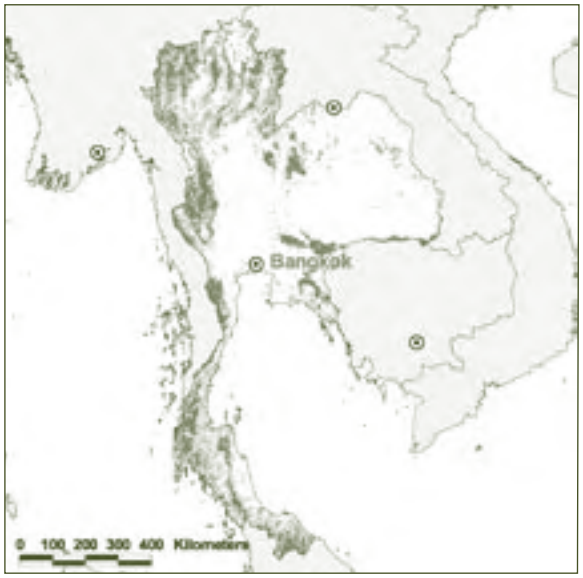
THAILAND



*For legend see page 58

Forest resources

The Kingdom of 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 of 63 million people. In the 1980s and 1990s, Thailand's economy was one of the fastest growing in the world, but this coincided with the rapid depletion of its natural resources. Estimates of forest cover range from 13.0 million hectares[a] to 14.8 million hectares (for 2000; FAO 2005a).

Forest types. The forests can be classified as: (i) evergreen forests with three sub-types – tropical rainforests, semi-evergreen forests and hill evergreen forests (43% of the forest area), dominated by species of the genera *Dipterocarpus*, *Hopea, Shorea, Lagerstroemia, Diospyros, Terminalia*, and *Artocarpus*; (ii) pine forests, mainly of *Pinus merkusii* (2%); (iii) mangrove and coastal forests (2%), the main mangrove genera being *Rhizophora, Avicennia* and *Bruguiera* and the main beach genera *Diospyros*, *Lagerstroemia* and *Casuarina*; (iv) mixed deciduous forest (22%), the dominant species being *Tectona grandis* (teak), *Xylia kerrii, Pterocarpus macrocarpus*, *Dalbergia* spp and *Afzelia xylocarpa*; and (v) dry dipterocarp forest (31%).

Dynamics of forest resource change. Forest covered over 60% of the land area in 1953, but by 2000 this had fallen to less than 30%. Between 1990 and 2000, the annual loss of forest cover was an estimated 112,000 hectares, a deforestation rate of 0.7% (FAO 2005a). Remaining forests are subject to a range of disturbances, including encroachment for agriculture, forest fires (an estimated 2.63 million hectares of mostly deciduous forest were affected by fire in the period 1996–2000[a]), refugees from neighbouring countries seeking living space, the development of infrastructure, and illegal logging.

Permanent forest estate. The area of PFE reported in 1991 was 23.5 million hectares, much of it already without forest cover. The most recent estimate suggests that this had shrunk by almost 50% to 13.0 million hectares in 2001[a], 1.15 million hectares of the original PFE having been converted to agriculture, 8.3 million hectares to settlements and infrastructure and 1.1 million hectares to other uses[a]. The balance now available comprises about 10.1 million hectares of closed forest (the estimated PFE given in Table 1) and 2.84 million hectares of open forest. The production forest is now mainly planted forest on government land.

Table 1 PFE

Estimated total forest area (million hectares)	Total closed natural tropical forest ('000 hectares) Source: FAO 2001	PFE ('000 hectares)[d]			
		Production		Protection	Total
		Natural	Planted		
13.0–14.8	10,127	0	1,870*	8,260	10,130

* Includes semi-natural planted teak

The security of the PFE in Thailand is somewhat problematic. The allocated areas keep changing, boundaries are not clearly demarcated and the land is subject to illegal occupation. The logging ban in 1989 (see 'forest policy and legislation') has not had the expected positive effect; it did little to limit environmental degradation (Pragtong 2000).

Planted forests. The total extent of planted forest in 2000 was an estimated 2.81 million hectares (FAO 2001); not all of this is in the PFE estimated in Table 1. In addition, there were about 2.1 million hectares of rubber plantations, an important source of timber (ibid.).

Institutional arrangements

Forest tenure. All forests in Thailand are owned by the state, although all trees established on private lands are private property. The 1997 constitution recognizes the right and duty of traditional and other local communities to participate in natural resource management, although without changes to forest-related legislation it is unclear what this means in practice for forest management. There is an ongoing debate in Thailand about the rights of traditional and other local communities to access forests, including in protected areas. Rural people dependent on the forest and forest land have the right to collect certain NWFPs for their consumption and rural trade[a]. Some 'disturbed' state forests are available for long-term rent at a low charge for growing crops or planting trees[a].

SFM policy framework. In the strict sense, there is no framework for SFM in Thailand, even though the country formally subscribes to the overall concept. Production forestry is concentrated in teak and rubber plantations and, for the time being, there is no comprehensive scheme to restore degraded forests to economic use.

Forest policy and legislation. Thai forestry is regulated by a number of legislative instruments: the National Forest Act of 1941, the Wildlife Preservation and Protection Act of 1960, the National Parks Act of 1961, the National Reserved Forests Act of 1964 and the Forest Plantation Act of 1992. A draft Community Forestry Bill has been under development and debate in Thailand for more than a decade, but as of September 2005 had not passed into law.

The national forest policy has been revised periodically, changing its focus to suit changing situations. The 1941 policy focused on timber production and dealt solely with the management 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. With the imposition of the logging ban in 1989 the focus of forestry moved clearly towards conservation. The present forest policy was adopted in 1997, based on suggestions contained in the forest-sector master plan, which was completed in 1995. Reforestation and afforestation were seen as important initiatives for the future supply of wood. Implementation of the plan has, however, been hindered by several constraints, mostly institutional.

Institutions involved in forests. The Royal Forest Department (RFD) was established in 1896 as the sole agency for the administration and management of forest resources. The RFD is also responsible for the training of field staff and for forestry research. In 2003, the RFD had five technical bureaux, seven administrative divisions, 21 regional offices, 76 provincial forestry offices and 530 district forestry offices[a]. However, with recent changes in the focus of policy and the decentralization of forest administration (see below), the structure of the RFD has been rationalized. For example, the Forest Management Division, which was responsible for preparing timber harvesting plans, has been dissolved.

The 1997 constitution provides for the decentralization of federal powers and functions to local governments. The 1992 Tambon (local) Administration Act also gives greater roles to local administrations. Accordingly, tambon administrations will manage forests within their territories. Mechanisms for decentralization will include: community forest and buffer-zone management; small-scale forest plantations; and local responsibility for forest and forest-fire protection. Achieving a balance between the roles and functions of the RFD at the various levels and the tambon administrations represents a significant challenge.

Civil society was influential in the decision of the government to ban commercial logging in 1989 in the wake of destructive floods which occurred in the southern region of the country. In 1997, civil

Table 2 Some commonly harvested species for industrial roundwood (2001–03)[d]

Timber species	Remarks
Hevea brasiliensis (rubberwood)	Used in furniture manufacturing
Tectona grandis (teak)	Expensive cabinet wood
Eucalyptus spp	Cheaper utility wood
Acacia spp	Cheaper utility wood
Pinus merkusii	Medium-quality timber

society was also closely involved in the revision of the constitution, which expressed as a fundamental state policy the recognition of the rights of communities to participate in natural resource management (Contreras 2002). The Thailand Environment Institute, established in 1993, is the main domestic NGO that focuses on environmental management.

Status of forest management

Forest for production

In the past, Thailand followed a scientific approach to natural forest management under the prescriptions of forest management (working) plans, adequately supported by forest inventories. The last such inventory was undertaken in 1975. 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. However, the working plan system was discontinued when Thailand banned commercial logging in 1989.

In the period 1960–1988, timber harvesting was carried out through timber concessions under the principle of harvesting yield control. More than 500 concessions were issued, covering about half the country; under this system the forests were over-harvested and residual forest stands badly damaged. After disastrous flash floods in 1988 in Nakomsithammarat Province, in which several villages were completely destroyed, the government banned logging in natural forests and cancelled all concessions. Despite the logging ban, however, the forests remained accessible and forest clearance and encroachment became widespread. In 1995, it was estimated that there were about 10 million people living on state forest lands; these lands were subsequently allotted to the squatters (Nalampoon 2002). In 1996, the government of Thailand also revoked all logging licences in mangrove forests to reduce their destruction. Today, there is no official logging in natural forest; nevertheless, illegal tree-cutting remains a problem[a], as does encroachment; for example, an estimated 77,000 hectares were encroached upon, presumably by settlers, in the period 1993–98[a].

Silviculture and species selection. Silvicultural management was started in Thailand in the early part of the last century. Different silvicultural systems such as selection, shelterwood, coppice with standards and modified coppice were tried and adopted as appropriate.

The pattern of wood use has changed over the last few decades. During the period of the logging concessions, 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%)[a]. Now, plantation species have taken the place of all but teak (Table 2), which is derived from 'semi-natural' forest.

Planted forest and trees outside the forest. The RFD began planting teak in 1906 on an area of less than one hectare. By 1980, the annual area planted was about 160,000 hectares, under the *taungya* system. The state enterprises (Forest

Table 3 Management of the production PFE ('000 hectares)

Natural					Planted		
Total	Allocated to concessions/ under licence	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
0	n.a.	n.a.	n.a.	n.a.	1,870	250*	1

* Semi-natural planted teak forests

Industry Organisation and 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. Through this project, private owners of plantations were to receive a subsidy from the government. In 2000, the areas of plantation species were: teak – 836,000 hectares; *Eucalyptus* spp – 443,000 hectares; *Acacia mangium* and other *Acacia* spp – 148,000 hectares; other broadleaved species – 541,000 hectares; *Pinus merkusii* and other *Pinus* spp – 689,000 hectares; and other conifers – 148,000 hectares (FAO 2001). But perhaps the most important plantation species for the timber industry is *Hevea brasiliensis* (rubber); the country's large estate of this species, planted originally for its rubber latex, has increasingly been harvested for its timber. Timber from agroforestry plots, home gardens, avenue trees and farm trees is of increasing importance in Thailand.

Forest certification. Legal forest production is based on non-forest sources and planted forest; thus there is no natural forest certified in Thailand. As of October 2005, one planted forest of 921 hectares had been certified by the FSC (FSC 2005).

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; semi-natural planted teak forests in which timber production is possible are treated as planted forests in Table 3.

Timber production and trade. Industrial roundwood production (a large part of it rubberwood) grew from 4.98 million m^3 in 1999 to 7.80 million m^3 in 2003 (ITTO 2004, 2005); total roundwood production, including for fuelwood, was 27.9 million m^3 in 2003 (FAO 2005b). Sawnwood production increased dramatically from 147,000 m^3 in 1999 to 2.29 million m^3 in 2003, and veneer also grew rapidly, from 3,000 to 160,000 m^3; plywood production increased more sedately over the period, from 82,000 to 90,000 m^3 (ITTO 2004, 2005). Thailand's downstream processing, particularly furniture and joinery, is also thriving.

Thailand is a net importer of primary wood products. Log imports were about 380,000 m^3 in 2003, down from 466,000 in 1999; sawnwood imports were 1.65 million m^3 in 2003 (ITTO 2004, 2005). Thailand also exported about 1.51 million m^3 of rubberwood sawnwood in 2002 (ITTO 2005).

Non-wood forest products. Rattan and bamboo are the most important marketed NWFPs, but pine resin, lac and medicinal plants also have considerable commercial value. The RFD maintains some 102 forest recreation sites, attracting an estimated 16 million visitors per year[a].

Forest for protection

Soil and water. Since 1965, the RFD's Watershed Management Division has taken measures to rehabilitate degraded steep lands in watersheds through tree-planting and the establishment of forest villages. Catchment areas have been divided into five classes based on the level of protection needed; Class I areas are to be put under strict control. The forest area managed primarily for the protection of soil and water is estimated to be about 9.32 million hectares[a]. However, controlling

Table 4 Management of the protection PFE ('000 hectares)

Total	Attributed to IUCN categories I–IV	Allocated for soil and water	With management plans	Sustainably managed
8,260	5,450	9,320	n.d.	522[d]

encroachment and other human activities to ensure compliance with existing laws and regulations relating to soil and water conservation is proving almost impossible[a].

Biological diversity. Thailand has at least 1,190 tree species, 9,440 flowering plants, 591 ferns, 292 mammals, 962 birds and 123 amphibians[a]. Thirty-eight mammals, 50 birds, 22 reptiles, three amphibians and 88 plants are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species; of these, 26 mammals, 40 birds, three amphibians and one plant are found in forests (IUCN 2004). Fifteen plants are listed in CITES Appendix I and 279 in Appendix II (CITES 2005).

Protective measures in production forests. As there is no timber production in natural forests, all forests are considered as protection forests, although many are still harvested for NWFPs for local consumption[a]. In mid 2002, the RFD introduced a new ecosystem management plan for the 1.8-million-hectare Western Forestry Complex that prescribes protective measures to sustain forest ecosystems.

Extent of protected areas. Thailand has a well-established system of 349 protected areas covering a total area of 8.25 million hectares[a]. According to UNEP-WCMC (2004), 5.45 million hectares of forest are in protected areas that conform to IUCN protected-area categories I–IV, including 2.04 million hectares of semi-evergreen moist broadleaved forest, 1.63 million hectares of deciduous and semi-deciduous broadleaved forest, and 627,000 hectares of lower montane forest. However, Thailand's protected-area system is fragmented (ICEM 2003), and some areas may be too small to sustain their flora and fauna, particularly large mammals.

Estimate of the area of the forest sustainably managed for protection. Five-year management plans are being produced for all gazetted national parks and wildlife sanctuaries. By 1999, more than 30 national parks and about 20 wildlife sanctuaries had approved management plans (ICEM 2003). However, clear data on the status of management in a large part of the protection PFE are not available. ITTO is providing support for the management of the Phatam Protected Forests Complex in northeast Thailand and to initiate cooperation in transboundary biodiversity conservation between Thailand, Cambodia and Laos. The project extends over an area of 174,000 hectares covering four protected areas. Another ITTO project supports the development of the buffer zone of the 348,000-hectare Kaeng Krachan National Park using participatory approaches. These areas are thought to be managed sustainably.

Socioeconomic aspects

Economic aspects. The decrease in forest production over the past 20 years has reduced the contribution of forestry to GDP to about 0.1%[a]. However, the wood-processing sector has been increasing production in recent years using timber obtained mostly from plantations, non-forest sources and imports; illegal logging contributes an unknown percentage of the timber supply. Employment figures in the forest sector are not available[a]. Tourism is the country's primary source of foreign exchange, and, no doubt, protected forests are a significant attraction.

Livelihood values. An estimated 10 million forest-dwelling and rural communities are dependent on about 2.6 million hectares of forests for subsistence uses and traditional and customary lifestyles[a], making use of NWFPs such as edible plants, wild fruits, wild meat, mushrooms and honey.

Social relations. The enactment of the Community Forest Bill would help community forestry to gain new prominence in Thailand and could help resolve conflicts between the national forestry administration and local communities. However, the long-running debate over the draft bill illustrates its contentious nature.

Summary

Forestry in Thailand is constrained by several factors. Coincident with Thailand's rapid economic growth in the 1980s and 1990s, its forest resources became severely depleted. Logging in natural forests has been banned, but the forests remain under pressure from encroachment, illegal logging, fire and other agents. The Royal Forest Department, the government agency responsible for forests, has a long history of forest management and remains reasonably well resourced. Plantations, especially of rubberwood, and imports are now supplying the country's thriving downstream-processing timber industry. The huge importance of tourism to the Thai economy provides an excellent incentive for strong measures to improve forest protection.

Key points

- The PFE is estimated to be 10.1 million hectares, of which 1.87 million is production PFE (all plantations) and 8.26 million protection PFE.
- An estimated 50% of the reported PFE in 1991 has been converted to agriculture, settlements and other uses.
- A logging ban has been in place in natural forests since 1989, after disastrous flash floods; however, it has not been sufficient to stop forest loss and degradation.
- Illegal tree-cutting in natural forests remains a problem.
- At least 522,000 hectares of protection PFE are being managed sustainably, but generally little information is available on the status of management in forested protected areas.
- Forests are owned by the state. There is an ongoing debate in Thailand about the rights of traditional and local communities to use and manage forests, including in protected areas.
- A draft Community Forestry bill has been under development and debate in Thailand for more than a decade.
- Timber production in Thailand has shifted from natural forests to planted forests, particularly teak and rubberwood, and non-forest sources of wood, supplemented by imports.

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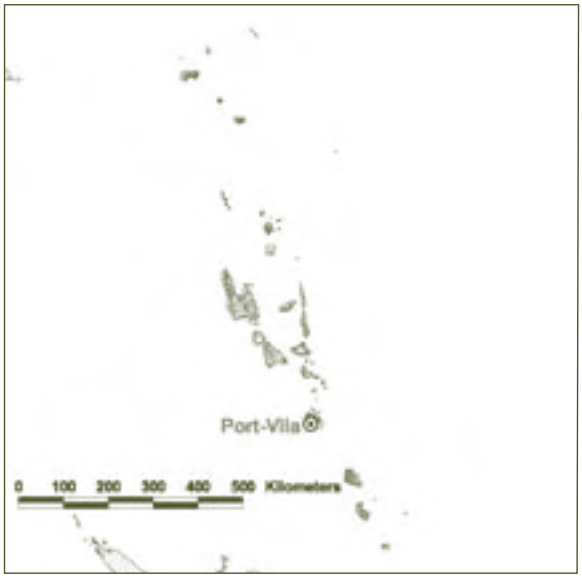
VANUATU



*For legend see page 58

Forest resources

Vanuatu has a land area of 1.21 million hectares across about 80 islands and a population of about 200,000 people. It lies approximately 170 km to the southeast of the southernmost island of the Solomon Islands and about 800 km west of Fiji. The four main islands of Santo, Efate, Malekula and Erromango generally consist of a narrow coastal plain rising through broken foothills to a steep mountainous interior. The majority of the rural population (about 80% of the total) lives in a subsistence economy. The land has not yet been classified according to function or land capability. The area of natural forests and other wooded land is an estimated 902,000 hectares (74% of the land area)[a].

Forest types. A national forest inventory, completed in 1990, estimated that forests and other wooded areas comprised 205,000 hectares of mid-to-high forest, 239,000 hectares of low forest and 2,500 hectares of mangroves; the rest were thickets (434,000 hectares), scrub (45,000 hectares) and woodland (380 hectares). The mid-to-high forest (canopy height ranging from 20–30 m) and low forest (ranging in height from 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*.

Dynamics of forest resource change. Despite reported agricultural expansion, FAO (2005a) estimated that Vanuatu's forest area increased slightly in the 1990s.

Vanuatu is subject to frequent cyclones; on average, at least one severe cyclone causing significant forest damage occurs every five years. These open up large gaps in the forest canopy and allow the invasion of the vine *Merremia.*

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 figures given in Table 1 show the area of forest that could possibly comprise a PFE in the future.

Planted forests. The area of planted forest in Vanuatu is about 2,100 hectares[a,d], including about 300 hectares of privately owned *Endospermum*

Table 1 PFE*

Estimated total forest area (million hectares)	Total closed natural tropical forest ('000 hectares) Source: FAO 2001	PFE ('000 hectares)[a,d]			
		Production		Protection	Total
		Natural	Planted		
0.902	442	117	2.10	8.37	127

* Possible components of a future PFE

medullosum. The annual planting rate in Vanuatu 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 in Vanuatu.

Institutional arrangements

Forest tenure. In Vanuatu, all lands, including forest lands, are customarily owned. The land may be owned communally, usually by clans (extended family units), or individually[a].

SFM policy framework. Article 7(d) of the 1979 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". This is echoed in the 1997 national forest policy, the principle goal of which is to ensure the sustainable management of Vanuatu's forests to achieve greater social and economic benefits for current and future generations. The ITTO C&I have been adopted as a monitoring tool, and training has been provided.

Forest policy and legislation. In 1991, the government instituted the National Forest Programme, 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 each 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[a]. It also makes specific recommendations on the management of forests in the different island groups. The policy defines a series of objectives, measures and strategies for implementation under nine major headings: forest management, environment and conservation, landowners and communities, forest industries, afforestation and extension, forest research, forest training and education, forest administration, and forest revenue. The policy advocates giving firm legal effect to a log export ban, establishing the AAC, and instituting licences of a kind that will encourage commitment to value-added processing, etc.

The principal forest law in force is the Forestry Act of 2001, which superseded the Forest Act of 1982. Other laws that support the implementation of the forest policy include the International Trade (Flora and Fauna) Act of 1989, the National Parks Act of 1993 and the Timber Rights Guarantees Act of 2000. Under the provisions of these acts, several rules and regulations have been issued: eg 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 Vanuatu Department of Forests (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. Total staffing for the implementation of SFM was 51 in 2000, including 18 professionals[a]. This is considered 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[a].

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 South Pacific support and assist in training and extension programs. The Forestry Act provides a mechanism for wider and more consultative planning in forest management.

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 resource. The final decision on how to use the forest resource is the prerogative of the owners. The guiding regulations include the following:

Table 2 Some commonly harvested species for industrial roundwood (2001–03)

Timber species	Remarks
Dysoxylum confertiflorum	Used for sawmilling and furniture manufacturing
Pterocarpus indicus (bluwota)	PNG rosewood, high-priced species
Intsia bijuga (natora)	Valuable timber species known as merbau in Southeast Asia
Calophyllum neo-ebudicum	Used for sawmilling and furniture manufacturing
Endospermum medullosum (whitewood)	New Guinea basswood

- harvesting quotas allocated to each of the four main islands (which are regarded as FMUs), based on estimated AAC levels;
- minimum diameter limit set for each timber species;
- periodic closure of harvesting in sandalwood areas;
- licensing of operators to help ensure good logging practice; and
- selection logging to be practised.

Even though the importance of long-term forest management plans is emphasized in the Forestry Act, so far no plans have been prepared for any of the four main FMUs (which correspond to the four main islands) or for individual concessions[a]. According to the Forestry Act, logging companies are required to prepare and submit a coupe harvesting plan, providing details of all operations, which has to 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, low sawlog volumes and cultural reasons. The quality of the natural forest for commercial forestry is low: in over 50,000 hectares of the 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 consultation involving representatives of the provincial government, the VDF, the Department of Environment, the Lands Department, resource owners' representatives and the logging company. A 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. Recently, logging has been increasingly observed to be more controlled and damage to the forest is reported to have been reduced (A. Leslie, pers. comm., September 2004); nevertheless, 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); at present, 7,200 hectares are allocated for logging under eight separate concessions. The largest concessions are 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 [a].

Silviculture and species selection. There are no comprehensive guidelines for the silvicultural management of the production forests, although the broad suggestion is to follow selective logging with minimum diameter cutting limits. Around 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 2, commonly used species are: *Syzygium* spp*, Myristica fatua, Elaeocarpus angustifolius, Antiaris toxicaria* and *Castanospermum australe.* In addition, *Agathis macrophylla* (kauri) is much

Table 3 Management of the production PFE ('000 hectares)

Natural					Planted		
Total	Allocated to concessions/ under licence	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
117	n.d.	0	0	0	2.1	2.1	0

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.

Planted forest and trees outside the forest. Forest plantations 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 tried out in the recent past together with agroforestry tree species. Currently, there is little logging for commercial purposes in planted forests. Plantation development in Vanuatu has been short on planning and proper implementation. Considering the inadequacies of Vanuatu's natural forests for production purposes because of their quality, composition and distribution, forest plantations will have to play a much larger role if future timber needs are to be met. The national forest policy suggested an initial target of 20,000 hectares of forest plantations 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. No certification initiatives have yet been taken.

Estimate of the area of forest sustainably managed for production. In the absence of long-term management plans and post-harvest care, production forests in Vanuatu cannot be considered to be managed sustainably (Table 3). Encouragingly, though, the current annual industrial log harvest of about 30,000 m^3 is well below the estimated sustainable yield (68,000 m^3 – see above).

Timber production and trade. Total roundwood production in 2003 was 119,000 m^3, of which about 76% was used as fuelwood (FAO 2005b). The production of industrial logs was an estimated 30,000 m^3 in 2003, down from 41,000 m^3 in 1999 (ITTO 2004, 2005). An estimated 1,000 m^3 of logs and 11,000 m^3 of sawnwood were exported in 2003 (ITTO 2005). The wood-processing industry is not well developed; 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 average recovery of logs processed for export is a low 35%[a]. The fixed-site mills generally have some form of wood-preservation treatment facilities.

The government of Vanuatu has operated a log export ban intermittently to assist the development of a domestic processing industry.

Non-wood forest products. Being the raw material to produce sandalwood oil, sandalwood (*Santalum album, S. austrocaledonicum*) is the most important NWFP in Vanuatu; about 52 tonnes were exported in 2000, much of it to Taiwan Province of China. The estimated sustainable yield of sandalwood is 80 tonnes. An oil-extraction facility has recently been constructed for the domestic production of sandalwood oil. Other important NWFPs 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 forest protected areas.

Forest for protection

Soil and water. Much of the natural forest in the mountainous interiors has a primarily protective role. However, some of these forests have been degraded by grazing and, in places, by burning.

Table 4 Management of the protection PFE ('000 hectares)

Total	Attributed to IUCN categories I–IV	Allocated for soil and water	With management plans	Sustainably managed
8.37[a]	0	n.d.	n.d.	n.d.

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[a].

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, eight birds, two reptiles and ten plants are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species; of these, two mammals and seven birds are found in forests (IUCN 2004). Forty-three plants are listed in CITES Appendix II (CITES 2005). Vanuatu has national conservation strategies for six commercial tree species (*Endospermum medullosum*, *Agathis macrophylla*, *Agathis silbae*, *Intsia bijuga*, *Pterocarpus indicus* and *Santalum austrocaledonicum*)[a].

Protective measures in production forests. The Code of Logging Practice has provisions for exclusion zones (eg steep slopes, environmentally sensitive and unstable soils, stream buffers, etc), guidelines for establishing infrastructure (eg road standards) and operational controls.

Extent of protected areas. There are five forest protected areas totalling 8,366 hectares, falling within the mid-to-high forest (6,349 hectares – 3% of all mid-to-high forest), low forest (1,717 hectares – 0.7% of all low forest) and mangrove forest (300 hectares – 12% of all mangroves)[a]. According to UNEP-WCMC (2004), however, no forests are in protected areas conforming to IUCN protected-area categories I–IV, although 5,900 hectares are reported in IUCN Category VI. The boundaries of the 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[a]. There is a 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[a].

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 4).

Socioeconomic aspects

Economic aspects. Forestry's contribution to GDP was about 7.7% (US$2.84 million) in 2000[a]. An estimated 500 people are employed directly in the logging sector[a].

Livelihood values. According to a recent national census, 80% of the Vanuatuan population is engaged in some form of small-scale commercial or subsistence forestry activities[a]. In addition to commercial forestry operations, fuelwood, herbal medicines, wild 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 the rural community. The value of forest products for subsistence use could be as high as US$14 million per year[a].

Social relations. The Forestry Act (2001) provides a mechanism for a broad consultative planning process. This mechanism comprises a management committee involving a provincial/state 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 forestry officers to fully explain forestry issues and terminology to landowners[a].

Summary

No formal PFE has been created in Vanuatu because all forests are under customary ownership. The role of the national government in forest management is in policy development, planning, protection, silvicultural principles and guidelines, and the supervision of logging companies. However, to date it has not been possible to implement a forestry regime that operates on the basis of long-term forest management plans.

Key points

- All lands, including forests, are customarily owned.
- There is, therefore, no formal PFE. Theoretically, a future PFE could amount to 127,000 hectares, of which 117,000 would be natural-forest production PFE and 8,340 protection PFE; there are about 2,100 hectares of plantations.
- 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 current annual harvest of about 30,000 m^3 is well below the estimated sustainable yield (68,000 m^3) from the 117,000 hectares of natural forest deemed suitable for production forestry.
- 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.
- The Department of Forestry under the Ministry of Agriculture, Forestry and Fisheries has responsibility for administering and managing the forest. The personnel, funds and facilities available to it are inadequate to carry out these functions.
- The four FMUs (corresponding to the four main islands) are not covered by long-term management plans, although coupes are usually covered by harvesting plans based on the Code of Logging Practice.
- The protected-area system of Vanuatu is very small; about 3% of the mid-to-high forest and 0.7% of the low forest are represented in protected areas.

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