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STATUS OF TROPICAL FOREST MANAGEMENT 2011

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The International Tropical Timber Organization (ITTO) is an intergovernmental organization promoting the conservation and sustainable management, use and trade of tropical forest resources. Its 60 members represent about 85% of the world's tropical forests and over 90% of the global tropical timber trade. ITTO develops internationally agreed policy documents to promote sustainable forest management and forest conservation and assists tropical member countries to adapt such policies to local circumstances and to implement them in the field through projects. In addition, ITTO collects, analyses and disseminates data on the production and trade of tropical timber and funds projects and other actions aimed at developing industries at both community and industrial scales. All projects are funded by voluntary contributions, mostly from consumer member countries. Since it became operational in 1987, ITTO has funded over 1000 projects, pre-projects and activities valued at around US\$350 million. The major donors are the governments of Japan, Switzerland, the United States, Norway and the European Union.

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KEY FINDINGS

- The estimated size of the natural tropical permanent forest estate (PFE) is 761 million hectares, comprising 403 million hectares of production forest and 358 million hectares of protection forest. Between 2005 and 2010, the area of natural forest under management plans in ITTO producer countries increased by 69 million hectares, to 183 million hectares, which is 24% of the PFE.
- The area of certified forest in ITTO producer countries grew from 10.5 million hectares in 2005 to 17.0 million hectares in 2010. The forest area certified in Africa more than tripled, to 4.63 million hectares.
- The area of PFE considered to be under management consistent with sustainability increased from 36.4 million hectares to 53.3 million hectares, comprising 30.6 million hectares of production PFE (compared with 25.2 million hectares in 2005) and 22.7 million hectares of protection PFE (compared with 11.2 million hectares in 2005).
- New international measures to combat trade in illegal timber have been introduced. In many countries there is increased transparency in forest operations, increased participation of stakeholders, and increased interest in forest conservation and SFM at the community level.
- The information submitted by ITTO producer countries has improved significantly, but in many cases quantitative data are still unreliable.
- Many ITTO producer countries are positioning themselves to take advantage of incentives that may become available for reducing deforestation and forest degradation, including through the conservation and sustainable management of forests and the enhancement of forest carbon stocks (REDD+).
- International assistance is required urgently to help ITTO producer countries undertake detailed inventories of their PFEs. This is particularly important given the requirements of REDD+ for reference-level data on forest extent and quality.
- Countries that made notable progress towards SFM during the period include Brazil, Gabon, Guyana, Malaysia and Peru.

FOREWORD

What is happening in the world's tropical forests? Until recently it was difficult to know. Few developing countries in the tropics have funds for regular forest inventories, so even basic information on forest extent and condition is at best out-dated and often non-existent. Information on how tropical forests are being managed has been even more difficult to obtain.

Starting almost a decade ago, ITTO began tackling the problem head-on by launching its Status of Tropical Forest Management report. The first of these, published in 2006, compiled all available sources of information and resulted in the first comprehensive estimates of the extent of tropical forest under sustainable management. This report builds on that work, detailing progress towards sustainable forest management (SFM) in ITTO producer member countries during a period that has seen important global developments of relevance to tropical forests and their management.

The country profiles contained in this report hold a wealth of information on the 85% of global tropical forests contained in ITTO member countries, structured using the criteria and indicators framework that ITTO pioneered more than two decades ago. As the profiles show, major developments in the past five years include increased stakeholder (particularly community) involvement in forest management; significant increases in the area of timber production forest independently certified as sustainably managed in all three tropical regions; increases in protected areas under sustainable management; and efforts to assess the role of forests in mitigating/adapting to climate change, including preparatory work to benefit from international efforts to reduce emissions from deforestation and forest degradation (REDD+).

A key finding of this report is that, worldwide, the area of tropical forest considered to be under SFM has increased by around 3 million hectares per year in the past five years, with significant increases in SFM observed in forests earmarked for both production and protective purposes. While this increasing trend is a cause for optimism, it is tempered by the fact that less than 10% of the total tropical forest resource that countries intend to maintain as forest (the "permanent forest estate") is being managed sustainably.

A complementary and even more disturbing fact is that every year many millions of hectares of precious tropical forest continue to be lost to (or seriously degraded by) alternative land uses. Why is this? After all, the potential value of the many goods and services provided by these forests far outweighs the benefits that can be obtained from almost any alternative land use. Recent studies have found, for example, that the value of tropical forest services (such as carbon sequestration, biodiversity conservation and soil and water protection) could reach many thousands of dollars per hectare. Unfortunately, markets to remunerate such services, where they exist, remain in their infancy. In the face of economic and social pressure to convert forest land to other purposes, it is essential that all the values of tropical forests are recognized and compensated to promote their retention and sustainable management. The information contained in this report will be crucial to establishing the robust monitoring mechanisms that will be needed in any eventual market mechanism for REDD+ or related schemes.

On behalf of ITTO I thank the donors (particularly Switzerland and Japan) who made this report possible, the many individuals from member countries who put time and effort into their country submissions for this report and provided personal insights, and the talented team of authors who compiled the information and wrote the report. ITTO is indebted to all these contributors.

2011 is both the 25th anniversary of ITTO's founding and the International Year of Forests. It is fitting that this excellent report is published during this special year to further guide the work of ITTO and to contribute to the efforts of our many partners working to improve forest management in the tropics.

Emmanuel Ze Meka

Executive Director

International Tropical Timber Organization

Yokohama, June 2011

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ACRONYMS AND ABBREVIATIONS

A&D	alienable and disposable <i>Philippines</i>	CBERS	China–Brazil Earth Resources Satellite
AAC	annual allowable cut	CBFM	community-based forest management
ABRAE	Area Bajo Régimen de Administración Especial (special designated forest areas) <i>Venezuela</i>	CBFMA	community-based forest management agreement <i>Philippines</i>
ABT	Autoridad de Fiscalización y Control Social de Bosques y Tierras (Authority for the Social Monitoring and Control of Forests and Lands) <i>Bolivia</i>	CDM	Clean Development Mechanism
ACR	area de conservación regional (regional conservation area) <i>Peru</i>	CERFLOR	Certificação Florestal (Forest Certification) <i>Brazil</i>
AFE-COHDEFOR	Administración Forestal del Estado–Corporación Hondureña de Desarrollo Forestal (State Forestry Administration) <i>Honduras</i>	CFAD	concession forestière sous aménagement durable (forest concession under sustainable development) <i>Gabon</i>
AIMA	Asociación Ecuatoriana de Industriales de Madera <i>Ecuador</i>	CGFLOP	Comissão de Gestão de Florestas Públicas (Commission on Public Forest Management) <i>Brazil</i>
ANAFOR	Agence Nationale de Développement des Forêts (National Agency for Forestry Development) <i>Cameroon</i>	CH-CFV	Honduran Council for Voluntary Forest Certification
ANAM	Autoridad Nacional del Ambiente (National Environmental Authority) <i>Panama</i>	CIB	Congolaise Industrielle des Bois <i>Congo</i>
ANCON	Asociación Nacional para la Conservación de la Naturaleza (Association for the Conservation of Nature) <i>Panama</i>	CIEF	Centro de Informacion Estrategica Forestal (Center for Strategic Forestry Information) <i>Peru</i>
ANPN	Agence Nationale des Parcs Nationaux (Agency for National Parks) <i>Gabon</i>	CIFOR	Center for International Forestry Research
ASEAN	Association of South East Asian Nations	CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
ASL	agrupacion social del lugar (local social group) <i>Bolivia</i>	cm	centimetre
ASOTECA	Asociación Ecuatoriana de Productores de Teca y Maderas Tropicales <i>Ecuador</i>	CNFP	Cadastro Nacional de Florestas Públicas (National Register of Public Forests) <i>Brazil</i>
ATO	African Timber Organization	CNIAF	Centre National d'Inventaire et d'Aménagement des Ressources Forestières et Fauniques (National Centre for the Inventory and Management of Forest and Wildlife Resources) <i>Congo</i>
ATO/ITTO PCI	ATO/ITTO Principles, Criteria and Indicators for the Sustainable Management of African Natural Tropical Forests	CO ₂	carbon dioxide
Bosnas	Forest and Management Authority <i>Suriname</i>	CO ₂ e	CO ₂ equivalent
BRIC	Forest Industry Revitalization Board <i>Indonesia</i>	COMAFORS	Corporación de Manejo Forestal Sustentable <i>Ecuador</i>
C&I	criteria and indicators	COMET	Consortium des ONG en matière d'Environnement au Togo (Consortium of NGOs Concerned with the Environment in Togo)
CAR	Central African Republic	COMIFAC	Commission en Charge des Forêts d'Afrique Centrale (Commission in Charge of Forests in Central Africa)
CBD	Convention on Biological Diversity	CONAFLOP	Comissão Nacional de Florestas (National Forest Commission) <i>Brazil</i>
		CONAFOR	Programa de Desarrollo Forestal (National Forestry Commission) <i>Mexico</i>
		CONAMA	Conama Conselho Nacional do Meio Ambiente (National Council for the Environment) <i>Brazil</i>

CONAP	Consejo Nacional de Areas Protegidas (National Council of Protected Areas) <i>Guatemala</i>	FDA	Forestry Development Authority <i>Liberia</i>
CONIF	Corporación Nacional de Investigación y Fomento Forestal (National Corporation for Forestry Research and Development) <i>Colombia</i>	FDA	forest development agency <i>India</i>
CPE	Constitución Política del Estado (Bolivian Constitution) <i>Bolivia</i>	FDF	Federal Department of Forestry <i>Nigeria</i>
CSO	Central Statistical Organisation <i>India</i>	FHCL	Fiji Hardwood Corporation Limited
CVD	comité villageois de développement (village development committee) <i>Togo</i>	FLONA	floresta nacional (national forest) <i>Brazil</i>
dbh	(tree) diameter at breast height	FMA	Forest management agreement <i>PNG</i>
DEGRAD	Sistema de Mapeamento de Degradação Florestal (System for mapping forest degradation) <i>Brazil</i>	FMB	Forest Management Bureau <i>Philippines</i>
DENR	Department of Environment and Natural Resources <i>Philippines</i>	FMC	forest management contract <i>Liberia</i>
DETER	Detecção de Desmatamento em Tempo Real (System of Deforestation Detection in Real Time) <i>Brazil</i>	FMU	forest management unit
DETEX	Detection of Selective Logging Activities <i>Brazil</i>	FNDF	Fundo Nacional de Desenvolvimento Florestal (National Forest Development Fund) <i>Brazil</i>
DGEF	Direction Générale des Eaux et Forêts (Directorate for Forests and Water) <i>Gabon</i>	FONABOSQUE	Fondo Nacional de Desarrollo Forestal (National Forestry Development Fund) <i>Bolivia</i>
DGF	Direction Générale des Forêts (Directorate for Forests) <i>Gabon</i>	FONDEFOR	Fondo de Protección y Desarrollo Forestal (National Fund for Forest Development and Protection) <i>Panama</i>
DGFFS	Dirección General de Flora y Fauna Silvestre (Direction General of Forests and Wildlife) <i>Peru</i>	FORIG	Forestry Research Institute of Ghana
DIARF	Direction des Inventaires, des Aménagements et de la Régénération des Forêts (Directorate of Forest Inventory, Management and Regeneration) <i>Gabon</i>	FPA	Forest Producers Association <i>Guyana</i>
DMC	Department of Marine and Coastal Resources <i>Thailand</i>	FPDMC	Forest Products and Marketing Council of Guyana
DNP	Department of National Parks, Wildlife and Plant Conservation <i>Thailand</i>	FPL	Fiji Pine Limited
DRC	Democratic Republic of the Congo	FRI	Forest Research Institute <i>Myanmar</i>
ECOFAC	Ecosystem Forestier d'Afrique Centrale	FSC	Forest Stewardship Council
EIA	Environmental Investigation Agency	FSI	Forest Survey of India
EMBRAPA	Empresa Brasileira de Pesquisa Agropecuária (Agricultural Research Corporation) <i>Brazil</i>	FSP	Foundation for the Peoples of the South Pacific
ENF	Evaluación Nacional Forestal (National Forest Inventory) <i>Honduras</i>	FUNAI	Fundação Nacional do Índio (Indian National Foundation) <i>Brazil</i>
ESNABIO	Brazilian National Policy and Strategy for Biodiversity	GDP	gross domestic product
FAO	Food and Agriculture Organization of the United Nations	GEF	Global Environment Facility
FCA	forest clearance authority <i>PNG</i>	GFC	Guyana Forestry Commission
FCEA	Franc Communauté Financière Africaine	GGMC	Guyana Geology and Mines Commission
		GHG	greenhouse gas
		GIS	geographic information system
		GPS	global positioning system
		GtC	gigatonne(s) of carbon
		GTZ	Gesellschaft für Technische Zusammenarbeit (Society for Technical Cooperation) <i>Germany</i>
		ha	hectare(s)
		HKV	houtkapvergunningen (communal wood-cutting permit) <i>Suriname</i>
		HPH	hak pengusahaan hutan (forest concession right) <i>Indonesia</i>
		HPHH	hak pemungutan hasil hutan (forest products collection right) <i>Indonesia</i>
		HPHTI	industrial forest plantation permit (<i>hak pengusahaan hutan</i>) <i>Indonesia</i>

HTI	hutan tanamaan industri (industrial forest plantations) <i>Indonesia</i>	INCCA	Indian Network for Climate Change Assessment
IBAMA	Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis (Brazilian Institute of Environment and Renewable Resources)	INCRA	Instituto Nacional de Colonização e Reforma Agrária (National Colonization and Agrarian Reform Institute) <i>Brazil</i>
ibid.	Ibidem – as per previous citation.	INPA	Instituto Nacional de Pesquisas da Amazonia (National institute of Amazonian Research) <i>Brazil</i>
ICF	Instituto Nacional de Conservación y Desarrollo Forestal, Areas Protegidas y Vida Silvestre (National Institute of Conservation of Forests, Protected Areas and Wildlife Development) <i>Honduras</i>	INPE	Instituto Nacional de Pesquisas Espaciais (National Institute for Space Research) <i>Brazil</i>
ICL	incidental cutting licence <i>Suriname</i>	INRENA	Instituto Nacional de Recursos Naturales (National Institute of Natural Resources) <i>Peru</i>
ICRAF	World Agroforestry Center	IPK	izin pemanfaatan kayu (log exploitation permit) <i>Indonesia</i>
IDEAM	Instituto de Hidrologia, Meteorología y Estudios Ambientales (Institute of Hydrology, Meteorology and Environmental Studies) <i>Colombia</i>	IPCC	Intergovernmental Panel on Climate Change
IFB	Industrie Forestière de Batalimo	IPR	individual property rights [agreement] <i>Philippines</i>
IFM	independent forest monitoring <i>Guyana</i>	IRAD	Institute of Agricultural Research for Development
IFMA	Integrated Forest Management Agreement (IFMA) <i>Philippines</i>	ITTA	International Tropical Timber Agreement
IPK	log exploitation permit (<i>izin pemanfaatan kayu</i>) <i>Indonesia</i>	ITTC	International Tropical Timber Council
IUPHHK HA	licence to commercially use timber in natural forests <i>Indonesia</i>	ITTO	International Tropical Timber Organization
IUPHHK HT	licence to commercially use timber in plantation forests <i>Indonesia</i>	IUCN	International Union for Conservation of Nature
IARNA	Instituto de Agricultura, Recursos Naturales y Ambiente, Universidad Rafael Landívar (Institute of Agriculture, Natural Resources and Environment, Rafael Landívar University) <i>Guatemala</i>	IUPHHK HA	Izin Usaha Pemanfaatan Hasil Hutan Kayu Hutan Alam (natural forest concessions) <i>Indonesia</i>
ICCN	Institut Congolais pour la Conservation de la Nature (Congolese Institute for the Conservation of Nature) <i>DRC</i>	IUPHHK HT	Izin Usaha Pemanfaatan Hasil Hutan Kayu Hutan Tanaman (timber plantation concessions) <i>Indonesia</i>
ICF	Instituto Nacional de Conservación y Desarrollo Forestal, Areas Protegidas y Vida Silvestre (National Institute of Conservation of Forests, Protected Areas and Wildlife Development) <i>Honduras</i>	JFM	joint forest management <i>India</i>
IFM	independent forest monitoring <i>Guyana</i>	JFMC	joint forest management committee <i>India</i>
IFMA	industrial forest management agreement <i>Philippines</i>	JKPP	Participatory Mapping Network <i>Indonesia</i>
IITA	International Institute of Tropical Agriculture	KPH	forest management totality <i>Indonesia</i>
ILG	incorporated landowner group <i>PNG</i>	KPHL	sustainable management units of protection forest <i>Indonesia</i>
ILO	International Labour Organization	KPHP	sustainable management units of production forest <i>Indonesia</i>
INAB	Instituto Nacional de Bosques (National Forest Institute) <i>Guatemala</i>	KPKKT	Kumpulan Pengurusan Kayu Kayan Terengganu Sdn Bhd <i>Malaysia</i>
IMAZON	Instituto do Homem e Meio Ambiente da Amazônia (Amazon Institute of People and the Environment) <i>Brazil</i>	KPSHK	Community Forest System Development Group <i>Indonesia</i>
		LAS	Legality Assurance System <i>Guyana</i>
		LBB	Lachtwet en BosBeheer (Forest Service) <i>Suriname</i>
		LEI	Lembaga Ecolabel Indonesia (Indonesian Ecolabelling Institute)

LGDFS	Ley General de Desarrollo Forestal Sustentable (General Law for Sustainable Forest Development) <i>Mexico</i>	MINEEF	Ministère de l'Environnement, des Eaux et Forêts (Ministry for Environment, Water and Forests) <i>Côte d'Ivoire</i>
LPI	Lembaga Penilai Independen (mandatory independent certification) <i>Indonesia</i>	MINEF	Ministry of Environment and Forests <i>Cameroon</i>
m ³	cubic metre(s)	MINEP	Ministry for the Environment and the Protection of Nature <i>Cameroon</i>
MADR	Ministerio de Agricultura y Desarrollo Rural (Ministry of Agriculture and Rural Development) <i>Colombia</i>	MINFOF	Ministère des Forêts et de la Faune (Ministry of Forests and Fauna) <i>Cameroon</i>
MAE	Ministerio del Ambiente (Ministry of Environment) <i>Ecuador</i>	MLF	Ministry of Lands and Forestry <i>Ghana</i>
MAFF	Ministry of Agriculture, Forestry and Fisheries <i>Cambodia</i>	MMA	Ministerio de Medio Ambiente (Ministry of the Environment) <i>Brazil</i>
MAGA	Ministerio de Agricultura, Ganadería y Alimentación <i>Guatemala</i>	MODIS	moderate resolution imaging spectroradiometer
MARN	Ministerio de Ambiente y Recursos Naturales (Ministry for Environment and Natural Resources) <i>Guatemala</i> ; Ministerio del Ambiente y de los Recursos Naturales (Ministry of the Environment and Natural Resources) <i>Venezuela</i>	Modeflora	Digital Model of Forest Exploitation <i>Brazil</i>
MAT	Ministerio del Poder Popular para la Agricultura y Tierras (Ministry for Agriculture and Lands) <i>Venezuela</i>	MPPA	Ministerio del Poder Popular para el Ambiente (Ministry for the Environment) <i>Venezuela</i>
MDF	medium density fibreboard	MtC	million tonne(s) of carbon
MECNT	Ministère de l'Environnement, Conservation de la Nature et du Tourisme (Ministry of Environment, Nature Conservation and Tourism) <i>DRC</i>	MTCC	Malaysian Timber Certification Council
MEFCPE	Ministère des Eaux, Forêts, Chasses, Pêches, Environnement et du Tourisme (Ministry of Environment, Water, Forests, Hunting and Fishing) <i>CAR</i>	MTCS	Malaysian Timber Certification Scheme
MEF	Ministère de l'Economie Forestière (Ministry of Forest Economy) <i>Congo</i>	MTE	Myanmar Timber Enterprise
MEFEPA	Ministère de l'Economie Forestière, des Eaux, de la Pêche et de l'Aquaculture (Ministry of Forest Economy, Water, Fisheries and Aquaculture) <i>Gabon</i>	MTIB	Malaysian Timber Industry Board
MERF	Ministère de l'Environnement et des Ressources Forestières (Ministry for Environment and Natural Resources) <i>Togo</i>	NAP	National Afforestation Programme <i>India</i>
MINAG	Ministerio de Agricultura (Ministry of Agriculture) <i>Peru</i>	NAPA	National Adaptation Programme of Action
MINAM	Ministerio del Ambiente (Ministry of Environment) <i>Peru</i>	NB	Nature Conservation Division <i>Suriname</i>
MINAMBIENTE	Ministerio de Ambiente, Vivienda y Desarrollo Territorial (Ministry of Environmental, Housing and Territorial Development) <i>Colombia</i>	NFS	National Forest Service <i>PNG</i>
		NFB	National Forest Board <i>PNG</i>
		NFP	National Forestry Policy <i>Malaysia</i>
		NFS	National Forest Service <i>PNG</i>
		NGO	non-governmental organization
		NIPAS	National Integrated Protected Area System <i>Philippines</i>
		NLTB	Native Land Trust Board <i>Fiji</i>
		NTFP	non-timber forest product
		ODEF	Office de Développement et d'Exploitation des Forêts (Office for Forest Development and Harvesting) <i>Togo</i>
		OIPR	Office Ivoirien des Parcs et Reserves Naturelles (National Office for National Parks and Nature Reserves) <i>Côte d'Ivoire</i>
		OSINFOR	Organismo Supervisor de Recursos Forestales y del Fauna Silvestre (Agency for the Supervision of Forest Resources and Wildlife) <i>Peru</i>
		PAFC	Pan-African Forest Certification

PAFSI	simplified forest management plan <i>Ecuador</i>	PRODES	Monitoramento da Floresta Amazônica Brasileira por Satélite (Program for the Calculation of Deforestation in the Amazon) <i>Brazil</i>
PAFSU	sustainable management area <i>Ecuador</i>		
PANE	patrimonio de áreas naturales del estado <i>Ecuador</i>	PROFEPA	Procuraduría Federal de Protección al Ambiente (Federal Office for Environmental Protection) <i>Mexico</i>
PCI	principles, criteria and indicators		
PEA	permis d'exploitation et d'amangement <i>CAR</i>	PROFORESTAL	Unidad para el Desarrollo Forestal del Ecuador
PEF	périmètre d'exploitation forestière (forest harvesting area) <i>Côte d'Ivoire</i>	PRS	poverty reduction strategy <i>Liberia</i>
PEF 2025	Programa Estratégico Forestal 2025 (Strategic Forestry Plan 2025) <i>Mexico</i>	PTE	Permis de transformation et d'exploitation (wood harvesting and processing permit) <i>Côte d'Ivoire</i>
PEFC	Program for the Endorsement of Forest Certification Schemes	RECOFTC-ASFN	Centre for Peoples and Forest-ASEAN Social Forestry Network
pers. comm.	personal communication	REDD	reduced emissions from deforestation and forest degradation
PFA	permis forestiers associé (associated forest permit) <i>Gabon</i>	REDDES	ITTO Thematic Programme on Reducing Deforestation and Forest Degradation and Enhancing Environmental Services
PFMC	provincial forest management committees <i>PNG</i>	REDD+	Policy approaches and positive incentives on issues relating to reducing emissions from deforestation and forest degradation in developing countries; and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries <i>From the Bali Action Plan of the UNFCCC</i>
PFE	permanent forest estate	RFD	Royal Forest Department <i>Thailand</i>
PHBM	communal joint forest management <i>Indonesia</i>	RFID	radio frequency identification device
PHS	Platform for the Timber Sector in Suriname	RKT	annual work plan (<i>rencana kerja tabunan</i>) <i>Indonesia</i>
PINFOR	Programa de Incentivos Forestales <i>Guatemala</i>	RRI	Rights and Resources Initiative
PINPEP	Programa de Incentivos para Pequeños Poseedores de Tierras de Vocación Forestal o Agroforestal <i>Guatemala</i>	SAG	Secretaría de Agricultura y Ganadería (Secretariat for Agriculture and Cattle Ranching) <i>Honduras</i>
PLANFOR	Plan de Acción Forestal (Forestry Action Plan) <i>Honduras</i>	SBB	Stichting voor Bosbeheer en Bostoezicht (Foundation for Forest Management and Forest Control) <i>Suriname</i>
PMDH	Forest Village Community Development and Empowerment <i>Indonesia</i>	SEMARNAT	Secretaría de Medio Ambiente y Recursos Naturales de México (Secretariat for Environment and Natural Resources) <i>Mexico</i>
PMFS	plano de manejo florestal sustentável (sustainable forest management plan) <i>Brazil</i>	SENPLADES	Secretaría Nacional de Planificación y Desarrollo (National Secretariat for Planning and Development) <i>Ecuador</i>
PNAE	Plan National d'Action pour l'Environnement (National Environmental Action Plan) <i>Togo</i>	SERFOR	Servicio Nacional Forestal y de Fauna Silvestre (National Forest and Wildlife Service) <i>Peru</i>
PNF	Programa Nacional de Florestas (National Forest Program) <i>Brazil</i>	SERNA	Secretaria de Recursos Naturales y Ambiente (Secretariat for Natural Resources and Environment) <i>Honduras</i>
PNG	Papua New Guinea		
POMF	plan de ordenación y manejo forestal (forest management plan) <i>Venezuela</i>		
PROCYMAF	Programa de Desarrollo Forestal Comunitario (community forest management project) <i>Mexico</i>		
PRODEFOR	Programa de Desarrollo Forestal (Forest Development Programme) <i>Mexico</i>		
PRODEPLAN	Programa para el Desarrollo de Plantaciones Forestales Comerciales (Programme for the Development of Commercial Forest Plantations) <i>Honduras, Mexico</i>		

SERNANP	Servicio Nacional de Areas Naturales Protegidas (National Service for Protected Areas) <i>Peru</i>	TPTI	Tebang Pilih Tanam Indonesia (Indonesian Selective Cutting and Planting System)
SFM	sustainable forest management	TPTJ	Tebang Pilih Tanam Jalur (Selective Cutting and Strip Planting System) <i>Indonesia</i>
SFP	state forest permit <i>Guyana</i>	TREC	Timber Rights Evaluation Committee <i>Ghana</i>
SGS	formerly Soci�t� G�n�rale de Surveillance	TSA	timber sales agreement <i>Guyana</i>
SIFMA	socialized industrial forest management agreement <i>Philippines</i>	TSC	timber sales contract <i>Liberia</i>
SIFOR/BOL	Sistema Nacional de Informaci�n Forestal <i>Bolivia</i>	TSS	Tropical Shelterwood System <i>Nigeria</i>
SIGAP	Sistema Guatemalteco de Areas Protegidas (Guatemalan Protected Areas System) <i>Guatemala</i>	TUC	timber utilization contract <i>Ghana</i>
SILIN	intensified silviculture <i>Indonesia</i>	TUP	timber utilization permit <i>Ghana</i>
SINAP	Sistema Nacional de Areas Naturales Protegidas (National System of Protected Areas) <i>Mexico</i> ; Sistema Nacional de �reas Protegidas de Panam� (Panama National System of Protected Areas)	UFA	unit� d'am�nagement forestier (forest management unit) <i>Congo</i>
SINANPE	Sistema Nacional de Areas Naturales Protegidas por el Estado (National System of Public Protected Areas) <i>Peru</i>	UFE	unit� foresti�re d'exploitation (forest logging unit) <i>Congo</i>
SMS	Selective Management System <i>Malaysia</i>	UNDP	United Nations Development Programme
SNAP	Sistema Nacional de �reas Protegidas (National System of Protected Areas) <i>Bolivia, Ecuador</i>	UNEP-WCMC	United Nations Environment Programme-World Conservation Monitoring Centre
SNBG	Soci�t� Nationale des Bois du Gabon	UNFCCC	United Nations Framework Convention on Climate Change
SNR	Service National de Reboisement (National Reforestation Service) <i>Congo</i>	UNODC	United Nations Office on Drugs and Crime
SNUC	Sistema Nacional de Unidades de Conserva�o da Natureza (National System of Nature Conservation Units) <i>Brazil</i>	UN-REDD	United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries
SODEFOR	Soci�t� de D�veloppement des For�ts (Forest Development Agency) <i>C�te d'Ivoire</i>	USAID	United States Agency for International Development
SPNN	Sistema de Parques Nacionales Naturales (National Park System) <i>Colombia</i>	VDF	Vanuatu Department of Forests
SPORC	Quick Response Forest Police Unit <i>Indonesia</i>	VFC	village forest committee <i>India</i>
TCC	Timber Certification Committee <i>Myanmar</i>	VPA	FLEGT voluntary partnership agreement
TCO	tierras comunitarias de origen (indigenous community lands) <i>Bolivia</i>	WAHLI	Indonesian Forum of Environmental NGOs
TISI	Thai Industrial Standard Institute	WCL	wood cutting lease <i>Guyana</i>
TLA	timber licence agreement <i>Philippines</i>	WWF	World Wide Fund for Nature
TLTV	Timber Legality and Traceability Verification (issued by SGS)		
TPI	Tebang Pilih Indonesia (Indonesian Selective Cutting System)		
TPSA	timber production sharing agreement <i>Philippines</i>		

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PART 1 OVERVIEW



An iguana lies on a forest log, Trinidad and Tobago.

INTRODUCTION

In 1987 the International Tropical Timber Organization (ITTO) commissioned a survey of tropical forests in its member countries, specifically directed at the management of forests for timber production. The scope of that survey was later extended by the publication *No Timber without Trees* (Poore et al. 1989), which set it in the wider context of the management of tropical forests for all purposes. It concluded that an insignificant proportion of the world's tropical forests was managed sustainably, although some – but not all – of the conditions for sustainable management were present in a much larger area.

At its 30th session in 2001, the International Tropical Timber Council decided to prepare a new and more comprehensive survey of sustainable forest management (SFM) in the tropics and, in its Decision 9(XXX), authorized the Executive Director “to prepare and publish [a] Status of Forest Management Report, based on available evidence”. The main report of that survey, which used 2005 as its nominal reporting year, was published in 2006 (ITTO 2006).

In its 2008–09 Biennial Work Programme, the International Tropical Timber Council made provision for a further report on the status of tropical forest management, and it made funds available to member countries to assist in the preparation of national reports that were to be used as one of the sources of information. This document is an outcome of that process, presenting, in effect, a third survey of the status of tropical forest management in the tropics.

Survey coverage

The present survey covers the same 33 ITTO producer member countries (referred to as ITTO producers in the figures and tables below) as were covered in the 2005 survey. It is divided into two main parts: this overview, and detailed profiles of all ITTO producer member countries, arranged according to region as follows:

- **Asia and the Pacific** – Cambodia, Fiji, India, Indonesia, Malaysia, Myanmar, Philippines, Papua New Guinea (PNG), Thailand and Vanuatu.
- **Latin America and the Caribbean** – Bolivia (Plurinational State of, abbreviated to Bolivia), Brazil, Colombia, Ecuador, Guatemala, Guyana, Honduras, Mexico, Panama, Peru, Suriname, Trinidad and Tobago, and Venezuela.

The year of reporting for all data is nominally 2010 – that is, five years after the nominal reporting year, 2005, used in ITTO (2006) – but the actual year to which data refer varies according to availability. Appendices to this report contain data on tropical forest area (Appendix I), summary tables on a range of parameters for ITTO producer member countries (Appendix II), notes on methodology (Appendix III), a list of tropical timber species and their common names by country (Appendix IV), and a tabulation of industrial roundwood production versus area of production forest for ITTO producer member countries (Appendix V).

ITTO forests in a global setting

Almost all of the world's closed tropical forests are found in 65 tropical countries, of which 33 are members of ITTO. The forests of these 65 countries cover about 1.66 billion hectares, and ITTO member countries account for 1.42 billion hectares (85%) of this (Table 1; Figure 1). Of the 65 countries, the top seven in terms of total forest area are ITTO producer member countries – Brazil (520 million hectares), DRC (154 million hectares), Indonesia (94 million hectares), India and Peru (68 million hectares), Mexico (65 million hectares) and Colombia (60 million hectares). The reported area of forest categorized by the Food and Agriculture Organization of the United Nations (FAO 2010) as ‘primary forest’ amounts to about 887 million hectares, of which ITTO producer member countries contain 96%. Brazil has an estimated primary forest area of 477 million hectares, which is more than 50% of primary tropical forests worldwide. Data for all 65 countries are presented in Appendix I.

Definitions

In a survey of this scope, which relies on such a wide range of sources (see below), clear definitions are essential. The following are definitions of the most important terms used in this survey.

- **Africa** – Cameroon, Central African Republic (CAR), Democratic Republic of the Congo (DRC), Republic of the Congo (abbreviated to Congo), Côte d'Ivoire, Gabon, Ghana, Liberia, Nigeria and Togo.

Figure 1 Tropical forested countries and ITTO members

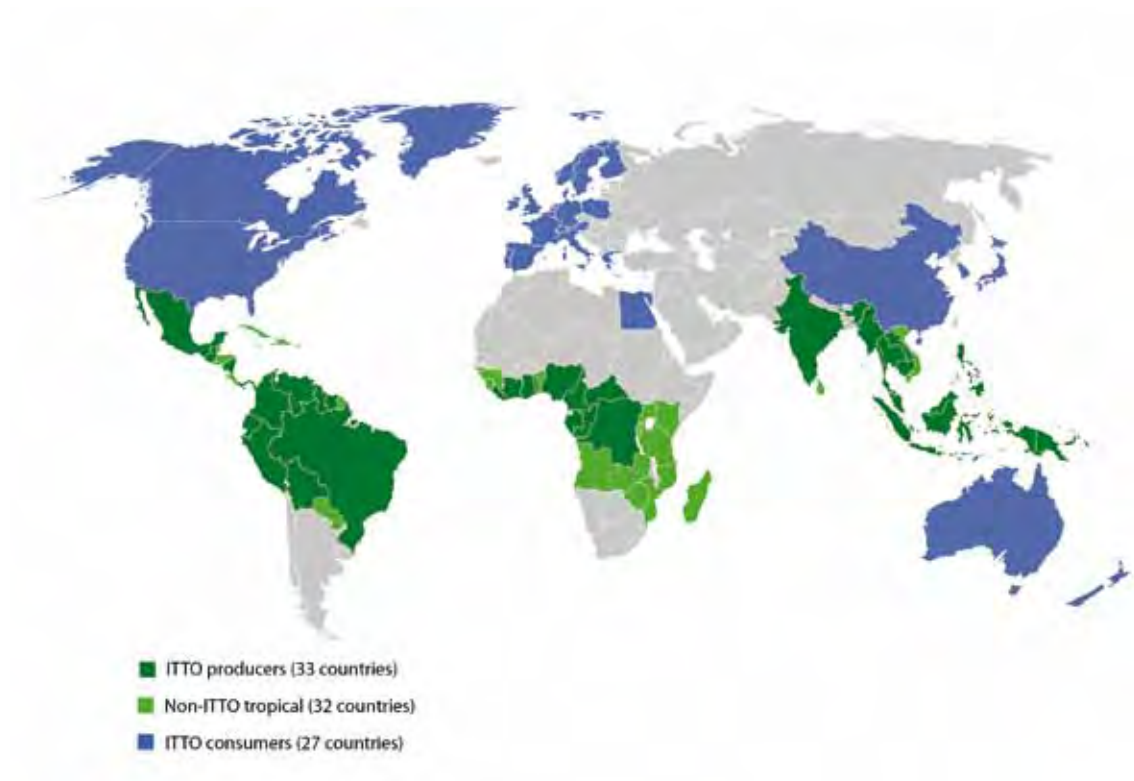


Table 1 Global tropical forest area, by region

Region (number of countries)	Total forest area (million ha)	% of forests in ITTO producer countries	Primary forest (million ha)	% of primary forests in ITTO producer countries
Tropical Africa (26)	440	61	102	98
ITTO (10)	270		100	
Other (16)	170		2	
Tropical Asia and the Pacific (16)	317	89	108	97
ITTO (10)	282		104	
Other (6)	35		3	
Tropical Latin America and the Caribbean (23)	907	96	678	96
ITTO (13)	868		647	
Other (10)	38		30	
Global total (65)	1664	85	887	96
Total ITTO producers (33)	1421		851	
Total non-ITTO (32)	243		35	

Note: Totals might not tally due to rounding. 'Other' refers to non-ITTO member countries with significant closed forests in the tropics. A few countries in Africa with at least part of their territories in the tropics – i.e. Sudan, Ethiopia, Namibia and the countries of the Sahel belt – are not counted here. While the open savannas of these countries are of significant value for many ecological, economic and social reasons, their low productivity means that they are not major contributors to the tropical forest products and services that are ITTO's main interest (see also definition of permanent forest estate below).

Source: FAO (2010). Note, however, that FAO (2010) does not provide estimates of primary forests for several countries, including the large forest area of DRC, in which cases ITTO estimates are used.

Forest

The definition of forest used by FAO is applied here. The definition is:

Land spanning more than 0.5 hectares with trees higher than five metres and a canopy cover of more than 10%, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use (FAO 2010).

Tropical forest

Consistent with the International Tropical Timber Agreement, 1994, this report defines tropical forest as forest lying between the tropics of Cancer and Capricorn (so forests at higher altitudes within the tropics that effectively are temperate forest types are still 'tropical'). Several producer countries – Brazil, India, Mexico and Myanmar – have significant areas of forest outside the tropics. In ITTO (2006) an attempt was made to distinguish tropical from non-tropical forests but it was not possible to do so from the available data for India. In this report, however, an attempt has been made to do so. This posed certain difficulties in comparing the results of the two surveys for India because in many cases the parameters being measured were different.

Primary forest

The term primary forest is used in some country profiles and also in this overview. Much of the data on primary forest has been obtained from FAO (2010), which defines it as:

naturally regenerated forest of native species, where there are no clearly visible indications of human activities and the ecological processes are not significantly disturbed.

Closed forest

The definition of closed forest used in this survey is forest whose tree canopy covers 60% or more of the ground surface, when viewed from above. In the case of India the percentage cover used was 40%, since only this measure of canopy cover was available for India's tropical forests.

Sustainable forest management

ITTO (2005) defined SFM as:

the process of managing permanent forest land to achieve one or more clearly specified objectives of management with regard to the production of a continuous flow of desired forest products and

services without undue reduction in its inherent values and future productivity and without undue undesirable effects on the physical and social environment.

To elaborate the definition and assist the monitoring, assessment and reporting of SFM, ITTO has developed a set of key criteria and indicators (C&I) for the sustainable management of tropical forests. These comprise the essential elements of SFM and are consistent with the seven thematic elements of SFM specified in the Non-Legally Binding Instrument on All Types of Forest (United Nations General Assembly 2007). Along with the definition of SFM given above, they constitute the basis for the assessment of SFM presented in this report.

The definition of SFM given here was not formulated for application in forests in totally protected areas, where forest goods are usually not extracted. Nevertheless, it can still be applied in such forests with the understanding that the extraction of 'desired goods' (both timber and non-timber forest products – NTFPs) should be zero, or close to zero, for SFM to be achieved.

Permanent forest estate

ITTO policies stress the need for countries to establish a PFE, which is defined in ITTO (2005) as:

Land, whether public or private, secured by law and kept under permanent forest cover. This includes land for the production of timber and other forest products, for the protection of soil and water, and for the conservation of biological diversity, as well as land intended to fulfil a combination of these functions.

In this report, two types of PFE are distinguished: production and protection. The production PFE includes both natural forest and planted forest, quantified separately. Figures given for production PFE are usually relatively dense forest and therefore large areas of savanna (even though they are counted as forest under FAO's definition of forest if canopy cover is 10% or greater) are often not included in the production PFE. In general, then, production PFE in this report comprises those tropical forests and planted forests (except those established solely for protective purposes) deemed to be accorded 'permanent' status. In general, protection PFE is considered to be the area of forest inside designated protected areas, where timber

production and other forms of resource exploitation such as mining and commercial hunting are not legal land uses.

Planted forest

The term 'planted forest' is preferred to 'plantations', but the two are used interchangeably in this report. ITTO (2005) defined planted forest as:

A forest stand that has been established by planting or seeding.

FAO (2010) used the following definition:

Forest predominantly composed of trees established through planting and/or deliberate seeding.

These two definitions are essentially complementary and constitute the definition of planted forests used in this report.

In some countries the distinction between planted forest and natural forest is blurred, especially where indigenous species have been planted. In some cases, such forests are regarded as 'semi-natural' forests. In this report, some 'semi-natural' forests are treated as natural forests, as indicated in individual country profiles.

Sources of data

The country profiles presented in this report were compiled from many sources. The most important sources, however, were reports of the ITTO producer member countries as requested by the International Tropical Timber Council in the format devised for the ITTO C&I. The ITTO C&I have been revised periodically in the light of experience and developments in international forest policy. The previous survey (ITTO 2006) used as a source of information questionnaires submitted by ITTO producer member governments based on a set of C&I published in 1998. ITTO (2005) presented a revision of the C&I, reducing the number of indicators and simplifying the reporting format. ITTO producer member countries were requested to use this revised set of C&I as a basis for submitting information to ITTO for the present survey.

Other datasets were also used. These included FAO's Global Forest Resources Assessment 2010, country reports submitted to the World Bank's Forest Carbon Partnership Facility, and others

such as web-based datasets maintained by the International Union for Conservation of Nature (IUCN), the United Nations Environment Programme-World Conservation Monitoring Centre (UNEP-WCMC) and ITTO member countries. Other useful sources included diagnostic missions conducted by ITTO at the request of members, ITTO field projects, national-level training workshops on the application of the ITTO C&I, field visits, investigative reports published by non-governmental organizations (NGOs), and personal communications with organizations and individuals with specialist knowledge. Sources varied by country, and are identified in each country profile. Some countries provided maps of ecological zones, forest types or other relevant parameters. Where they were of sufficient resolution, these maps are presented in the country profiles in their original languages.

The data obtained from such diverse sources are necessarily highly variable, which often posed considerable difficulties in interpretation. These are discussed later.

Estimating the area under SFM

In order to assess progress in the achievement of SFM, this report estimates the area of natural forest in each ITTO producer member country that can reasonably be thought to be under management that is largely consistent with SFM. These estimates have been derived for the natural-forest production PFE by adding the forest management units (FMUs) that have been independently certified or in which progress towards certification is being made; have fully developed, long-term (ten years or more) forest management plans with firm information that these plans are being implemented effectively; are considered as model forest units and information is available on the quality of management; and/or are community-based units with secure tenure for which the quality of management is known to be of a high standard.

Since trends are more useful than one-off measurements in determining progress towards sustainability, the assessment of SFM requires the long-term monitoring of forest values, but there are very few tropical production forests in which this is carried out. For some forests, therefore, information on changes in the quality of management is anecdotal or unpublished.



Many people living in Amazon have a high dependency on forests for their livelihoods. © J. McAlpine

In most cases the estimates should be considered conservative, since they include only those forest areas where information about the quality of forest management was available. It is possible that other forest areas are also being managed well, but information was not available to identify these. The resulting estimates of SFM in this report give the area of forests being managed in a way that is unlikely to cause long-term, undue harm to the biological, physical and social environments (as consistent with the definition of SFM).

Where data allowed, estimates were also made of the extent of protection PFE under management considered consistent with SFM. These estimates were derived from information provided by countries and from other (mostly unpublished) sources. Areas included are those with secure boundaries and a management plan (usually fully in place, but in some instances still being developed), that are generally considered in the country and by other observers to be well managed, and that are not under significant threat from destructive agents.

Other methodological matters are described in Appendix II.

Recent developments

There has been considerable change in the global policy environment in the five years since the preparation of ITTO's report on the status of tropical forest management in 2005 (ITTO 2006).

Some of these changes have had, or are likely to have, a significant effect on efforts to promote SFM in the tropics. Many of them also feature in the country profiles in the second part of this report, and they are therefore described briefly below.

REDD+

A concept that was only nascent in debates on tropical forests in 2005 is that of REDD (reduced emissions from deforestation and forest degradation) and its more evolved form, REDD+. REDD+ is part of a broader development agenda that particularly addresses the role of tropical forests in climate-change mitigation and adaptation. The term has been defined in the framework of the climate-change negotiations of the United Nations Framework Convention on Climate Change (UNFCCC) as “policy approaches and positive incentives on issues relating to reducing emissions from deforestation and forest degradation in developing countries; and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries” (UNFCCC 2007). REDD+ has developed since 2008 as a major new policy tool in tropical forests and has the potential to provide substantial new and additional funding for the sustainable management of tropical forests.

REDD+ focuses on the capacity of forests, especially in the tropics, to capture and store

carbon. Forest carbon occurs in living and dead above-ground biomass, litter, below-ground biomass (roots) and the organic soil (collectively, 'carbon pools'). In most closed tropical forests, living biomass is by far the most important component of the carbon stock (although there are exceptions, such as heath forests on poor podsol soils and, in particular, peat swamp forests). Carbon may accumulate rapidly in young planted forests or in recently harvested forest stands but is mostly lost on harvesting, unless retained in the form of wood products. Primary forests often have the largest accumulation of carbon in their biomass but they tend to sequester little new carbon. A sustainably managed production forest is carbon-neutral in the long term – that is, there is no long-term net emission or sequestration of carbon.

Forests sequester and store more carbon than most other terrestrial ecosystems and could play an important role in mitigating climate change. When forests are cleared or degraded, however, their stored carbon is released into the atmosphere as carbon dioxide (CO₂) and other greenhouse gases (GHGs; such as methane). Tropical deforestation is estimated to have released in the order of 1–2 billion tonnes of carbon per year over the past 20 years, with estimates of the contribution to global GHG emissions ranging up to 20% (e.g. Houghton 2005). There are no estimates of counteracting sequestration. The largest source of GHG emissions in most tropical countries is deforestation and forest degradation. In Africa, for example, deforestation accounts for nearly 70% of total emissions (FAO 2005). Moreover, clearing tropical forests further destroys globally important carbon sinks that are currently sequestering CO₂ from the atmosphere and are critical to future climate stabilization.

The aim of REDD+ is to provide financial incentives to help tropical countries voluntarily reduce national deforestation, conserve and sustainably manage their permanent forest estates, and increase forest cover through reforestation and afforestation. Thus, REDD+ could simultaneously mitigate climate change (through carbon capture and storage), conserve biodiversity, protect other ecosystem goods and services, increase income for forest owners and managers, and help address issues of forest governance.

The operationalization of REDD+ will require accurate monitoring and reporting; forest

management activities included in REDD+ schemes are likely to be subject to high levels of scrutiny and accountability at the international level. Concepts such as PFE and SFM are likely to be adapted for use in REDD+ schemes. In this report, each country profile includes information on forest vulnerability to climate change and the country's potential to address the challenges and opportunities for tropical forests stemming from an international climate-change regime.

Vulnerability of forests to climate change

Climate change and climate variability¹ could be among the most serious threats to sustainable development, with potential adverse impacts on natural resources, physical infrastructure, human health, food security and economic activity.

Forests and rural landscapes in the tropics may be particularly vulnerable to the effects of climate variability, for example extreme weather events such as droughts (and associated wildfires), flooding and storms. At the same time, forests have the capability to reduce both environmental and social vulnerability.

In many tropical countries the climate appears to be changing. Recent data (as reported in Part 2) provide evidence of, for example, increasing temperatures and prolonged dry periods in some regions, and increased rainfall and more frequent tropical storms in others. In Mexico, there has been an increase in mean annual temperature of 0.6 °C in the past four decades. In Peru, average annual temperature has increased by 0.3 °C in the last 50 years. In Ghana, average annual temperature has increased by 1.0 °C since 1960, thus damaging the integrity of forest ecosystems. Adaptive approaches to forest management will become increasingly important in the face of climate change. Regardless of the pace of such change, healthy forests maintained under SFM will be better able to cope than those weakened and/or degraded by over-exploitation.

Rise of local stakeholders

In many countries, not only in the tropics, forest management has often taken a 'top-down' approach, whereby a central forest administration has supervised the harvesting and management of

¹ Climate change refers to long-term changes of climatic parameters, such as temperature, while climate variability refers to short-term changes and extreme weather conditions, such as droughts and increased frequency or intensity of storms.

large areas of forest. In recent years, however, people living closer to the forest, including Indigenous communities, have begun to express, at the national and international levels, their strong desire for more control over local resources. This trend has been strengthened in the United Nations with the adoption, in 2007, of the Declaration on Rights of Indigenous Peoples. Among other things, this declaration:

- States that Indigenous peoples have the right “to the recognition, observance and enforcement of treaties” concluded with states or their successors.
- Prohibits discrimination against Indigenous peoples.
- Promotes the full and effective participation of Indigenous peoples in all matters that concern them.
- Declares that states should consult and cooperate in good faith with Indigenous peoples in order to obtain their free, prior and informed consent before adopting and implementing legislative or administrative measures that may affect them.

The effects of this rise of local stakeholders vary. At the international level, the increased influence of Indigenous peoples is having an effect in shaping policies, especially in climate-change related bodies such as the UNFCCC, the Forest Carbon Partnership Facility and the REDD+ Partnership. In Latin America, there has been a significant transfer of forest ownership from the state to Indigenous and local communities. In Asia a similar if less significant trend has been observed, but there has been less change in Africa (ITTO & RRI 2009). In some instances there has been increased tension at the local and national levels over rights to land and resources.

The rise of local stakeholders has highlighted the limitations of what has been termed the ‘big-conservation’ model, whereby biodiversity conservation is achieved through the creation of large protected areas, often without accommodating the traditional ownership attached to, or the use made of, those areas by Indigenous and local people. In recent years there has been a strengthening of the view that a big-conservation approach to forest protection can be counterproductive where Indigenous people

and local communities have customary land-rights claims over those forests. At the international level and in many countries, including some in the tropics, efforts are being made to strengthen the participation of Indigenous and local people in policy debates and decisions and to reform land tenure, including forest tenure.

Ecosystem services

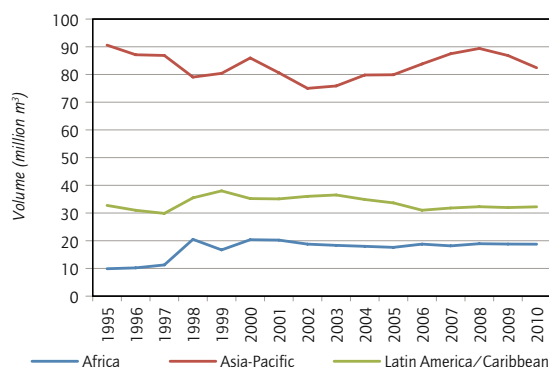
The role of tropical forests in the provision of ecosystem services, such as catchment protection, biodiversity conservation and carbon sequestration, is increasingly being recognized. Markets to facilitate payments for such services have been created in a number of countries and also internationally. At the international level, the volume and value of payments is still low, but, as discussed above in the context of REDD+, there is substantial potential for an increase, especially for carbon sequestration.

Tropical timber trade

The tropical timber trade faces increasing competition from non-tropical timber and a range of substitute products such as aluminium, plastics and steel. Moreover, some export markets are increasingly requiring evidence that imported timber is legal and, in some cases, that it has been produced in well-managed forests or is certified as sustainably produced. In some countries, especially in Africa, these demands appear to be having an effect on forest management.

Figure 2 shows that official timber (industrial roundwood or log) production was more-or-less stable in the 16 years from 1995 to 2010 in each of the three tropical regions, with declines in production in natural forests in some countries offset by increases in production from planted forests. Figure 3 shows charts of regional price indices derived by combining data for species tracked in ITTO’s *Annual Review and Assessment of the World Timber Situation* (ITTO 2010). The charts show that despite the cyclical nature of tropical timber commodity markets, most products have experienced modest price increases over the past decade. African and Asian logs (both up by over 60% in real terms since January 2000, an average increase of about 5% per year) were the best performers, due to continuing demand from countries such as China and India and supply restrictions (including export bans) in several

Figure 2 Tropical timber production, by region, 1995–2010



Note: Data reflect official production statistics from most countries.

Source: ITTO (2010).

exporting countries. African and Latin American sawnwood prices have risen by over 40% during the period (averaging about 3.5% per year), while Asian prices remained at 2000 levels at the end of 2010. Asian plywood prices were up by around 20% from 2000 levels at the end of 2010 (an annual increase of less than 2%), while Latin American plywood prices rose by around 15%. Even the average annual increase in log prices identified above barely kept pace with inflation in most exporting countries. The global financial crisis led to significantly lower prices for most tropical timber products in the second half of 2008 (although it had little apparent impact on overall timber production), and pre-crisis prices had generally not been attained by December 2010.

Tropical plywood exports, once a mainstay of the sector in several countries, have declined dramatically since the 1990s (Figure 4). Overall, many tropical countries are concerned that their natural-forest-based timber sectors are in decline, with key export markets turning away from natural tropical timber, supply dwindling, and prices stagnant or rising only slowly.

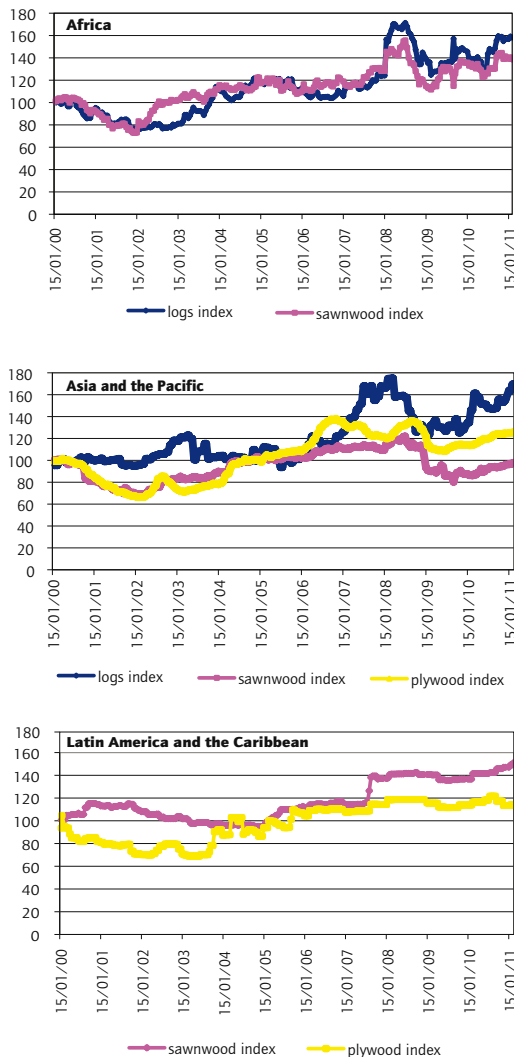
Nevertheless, the tropical timber sector also has opportunities to consolidate its position by moving towards SFM and by improving marketing and the use of innovative wood technologies. Some governments and industry segments believe that a move towards the production of certified, higher-value products would capitalize on an emerging 'green economy' and help to secure a viable future for the natural-forest-based tropical timber sector.

Measures to combat illegal timber trade

A number of consumer markets are becoming increasingly sensitive about the environmental credentials of timber products. New trade legislation, procurement policies and buyer preferences for legality-verified wood (as a minimum) are being developed and enforced. In 2008, the United States passed legislation (the Lacey Act) that makes it a criminal offence to import or trade in timber products that have been harvested illegally. The Government of Japan has adopted a public purchasing policy whereby only legally produced timber products may be procured for government projects. The European Union has passed legislation that requires all entities placing timber products on the European Union market to implement management systems that provide assurance that such products have been produced legally. In addition, several European Union member states have adopted public procurement policies that demand legally or sustainably produced timber, and the European Commission has issued guidelines for green public procurement that recommend legally produced timber as a minimum requirement.

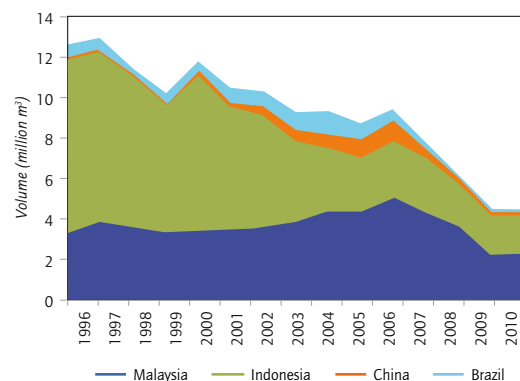
Such measures could have a dramatic impact on the tropical timber trade, and many export-oriented companies and countries are moving to adapt their management systems to meet these market demands. To assist such moves, the European Union is providing, through its Forest Law Enforcement, Governance and Trade Action Plan, technical assistance to governments, industry and NGOs to improve forest governance and the production and trade of legal timber products. In some cases this assistance is being provided on the basis of 'voluntary partnership agreements' (VPAs) between the European Union and timber-exporting countries, which, once entered into, become legally binding on both parties, committing them to trading only legal timber. Under VPAs, exporting countries develop systems to verify the legality of their timber exports to the European Union. The European Union and its member states provide support to help implement those systems. Other organizations are also helping tropical countries to address forest governance and timber legality through a range of measures. ITTO, for example, is assisting its member countries through several national-level projects and through its Tropical Forest Law Enforcement and Trade thematic program.

Figure 3 Tropical timber price indices, 2000–2010 (Jan 2000 = 100)



Source: ITTO (2010).

Figure 4 Aggregate tropical plywood exports, major countries, 1996-2010



Source: ITTO (2010).

STATUS OF TROPICAL FOREST MANAGEMENT

Assessment of data reliability

The capacity of countries to provide data for the present survey varied considerably, and no country was able to provide data for all indicators. In some cases there were differences in the ability to provide data depending on the legal status of the forests: for example, good-quality data might have been available for production forests, but few or no data were available for forests in protected areas.

Federations have an additional challenge in supplying national-level information because they must collate sometimes inconsistent data from their states or provinces. This is also an issue in countries undergoing decentralization.

Nevertheless, there has been a significant improvement in the information submitted by ITTO producer member countries. This can be seen in the overall response: in the 2005 survey, 21 of 33 countries submitted reports as requested, compared with 32 of 33 in the present survey (Vanuatu was the only country that did not submit a report). Moreover, Table 2 shows that, overall, the usefulness of country responses also increased.

Notwithstanding improvements in the information provided by countries, however, overall the data available for the present survey must be viewed, in many cases, as still unreliable or, at best, inconsistent. Ten countries² did not submit their reports in the ITTO C&I reporting format and there was a lack of recent quantitative data on a range of parameters. Estimates for the same parameter often differed according to source. Where the sources were credible, such contradictory estimates are included here, partly to illustrate the uncertainty associated with the data and partly to provide readers with realistic bounds for estimates. Overall, there remain serious deficiencies in the data, which should be borne in mind when assessing the report's conclusions.

For example, there were often very large differences in the estimates of total forest cover made by FAO (2010) and UNEP-WCMC (2010). These differences can be explained, at least in part, by the different methods employed in producing the

2 CAR, Gabon, Indonesia, India, Liberia, Mexico, Myanmar, Papua New Guinea, Thailand and Trinidad and Tobago.

Table 2 Assessment of ITTO producer responses, ITTO C&I reporting format, by region

Criterion*	Average score**							
	Africa		A/P		LAC		Overall average	
	2005	2010	2005	2010	2005	2010	2005	2010
1. Enabling conditions for SFM	1.6	2.3	2.1	2.0	2.3	2.3	2.0	2.2
2. Extent and condition of forests	1.1	2.0	1.8	2.0	2.1	2.2	1.7	2.1
3. Forest ecosystem health	1.0	1.5	1.9	1.8	1.8	2.1	1.6	1.8
4. Forest production	1.1	2.1	1.6	1.7	1.6	2.4	1.4	2.1
5. Biological diversity	1.2	1.6	1.6	1.6	1.8	2.1	1.5	1.8
6. Soil and water protection	0.9	1.2	1.4	1.7	0.9	1.9	1.1	1.6
7. Economic, social and cultural aspects	1.2	1.9	1.8	1.8	1.7	2.1	1.5	1.9
Average, all criteria	1.2	1.8	1.7	1.8	1.7	2.2	1.5	1.9

Note: A/P = Asia and the Pacific; LAC = Latin America and the Caribbean.

* The wording of criteria 2, 3, 4 and 6 has changed slightly. The criteria used in ITTO (2006) were: 2) Forest resource security; 3) Forest ecosystem health and condition; 4) Flow of forest produce; 6) Soil and water. Nevertheless, the scoring is comparable between reports.

** 0 = no information submitted; 1 = information given was not useful for reporting; 2 = information was partly useful for reporting; 3 = information was useful for reporting.

two datasets, but they nevertheless complicate any attempt at interpretation. For FAO (2010), the countries themselves provided estimates of their forest cover reached in various ways. UNEP-WCMC (2010), on the other hand, generated estimates of forest cover (in three crown-cover classes – 10–30%, 30–60% and >60%) on the basis of MODIS satellite imagery, which is unable to resolve at less than a 25-hectare scale. Under the approach taken by UNEP-WCMC (2010), any imagery pixel containing at least 10% canopy cover was counted as completely covered by forest, resulting in forest-cover estimates that are likely to be considerable over-estimates, as shown in Table 3.

This discrepancy in forest-cover data according to different sources and methods of data collection illustrates the difficulty of preparing consistent estimates of the many forest parameters that should be measured for the assessment of the status of forest management. While the estimates of overall forest cover provided by UNEP-WCMC (2010)

are not used in this report, data from that source were used in several ways, as detailed in Appendix II. Moreover, the forest-cover maps generated by UNEP-WCMC for each ITTO producer member country (and each tropical region) on the basis of that organization's forest-cover estimates are included here to indicate areas with significant forest cover, although overall these maps almost certainly over-estimate forest cover.

Inconsistency in the data makes comparisons between the 2005 and 2010 surveys difficult. The sources of data, or the methodology by which they were obtained, often differ: for example, the Government of Brazil did not submit a C&I report for the 2005 survey, but provided a great deal of useful information for the 2010 survey. There may also be differences in the parameters measured. To again use Brazil as an example, its tropical forest estate is taken to comprise forests in Amazonia, on the Atlantic coast, and in the *cerrado* and *caatinga*, although parts of some of these occur outside the tropics.

Table 3 Comparison of forest area estimates

Country	FAO (2010) and other sources*	UNEP-WCMC (2010)
	'000 ha	
DRC	112 000–154 000	224 000
Ghana	4680	19 000
Guatemala	2850–4290	10 600
Honduras	5190–6660	11 000
Indonesia	94 400–98 500	182 000
Nigeria	9040	52 300

* Other sources are specified in country profiles in Part 2.



Log landing in the buffer zone of the Pulong Tau National Park, Sarawak, Malaysia, with Batu Lawi in the background.

There is often uncertainty about what constitutes a PFE. In many countries a PFE could not be identified, data were ambiguous, forest designated as PFE had not been allocated to a particular function (e.g. production or protection), or it was unclear how much of a legally designated PFE was actually forested. As far as possible, anomalies in the PFE, and in the interpretation adopted here, are identified, by country, in the country profiles. In the case of the protection PFE, information was often deficient because the management of protected areas comes under a different jurisdiction to that of the institution providing the report to ITTO and internal communications between such institutions are often less than optimal.

Given their inconsistency, the data presented in this report should in many cases be treated with caution. Nevertheless, some broad legitimate conclusions can be drawn on the status of tropical forest management, and on the changes that have occurred since 2005, based on the following results.

Forest area and deforestation

Table 4 shows the estimated total forest area, total area of closed forest, and area of planted forest in ITTO producer member countries. By far the largest share of both total forest and closed forest is in Latin America and the Caribbean, due mainly to Brazil, which has an estimated 520 million hectares of forest (including non-tropical forest), an estimated 265 million hectares of which is closed forest.

The total estimated area of productive planted forest in ITTO producer member countries is 22.4 million hectares, more than half of which is in the Asia/Pacific region. Compared with other sources, such as FAO (2010) and ITTO (2009a), this is a low estimate, and indicates a halving in the area of planted forests since the 2005 survey (when a total planted forest area of 44.8 million hectares was reported). However, the entire apparent decline is accounted for by India, where the 32.6 million hectares reported in ITTO (2006) is now regarded as a significant over-estimate and has been reduced

Table 4 Total forest, closed forest and planted forest, ITTO producers by region, 2010

	Africa	A/P	LAC	Total
	million ha			
Total forest area*	270	282	868	1421
Total closed**	153	162	497	811
Total planted**	0.95	12.0	9.4	22.4

Note: Totals might not tally due to rounding. A/P = Asia and the Pacific; LAC = Latin America and the Caribbean.

* Source: FAO (2010); estimates include non-tropical forest in Brazil, India, Mexico and Myanmar. Total forest area includes natural and planted forest.

** Source: Country profiles in Part 2.

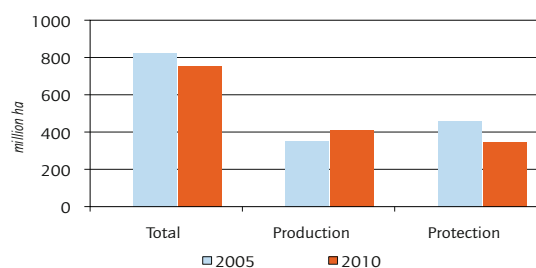
to 5.60 million hectares in this report. The apparent decline in area of 27 million hectares in India is due partly to the consideration in the report of India's tropical forest area only, partly to differing definitions of 'planted forest' (the higher estimate included 'natural' forests that had been subject to enrichment planting of local species, especially teak), and partly to the reportedly very low survival rates of newly established planted forests in India. The decline in India's reported planted forest area is partly offset in the regional and global totals shown in Table 4 by gains in a number of countries, the largest increases (in gross area) being in Brazil, Colombia, Malaysia, Myanmar and Peru.

In most ITTO producer member countries, deforestation rates in the period 2005–10 were generally well below 1%. Countries which exceeded this were Togo (5.75%), Nigeria (4.0%), Ghana (2.19%), Honduras (2.16%), Ecuador (1.89%), Guatemala (1.47%), Cambodia (1.22%) and Cameroon (1.07%) (FAO 2010).

Permanent forest estate

Overall, the global natural-forest tropical PFE in ITTO producer member countries reported here (761 million hectares) is lower than that reported for 2005 (814 million hectares; Table 5; Figure 5). This is not likely to be due to an actual reduction in the PFE, however. As noted above, the Government of Brazil did not submit data for the 2005 survey; the overall decrease in the estimated total PFE in Brazil (and differences in estimates for the production and protection PFE) between the 2005 and 2010 surveys is most likely due to differences in the definition of what constitutes PFE rather than to a significant change in legal status or forest area. In India, estimates of PFE for 2005 and 2010 refer to different kinds of forest; in 2010 only the PFE situated in the tropical part of India has been counted, whereas the 2005 estimate also included

Figure 5 Total, production and protection natural-forest PFE, ITTO producers, 2005 and 2010



Source: Country profiles in Part 2.

PFE in the temperate forest zone. If Brazil and India are ignored, the area of PFE in the tropics increased somewhat between surveys.

Sixty-three percent (482 million hectares) of the total natural-forest tropical PFE is in Latin America and the Caribbean, 22% (167 million hectares) is in Asia-Pacific and 15% (112 million hectares) is in Africa. Brazil accounts for 40% (310 million hectares) of the entire PFE of all ITTO producers, and about one-third of the total tropical natural-forest production PFE. Other countries with large natural-forest PFEs include Indonesia (65.9 million hectares), DRC (48.3 million hectares), Bolivia (38.2 million hectares) and Peru (38.1 million hectares).

The concept of PFE was first conceived for forests under state ownership and centralized control. It remains important for SFM and is likely to be crucial in REDD+, but, in many countries, its status under the law, its identification, and its demarcation on the ground remain problematic. This is not always for want of trying. Many conflicts over land tenure, discussed in greater detail below, are yet to be resolved and complicate efforts to prescribe a PFE or ensure its security on the ground. A trend towards greater community

Table 5 Total, production and protection natural-forest PFE, ITTO producers, by region

Region	Total PFE		Natural-forest PFE		Of which				Planted-forest PFE	
					Production PFE		Protection PFE			
	million ha									
	2005	2010	2005	2010	2005	2010	2005	2010	2005	2010
Africa	111	113	110	112	70.5	68.2	39.3	43.7	0.82	0.95
A/P	206	179	168	167	97.4	108	71.0	58.4	38.3	12.0
LAC	542	491	536	482	185	227	351	256	5.60	9.4
Total	859	783	814	761	353	403	461	358	44.8	22.4

Note: Totals might not tally due to rounding. A/P = Asia and the Pacific; LAC = Latin America and the Caribbean.

Source: Country profiles in Part 2.

Table 6 Natural-forest production PFE, ITTO producers by region, 2005 and 2010

Region	Total		Total available for harvesting		With management plans		Certified		Sustainably managed	
	million ha									
	2005	2010	2005	2010	2005	2010	2005	2010	2005	2010
Africa	70.5	68.2	44.0	45.7	10.0	28.0	1.48	4.63	4.30	6.56
A/P	97.4	108	72.5	62.8	55.1	58.0	4.91	6.37	14.4	14.5
LAC	185	227	34.7	56.9	31.2	44.7	4.15	6.02	6.47	9.51
Total	353	403	151	165	96.2	131	10.5	17.0	25.2	30.6

Note: Totals might not tally due to rounding. A/P = Asia and the Pacific; LAC = Latin America and the Caribbean.

Source: ITTO (2006) for 2005 estimates, country profiles in Part 2 for 2010 estimates.

ownership need not render the PFE concept obsolete, although it could mean that it will need to be approached in new ways.

Many countries still have large areas of forest outside the PFE. These are sometimes set aside deliberately for later planned conversion or reservation for other uses – as agricultural land, for example. Sometimes, however, land-use plans – if formulated – are not followed and forest – including in parts of the PFE – is parceled up and converted to other uses in an ad hoc fashion, jeopardizing efforts to achieve SFM.

Natural-forest production PFE

The total area of natural-forest production PFE in ITTO producer countries reported here is 403 million hectares (53% of the total PFE), compared with 353 million hectares in 2005 (Table 6). The estimate for Brazil in 2010 was considerably larger than in 2005 (135 million hectares compared with 98.1 million hectares), and it was larger in most other countries in Latin America and the Caribbean and in India and Myanmar. The estimated area of natural-forest production PFE decreased in Indonesia, from 46.0 million to 38.6 million hectares.

The extent of the production PFE in African ITTO member countries was relatively stable between the two surveys, although there was an increase in CAR and a decrease in Cameroon and Congo. Of the 403 million hectares of natural-forest production PFE, 165 million hectares are available for harvesting (e.g. they have been allocated as concessions, are under harvesting licences, or communities have harvesting rights), an increase of 14 million hectares compared with 2005.

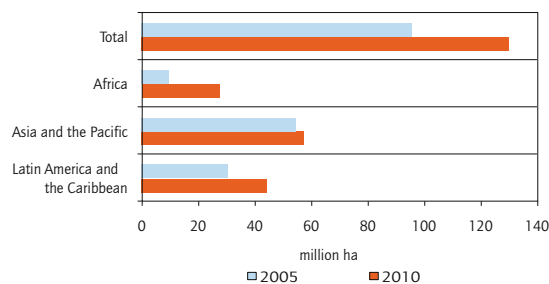
Management plans

The area of natural-forest production PFE under management plans increased in each region between the 2005 and 2010 surveys (Figure 6). Overall, an estimated 131 million hectares of the natural-forest production PFE is subject to management plans, an increase of about 35 million hectares since 2005. There were significant increases in the area subject to management plans in Bolivia, Brazil, Cameroon, Congo, DRC, Gabon, Myanmar, Peru and Venezuela, and there was a decrease in Indonesia. In Latin America in particular, a large area of PFE is neither harvested nor subject to management plans and may be under no threat due to its remoteness. A part of the estimated change in area can be attributed to improved information.

Certified forest

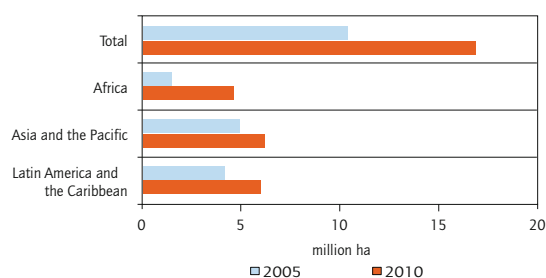
The area of certified natural-forest production PFE increased in each region between 2005 and 2010 (Figure 7). In all three regions combined, the certified forest area grew from 10.5 million hectares to 17.0 million hectares, an increase of 63% (1.3 million hectares per year). In percentage terms the

Figure 6 Area of natural-forest production PFE with management plans, ITTO producers by region, 2005 and 2010



Source: Country profiles in Part 2.

Figure 7 Area of certified natural-forest production PFE, ITTO producers by region, 2005 and 2010



Source: Country profiles in Part 2.

biggest growth was in Africa, where the certified forest area more than tripled, from 1.48 million hectares to 4.63 million hectares.

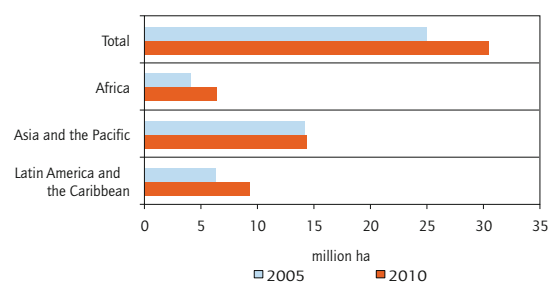
The general upward trend in the area of certified forest masks declines in some countries. In Bolivia, for example, there was a decline of about 500 000 hectares between the two surveys, and in Mexico there was a drop of about 150 000 hectares.

Under SFM

The area of production PFE considered to be under SFM increased between the 2005 and 2010 surveys, from 25.2 million hectares to 30.6 million hectares, an increase of about 20% (1.1 million hectares per year). This was despite a significant decline in the area under SFM in PNG (where the estimate made in the 2005 survey was likely a significant over-estimate) and lesser decreases in several other countries, such as CAR, Côte d'Ivoire and Ghana. Figure 8 shows that the area was steady in Asia and the Pacific and increased in Africa and Latin America and the Caribbean.

Even though the estimated total area of natural-forest production PFE is somewhat larger than the area estimated in 2005, the area under SFM as a percentage

Figure 8 Area of sustainably managed natural-forest production PFE, ITTO producers by region, 2005 and 2010



Source: Country profiles in Part 2.

of the natural-forest production PFE increased slightly, from 7.1% in 2005 to 7.6% in 2010.

Planted-forest production PFE

ITTO producer countries have an estimated 22.4 million hectares of timber-producing planted forests, of which 54% is in the Asia-Pacific region, 42% is in Latin America and the Caribbean, and only about 4% is in Africa (Table 5).

Protection PFE

The area of natural-forest protection PFE reported here is 358 million hectares (47% of the total PFE), compared with 461 million hectares in 2005 (Table 7). The estimated protection PFE for Brazil was considerably lower in 2010 (175 million hectares) than in 2005 (271 million hectares), which, combined with a decrease in protection PFE in India (from 25.6 million hectares to 4.54 million hectares), accounts for most of the decline. The protection PFE increased or was relatively stable in most other countries. Exceptions to this included Suriname, Mexico and DRC. All the apparent declines were due to the supply of better information, which allowed a more accurate estimation, rather than to changes in legal status.

Table 7 Protection PFE, ITTO producers by region, 2005 and 2010

Region	Total		With management plans		Sustainably managed	
	million ha					
	2005	2010	2005	2010	2005	2010
Africa	39.3	43.7	1.22	6.0	1.73	4.38
A/P	71.0	58.4	8.25	15.0	5.15	6.06
LAC	351	256	8.37	30.8	4.34	12.3
Total	461	358	17.8	51.9	11.2	22.7

Note: A/P = Asia and the Pacific; LAC = Latin America and the Caribbean.

Source: Country profiles in Part 2.

Management plans

The estimated area of protection PFE with forest management plans in 2010 (51.9 million hectares) is significantly higher than the estimate made for 2005 (17.8 million hectares). The largest regional increase in percentage terms was in Africa, and the largest in terms of gross area was in Latin America and the Caribbean (Figure 9).

Part of the overall increase in 2010 may be due to better information. For example, no data were available in 2005 on the extent of protection PFE covered by management plans in Myanmar, but an estimate of 5.33 million hectares was provided for 2010. Nevertheless, there has also been a real expansion in the use of management plans for protected areas. For example, considerable progress in the development of management plans has occurred in Cameroon (2.23 million hectares of protection PFE now covered by management plans, compared with none in 2005), provisional management plans are now in place for about 1.23 million hectares of protection PFE in Gabon, and about 11.6 million hectares of protection PFE in Peru are now subject to some sort of management planning.

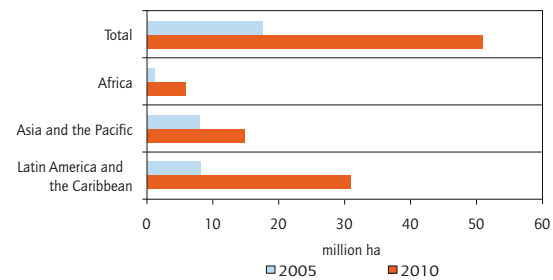
Under SFM

The estimated area of sustainably managed protection PFE more than doubled over the period, from 11.2 million hectares in 2005 to 22.7 million hectares in 2010. This increase was due mostly to a near tripling of the area in Africa and Latin America and the Caribbean (Figure 10).

To a very large extent the apparent increase is due to the better availability of information on the management of protected areas. In 2005, no estimates were made of the area of protection PFE under SFM in 19 of the 33 ITTO producer member countries; in 2010, estimates have been made in all but seven countries. Nevertheless, payments for ecosystem services, and international donors, including NGOs, are playing an increasing role in the financing of protected-area management in tropical countries and thereby helping to ensure the sustainable management of the protection PFE.

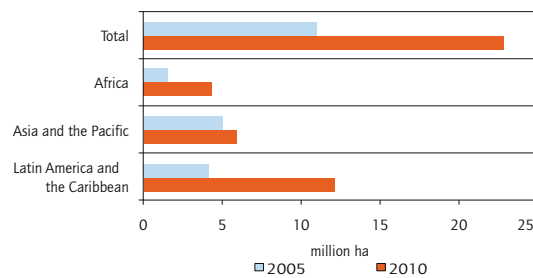
If protected areas are to be effective in the conservation of biodiversity it is essential that, among other measures, large samples of each forest type should be conserved in all the ecoregions in which they occur. For this, a division into

Figure 9 Area of protection PFE with management plans, ITTO producers by region, 2005 and 2010



Source: Country profiles in Part 2.

Figure 10 Area of protection PFE under SFM, ITTO producers by region, 2005 and 2010



Source: Country profiles in Part 2.

ecoregions and a classification of forest types is necessary. Many classifications have been devised for this purpose. The World Wide Fund for Nature (WWF)'s 'ecoregions framework' was used recently by Coad et al. (2009) in a review of progress towards the Convention on Biological Diversity (CBD)'s targets on protected-area coverage. This framework distinguishes five tropical ecoregions – Neotropic, Afrotropic, Indo-Malay, Australasia and Oceania – and identifies twelve tropical forest types (plus some areas of 'unresolved tree cover'). For each of these forest types, Coad et al. (2009) estimated the area of forest in IUCN protected-area categories I–IV globally, as shown in Table 8.

One of the CBD's targets with respect to protected-area coverage is "at least 10% of each of the world's ecological regions effectively conserved". Table 8 shows that, at the global scale, this target has been achieved or exceeded in six of the twelve tropical forest types, is relatively close to being achieved in four tropical forest types, and is some way from being achieved in tropical freshwater

swamp forest and tropical mixed needleleaf/broadleaf forest. There is immense ecological variation within these broad categories which should be considered in the design of protected-area networks at the subregional and national levels.

In some ITTO producer member countries there are moves towards an expansion of the protected-area network, as illustrated by a growing trend towards the establishment of transboundary conservation areas (that is, complexes of protected areas and sustainable-use areas involving cross-border cooperation, many of which have been supported by ITTO). More data on the representativeness of protected-area networks are required, however.

Moreover, as noted earlier, the concept of big conservation – the setting aside of large areas of forest, where human disturbance is discouraged – can be counterproductive where Indigenous people and local communities have customary land-rights claims over those forests. In many countries, further work is required to ensure that the establishment and management of representative protected-area networks are compatible with the rights and needs of Indigenous and local people.

Forest ownership

There have been many recent developments in forest tenure and ownership in response to a general movement to involve local communities more closely in decisions about the future of the forests and the realization that clear tenure is a prerequisite for SFM.

Data on forest ownership were not tabulated in the 2005 survey and the discussion below relates to the present situation and qualitative changes that have occurred in recent years. Figure 11 shows that the trend towards greater ownership by Indigenous and other local communities is most pronounced, by far, in Latin America and the Caribbean. Generally, however, data on forest tenure are patchy, and few countries were able to provide data on tenure specific to the PFE. In some countries, confusion about the status of land tenure may partly be the cause of the generally poor data available on forest ownership.

In most countries in West and Central Africa the state has claimed legal title since the colonial period, although the customary ownership of the same areas dates back centuries. In Ghana, forests are owned by tribal chiefs but held in trust by the state. The disconnection between the legal and customary systems in Africa is a hindrance to SFM, exacerbating problems of governance, inequity and conflict and restricting the capacity of local communities to pursue development opportunities (ITTO 2009b). Nevertheless, in some African countries, such as Cameroon and Liberia, there are signs that governments have recognized the problem and are moving to address it.

In Asia, too, the overwhelming majority of forest is owned by the state, with greater than 80% public ownership in Cambodia, India, Indonesia, Malaysia, Myanmar, the Philippines and Thailand. In the Pacific Island states of Fiji, Papua New

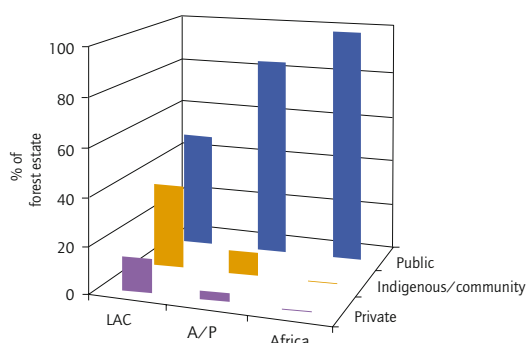
Table 8 Tropical forest types, and their representation in IUCN protected-area categories I–IV

Tropical forest type	Total area	Area in IUCN I–IV	% of total
	million ha		in IUCN I–IV
Upper montane forest	47.6	8.65	18
Semi-evergreen moist broadleaf forest	84.3	14.9	18
Sclerophyllous dry forest	24.1	3.87	16
Mangrove	11.9	1.69	14
Lower montane forest	44.8	5.69	13
Lowland evergreen broadleaf rainforest	649	66.7	10
Thorn forest	1.01	0.10	9.5
Deciduous/semi-deciduous broadleaf forest	173	15.4	8.9
Needleleaf forest	3.20	0.28	8.8
Sparse trees/parkland	101	8.02	8.0
Freshwater swamp forest	44.0	3.01	6.9
Mixed needleleaf/broadleaf forest	0.89	0.04	4.3
Total forest cover	1180	128	11.3

Note: This table gives a lower estimate of total tropical forest cover than that shown in Table 1. In part this is due to differing assessment methodologies, including in the definition of tropical forest.

Source: Coad et al. (2009).

Figure 11 Tropical forest ownership, ITTO producers by region, 2010



Note: A/P = Asia and the Pacific; LAC = Latin America and the Caribbean.

Source: Country profiles in Part 2.

Guinea and Vanuatu, in contrast, almost all forest is under Indigenous or community ownership, although compared with the Asian countries the area of forest involved is small. Conflicts over land ownership are reported to be widespread in Cambodia, and there is an ongoing dispute over land ownership between the state and the Penan in Sarawak, Malaysia. In India, the legal transfer of ownership to Indigenous communities may increase under the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, although the implementation of that Act has so far proved problematic.

In Latin America and the Caribbean, large areas of forest are owned by Indigenous people and other local communities. In Brazil, for example, 106 million hectares of the Amazon Basin have been allocated to Indigenous communities, and the majority of those lands have been regularized (meaning that full rights have been secured). More than 50% of Ecuador's forest is under Indigenous or community ownership, and there are also significant areas under such ownership in Bolivia,

Colombia, Guatemala and Mexico. In contrast, almost all forest is owned by the state in Suriname and Venezuela, and 80% or more is owned by the state in Guyana, Panama and Trinidad and Tobago. In Brazil, where about 20% of the forest is already owned privately, a law approved in 2009 will facilitate the further privatization of federally owned forest in the Legal Amazon. As elsewhere in the tropics, disputes over land tenure are common in Latin America and the Caribbean, and recent tensions have been observed in Bolivia, Colombia, Mexico and Peru.

Timber production

Table 9 shows the total official industrial roundwood production and the area of production PFE, by region. The ratio of these two parameters gives an approximation of the average harvest per hectare per year, an (albeit rough) indicator of the sustainability (or otherwise) of timber production.

It is generally accepted that the mean annual increment of well-managed tropical forest is about 1 m³ per hectare. As Table 9 shows, average production is well below this in all three regions, and a country-by-country analysis (Appendix IV) shows that this is true for the great majority of ITTO producer countries. For 24 countries the average annual industrial roundwood harvest is under 0.5 m³ per hectare. Harvest levels exceed 1 m³ per hectare per year in the following five countries: Ghana (1.39 m³ per hectare per year), Nigeria (2.29 m³ per hectare per year), Togo (8.2 m³ per hectare per year), Malaysia (1.64 m³ per hectare per year) and Thailand (2.37 m³ per hectare per year). Note, however, that even in these countries the harvest in the PFE may not exceed the sustainable yield, since some of the recorded harvest was obtained from planted forests (with a much higher annual yield per hectare than natural forests) and/or from outside the PFE (in conversion

Table 9 Industrial roundwood production versus area of production PFE, ITTO producers by region

Region	Industrial roundwood production (2009) (million m ³ /year)	Total area of production PFE (million ha)	Average annual production per ha of production PFE (m ³ /ha)
Africa	18.8	69.2	0.27
A/P	85.5	120	0.71
LAC	31.7	236*	0.13
Total	136	425	0.32

Note: A/P = Asia and the Pacific; LAC = Latin America and the Caribbean.

* Includes planted forest in Brazil, some of which is non-tropical.

Source: Country profiles in Part 2, and ITTO (2011).

forests, for example). Moreover, the sustainable mean annual increment may be higher than 1 m³ per hectare in some forest types. On the other hand, official data for timber harvests often do not take into account illegal and other informal extraction (often including fuelwood harvesting) and therefore may underestimate the actual off-take. In addition, some of the PFE (e.g. some planted forest in Brazil) is outside the tropics.

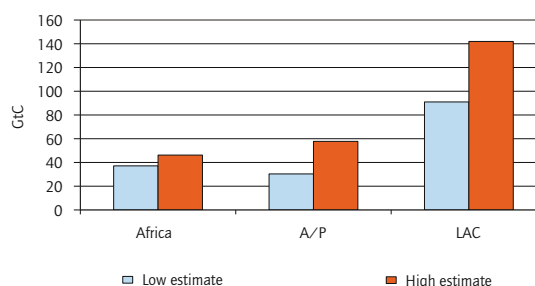
Forest carbon

The IPCC (2007) estimated the total global carbon stock in above-ground living forest biomass in the range 352–536 gigatonnes of carbon (GtC). There is considerable uncertainty about forest carbon estimates, however, because there is no methodology for measuring it directly. Some authors have proposed lower estimates for above-ground living forest biomass than those of the IPCC because of forest degradation and the effects of management interventions on carbon stock; for example, Kauppi (2003) estimated it at 300 GtC. Outside the tropics, the stock of carbon in above-ground living forest biomass is reasonably well known on the basis of ongoing forest inventories (Houghton 2005), but data on the carbon stock in tropical forests is much more uncertain because only a few tropical countries have reliable forest inventory data. Thus, the range of estimates of carbon emissions arising from tropical deforestation and forest degradation is broad. This uncertainty over the size of tropical-forest carbon pools and emissions, and their potential as sinks, is one of the main challenges for the readiness phase of REDD+.

This report provides estimates of the total above-ground forest carbon stock on the basis of Gibbs et al. (2007) and other sources for the 33 ITTO producer member countries. In total, the estimates by Gibbs et al. (2007) are in the range 157–247 GtC, which is more than 80% of the total estimated above-ground forest carbon stock in the tropics. Figure 12 summarizes these estimates by region. For both the high and low estimates, Latin America and the Caribbean accounts for about 57% of the total, due mainly to the vast stocks in the Amazon.

The vegetation density of a country is a good indicator of its potential for both the conservation of existing forest carbon stock and the creation of additional carbon sinks. Figure 13 shows, for each

Figure 12 High and low estimates, forest carbon (above-ground living biomass), ITTO producers



Note: A/P = Asia and the Pacific; LAC = Latin America and the Caribbean.

Source: Country profiles in Part 2, based on data in Gibbs et al. (2007).

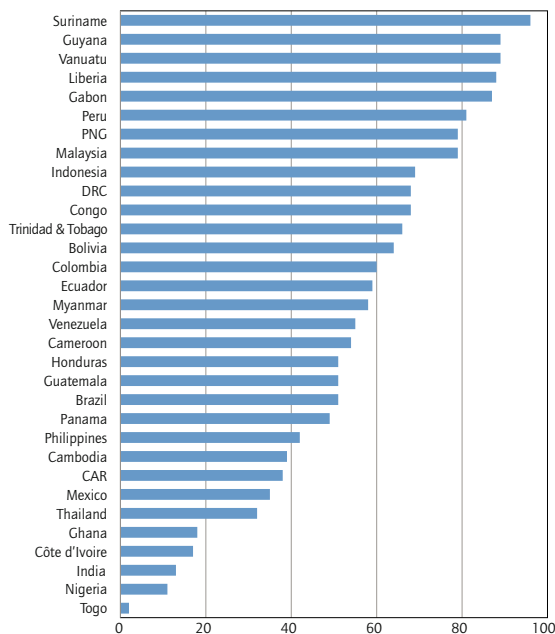
ITTO producer member country, the area of forest with canopy cover greater than 60%, based on data provided by UNEP-WCMC (2010).

Adaptation to climate change

Few data are available on the adaptive capacity of ITTO producer member countries to address the issue of vulnerability in the forest sector. More research and action-oriented planning is needed to assess more exactly the possible nature of climatic changes in each instance, the vulnerability of the forest to these anticipated changes, and the most suitable adaptive measures in each case. Many management options are available to increase the resilience of forest ecosystems, including adaptive silviculture and, in planted forests, judicious species selection. At the landscape scale, the protection of large areas of forest with internal variations in climate, altitude and soils and the development of linking networks of forest would likely enable the internal migration of species and decrease vulnerability to climate change.

ITTO producer member countries have addressed the vulnerability of their forest sectors to climate change in various ways. Those classified as Least Developed Countries – Cambodia, CAR, DRC, Liberia, Togo and Vanuatu – are eligible for funding to develop national adaptation programs of action (NAPAs), which include references to the importance of ecosystems, including forests, in climate-change adaptation. Other countries (e.g. Indonesia, Ghana and Peru) have included forests in their national adaptation strategies and linked their forest-based adaptation agenda to REDD+.

Figure 13 Percentage of forest with canopy cover >60%, ITTO producers



Note: Data unavailable for Fiji.

Source: UNEP-WCMC (2010).

Involvement in REDD+

As of March 2011, only seven of the 33 ITTO producer members (Côte d'Ivoire, Fiji, Malaysia, Myanmar, Togo, Vanuatu and Venezuela) were not participating in one or more of the major global initiatives on REDD+ readiness (i.e. the Forest Carbon Partnership Facility, UN-REDD, the Forest Investment Program, the Global Environment Facility and major bilateral programs on REDD+). Some ITTO producers (e.g. Brazil, DRC, Indonesia and others) are involved in several such initiatives.

Each country profile presented in this report contains a qualitative assessment (on the basis of a methodology proposed by Herold 2009) of the country's potential for forest carbon capture and storage and (where available) information on the challenges facing the country in exploiting that potential.

CONCLUSIONS AND RECOMMENDATIONS

Key parameters

Overall, there appears to have been continuing progress towards SFM in tropical forests in the period 2005 to 2010. Some of the developments that were identified as indicating progress towards SFM in the 2005 survey have continued since, including the move towards the enactment of new forest laws and regulations and the reorganization of departments responsible for forests. Increasing interest in certification is also apparent within both government and the private sector. There have been developments in forest law compliance, stimulated particularly by demands from importing countries for legality-verified products.

The REDD+ concept has been embraced in many countries, stimulated in part by the growing availability of funds to support such measures. Overall there have been increases in the areas of production and protection PFE subject to management plans and the area of production PFE that is certified, and there has been a significant increase in the total area of production and protection PFE under management considered consistent with sustainability, from 36.4 million hectares in 2005 to 53.6 million hectares in 2010, an increase of nearly 50%, or about 3.4 million hectares per year. Part of this increase may be due to improvements in information, especially for the protection PFE.

The improvement in the quality of information submitted by countries for the survey is noteworthy. This is no doubt due in part to the revision of the ITTO C&I reporting format (and associated national training workshops), which reduced the number of indicators and provided clearer guidance. Moreover, there have been improvements in many countries in data collection and management. For the present survey, eight countries³ submitted reports without financial assistance from ITTO, suggesting a growing capacity to generate and supply data as part of routine work. However, many countries are still unable to provide reliable data on a range of parameters, and there is a continuing need to improve data collection and management. For example, few countries provided estimates of

³ Brazil, Fiji, Guyana, Honduras, Malaysia, Myanmar, Trinidad and Tobago and Suriname.

sustainable timber yields or data on actual off-takes in their PFEs.

There has been a continued devolution of responsibility to lower echelons of government and to communities. In the long run this may have a beneficial effect on SFM but, in the short term, local governments and communities often lack the human and financial resources to pursue SFM. In many countries, the capacity of Indigenous organizations requires strengthening to ensure that SFM is feasible on lands under their control and that Indigenous rights are upheld. In some cases, community enterprises have struggled to sustain certification programs because of their relatively high cost and uncertain benefits. While some countries have enacted laws designed to clarify land (including forest) tenure and to recognize customary ownership, the pace of such reforms is often slow. Conflicts over resource ownership and use continue and appear to be particularly prevalent in countries that are not moving to address tenure.

Countries that appear to have made significant progress towards SFM in the past five years include Brazil, Gabon, Guyana, Malaysia and Peru. These countries were all able to supply useful information in the C&I reporting format (with the exception of Gabon, whose report was not in the C&I format), they have generally progressive forest-related policies, laws and regulations, relatively clear tenure regimes and strong institutions, and law enforcement is improving on the ground. There has been a general improvement in countries of the Congo Basin, including rapid growth (albeit from a low base) in the area of certified natural forest.

While almost all countries have seen improvements in forest management in the past decade, some countries appear to be making less progress towards SFM than others. A number of ITTO producer countries – for example, Cambodia, Côte d'Ivoire, DRC, Guatemala, Liberia and Suriname – have endured major conflicts in recent decades, greatly hindering the development of the institutions required to put SFM into effect and restricting the development of local expertise. In countries such as Nigeria and PNG, the forest administration lacks the resources to adequately supervise the forest management regime. A lack of forest law enforcement remains a major problem in many countries, and there has been less progress in identifying, demarcating and

securing PFEs than ITTO and other observers hoped for. While Vanuatu has not been subject to conflict, its inability to provide information on the management of its forest resources may be indicative of a lack of capacity to implement SFM. ITTO and others will continue working with all countries to try to accelerate progress towards SFM.

Natural-forest production PFE

Significant progress has been made since the 2005 survey towards the sustainable management of the production PFE. There has been an increase in the overall area of the PFE (403 million hectares, compared with 353 million hectares in 2005), in the area covered by management plans (131 million hectares, compared with 96.3 million hectares in 2005), in the area certified (17.0 million hectares, compared with 10.5 million hectares in 2005), and in the area considered to be under SFM (30.6 million hectares, compared with 25.2 million hectares in 2005). Table 10 summarizes these trends for the natural-forest production PFE in each of the three regions.

As noted in the 2005 survey, the area of production PFE under management plans is much greater than the area considered to be under SFM. Part of the discrepancy may be because more information is available on the area covered by management plans than on the extent to which such management plans are being implemented. The process of developing management plans is important in itself because it requires the collection and collation of data on the forests in question and a clear statement of management objectives and requirements. If SFM is to be achieved, however, at any scale, management plans must be implemented, their implementation must be supervised, and their impacts must be monitored and reported. Ultimately, new knowledge must be gained through monitoring and experience to feed into the future planning of adaptive forest management.

In many ITTO producer member countries, such a process is lacking or only nascent; it is hampered by a general lack of capacity in the agencies and community organizations that have responsibility for overseeing forest management. Increased international support, including that envisaged through REDD+, would help to address this problem, as would increased domestic support for forest administration.

Table 10 Regional trends, production PFE, ITTO producers

Region	Area of forest in:			
	Production PFE	Production PFE under management plans	Certified forest	Production PFE under SFM
Africa	→	↑	↑	↑
A/P	↑	↑	↑	→
LAC	↑	↑	↑	↑
All	↑	↑	↑	↑

Note: Trend assumed to be steady if less than 5% change. Trends in individual countries may differ from regional trends. A/P = Asia and the Pacific; LAC = Latin America and the Caribbean.

Planted-forest production PFE

Planted forests are playing an increasingly significant role in the supply of tropical timber. Although the quality of data on the area of productive planted forests is highly variable, it is clear that the area of planted tropical forest has expanded considerably in the last 15–20 years. Some areas where trees were planted but subsequently died or were otherwise removed are still recorded as plantations in forest area statistics of a number of countries. The estimated 22.4 million hectares of productive planted forests in ITTO producer countries is about 5% of the total production PFE. This percentage varies by country and region. In the Asia-Pacific region, for example, planted forests comprise about 10% of the total production resource.

Often, countries with scarce natural-forest resources have particularly focused on their planted-forest estates, but an exception is Brazil, which not only has the single-largest natural-forest resource among ITTO producer member countries but also a large area of planted forests. In some countries, the absence of well-defined property rights has been an obstacle to attracting investment in planted forests. Additional constraints are competition for land; low technical or organizational ability in the management of planted forests; little dialogue between the public and private sectors; insufficient research and development; and a lack of financing mechanisms.

In some countries, the expansion of planted forests will ease pressure on natural forests as they meet an increasing proportion of those countries' timber needs. On the other hand, this easing of pressure may be at least partly offset by the superior financial performance of well-managed plantations, which

increases their attractiveness as a land-use, possibly at the expense of natural forests. Many industrial forms of agriculture have a similar superior financial performance, and this is a major cause of deforestation.

Non-timber forest products

Although NTFPs are important for local livelihoods in all ITTO producer member countries, and many are traded in significant quantities at the local, regional and global levels, data on their use and economic value remain scarce. Moreover, in many countries the management of NTFPs is ad hoc, and little is known about its sustainability. There is little doubt that some NTFPs, such as some forms of bush meat, are being harvested unsustainably, and more effort is needed to regulate their management, harvesting and trade.

Protection PFE

Significant progress has been made since the 2005 survey towards the sustainable management of the protection PFE. The apparent decrease in the overall area (358 million hectares, compared with 461 million hectares in 2005) is due mainly to greater clarity in the data rather than to any change in legal status of such areas. There have been large increases in the area covered by management plans (51.9 million hectares, compared with 17.8 million hectares in 2005) and the area considered to be under SFM (22.7 million hectares, compared with 11.2 million hectares in 2005). Table 11 summarizes these trends for the protection PFE in each of the three regions.

Data are still sparse on the extent to which the protection PFE represents the full diversity of forest ecosystems found in tropical countries. Until recently, the designation of protected areas

Table 11 Regional trends, protection PFE, ITTO producers

Region	Area of forest in:		
	Protection PFE	Protection PFE under management plans	Protection PFE under SFM
Africa	↑	↑	↑
A/P	↓	↑	↑
LAC	↓	↑	↑
All	↓	↑	↑

Note: Trend assumed to be steady if less than 5% change. Trends in individual countries may differ from regional trends. A/P = Asia and the Pacific; LAC = Latin America and the Caribbean.

has often been relegated – not just in the tropics – to those areas of land left over when all other economic land-uses have been satisfied or that are too difficult to harvest. But it is now recognized that protected areas should be selected according to their intrinsic value for biodiversity conservation, which usually means the inclusion of representative samples of all forest ecosystems; any areas of exceptional biological richness or where there are concentrations of endemic species; and the breeding, feeding and staging grounds of migratory species. It is desirable that protected areas are large and contain internal variation and, ideally, they should constitute a network of connected habitats if they are to accommodate large animals and be buffered against environmental change. They also depend crucially on the cooperation and support of local communities. Data were generally insufficient to assess the extent to which the present allocation of protected areas takes account of such factors.

Forest carbon

Most ITTO producer member countries have considerable potential for forest-based carbon capture and storage, and most have taken steps to prepare for REDD+. Given the high expectations in many countries that REDD+ could generate significant funds for tropical forest management, clear signals from international climate-change negotiators, including the eventual establishment of a market in forest carbon credits, are to be welcomed.

Summary of change

The following points summarize the present status of SFM in ITTO producer countries.

- In many countries, more progress is needed to clarify the concept of PFE according to national

circumstances and to identify, inventory, demarcate and protect the PFE.

- Forest-related laws and regulations continue to evolve, for the most part in a direction compatible with SFM.
- A general trend towards decentralization and greater recognition of Indigenous and local people is not yet matched by a flow of resources to support efforts to achieve SFM at the decentralized level.
- Forest law enforcement is often weak, exacerbated by a lack of enforcement capacity, confusing and sometimes conflicting laws, especially those related to tenure, and uncertainty generated by decentralization processes, including disputes over jurisdiction between government agencies. In some countries, the demand for legality-verified timber is having an effect on timber exports.
- The resources allocated by governments and development assistance agencies to forest management remain seriously inadequate, reflected in a lack of capacity in government agencies.
- Information about SFM continues to improve but is still far from adequate for the comprehensive monitoring, assessment and reporting of SFM and any large-scale fund-transfer mechanism arising out of REDD+ or other schemes designed to improve the management of tropical forests.

Constraints to SFM

Putting aside the difficulties caused by wars and armed conflicts, which are profound, several constraints frequently recur in the country profiles. Probably the most important, and the



Ghanaian scientists assess plant biodiversity in a forest plot in Ghana. © L. Amisah

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

Nevertheless, natural tropical forests are recognized increasingly as a valuable resource at the local, national and global levels, especially for the ecosystem services they supply. In some countries, payments are being made for such ecosystem services, and REDD+ offers a potentially important revenue-earning opportunity for forest owners. In the long run, the extent of payments for the ecosystem services supplied by tropical forests – made at either the national level or the global level – are likely to play a large part in determining the fate of the remaining tropical forests. In order for such payments to achieve their potential to impact forest management, constraints related to governance also need to be overcome. Those governments, companies and communities that

have been striving to improve forest management, even when they have not yet been wholly successful, merit the long-term support of markets, development assistance agencies, NGOs and the general public.

Another constraint to SFM is confusion over ownership. Without the security provided by credible, negotiated arrangements on tenure, SFM is unlikely to succeed. In many countries, resolving disputes over land tenure is no easy task but it must be tackled – preferably through a transparent and equitable process – if resource management is ever to become sustainable. If the trend towards greater community and Indigenous ownership, and less state ownership, continues, the concept of PFE may need to be re-thought, but it should not be discarded.

Future directions

The global setting for the management of tropical forests is changing. Populations and aspirations are growing and the ability of people living in remote areas to communicate with others is escalating at phenomenal speed. The agricultural frontier is continuing to advance at the expense of forests. For timber, the demand for certified and/or legality-verified wood is starting to influence the management of export-oriented suppliers, but

this effect may be very small for the majority of the tropical forest estate. Conversely, the ready availability of relatively cheap commodity timbers from non-tropical forests, tropical planted forests and illegal operations, as well as other substitute materials, will restrict the price increases that are possible for timber from sustainably managed natural tropical forests for as long as it remains a commodity product.

The global market for tropical timber is also changing. Demand in the traditional export markets of Europe, Japan and North America has declined, and ITTO producer countries are exporting increasing quantities of timber to China and India and intra-regionally. Domestic markets are growing. Some of these markets place little emphasis on certification or legality-verification. The continued growth of these markets may reduce the incentive to pursue SFM, but certification and legality-verification will likely emerge as drivers in some of them.

Standards of forest management tend to improve as countries become richer and better able to allocate resources to enforce forest laws and implement SFM. It is likely, therefore, that SFM will become more widespread in the tropics as economies grow, although such growth might also increase deforestation, at least temporarily. In some instances there may be migration from the forest to cities, which may reduce pressure on the forest. Eventually, countries that continue to develop economically will attain the capacity necessary to safeguard their PFEs and to manage them sustainably. Conversely, continued poverty poses a significant threat to tropical forests.

A review of the information used to assemble this report indicates that a number of developments in tropical forests are possible in coming years, including the following.

- A continued expansion of planted forests and the use of agricultural tree crops for timber may reduce timber-demand pressure on the natural forest by supplying an increasing proportion of wood production, although it may also cause more deforestation, as might an increased demand for biofuels.
- Declining timber prices, increased prices for agricultural products and/or a larger shift to emerging markets could undermine efforts towards SFM.
- A flow of funds for REDD+ and other forest services could stimulate increases in the capacity to manage, monitor and police forests; it could also induce efforts in reforestation and forest restoration.
- A greater focus on the management of high-value timber species, an expanded range of species, and/or increased value-added production could help increase the profitability of natural forest management.
- Changes in climate or weather patterns could affect the growth, yield and vitality of forests. Extreme weather conditions, such as prolonged droughts, torrential rain and tropical storms could reduce the stability of forest structure and lead to increased erosion, forest fire and wind damage, and changes in the incidence of pests and diseases. Adaptive management, and a diverse forest resource, will increase resilience.
- Tenure issues could be resolved more often on the basis of transparent and equitable negotiation between claimants. As their rights become more recognized, Indigenous peoples could play an increasing role in the management of natural forests.
- The wider responsibilities of communities and Indigenous people living in constant contact with the forest may lead to a diversification of forest use, with more emphasis on ecosystem services.

Overall, it seems likely that the global area of natural tropical forests will continue to decline in the medium term as land is diverted to more profitable uses. On the other hand, the management of the PFE is likely to continue to improve, although the pace of such improvement is less easy to predict. Those countries with clear and undisputed forest tenure, a well-defined PFE and adequate resources for administering the resource are best placed to make rapid progress. ITTO and others seeking to promote SFM in the tropics must be vigilant for change, remain flexible in approach, but continue to press for the sustainable management and conservation of tropical forests.

Recommendations

The usefulness of this survey will be enhanced if it continues to be repeated at reasonably regular (and frequent) intervals, because the identification

of trends is essential in assessing progress towards SFM. It is therefore recommended that regular reporting on the status of tropical forest management be continued at the international level. Given that FAO has also started to provide data on SFM in its five-yearly forest resources assessment, there will be benefits in continuing to align the two processes more closely.

Many countries still lack the capacity to collect, analyze and make available comprehensive data on the status of forest management. Assisting countries to improve the quality of data on forest management should be a priority for the international community.

A crucial element of improving forest management is an accurate picture of the PFE. Many countries still lack such an accurate picture, and assistance should be provided as a matter of urgency to enable them to establish their PFEs if they have not already done so and to undertake detailed inventories of these areas. This will be even more crucial should significant funds become available through REDD+.

A general progression towards SFM in the tropics will be faster and more robust if SFM is seen as a financially competitive land-use. Another priority for the international community should be to increase payments for the global ecosystem services provided by natural tropical forests, including those related to carbon capture and storage.

Member countries should be encouraged to build on the advances identified in this report. ITTO will continue working with its many partners to help them to do so.

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PART 2 COUNTRY PROFILES



A moabi tree in the production PFE, Cameroon.

AFRICA



Cameroon 46

Gabon 90

Central African Republic 55

Ghana 99

Congo 64

Liberia 112

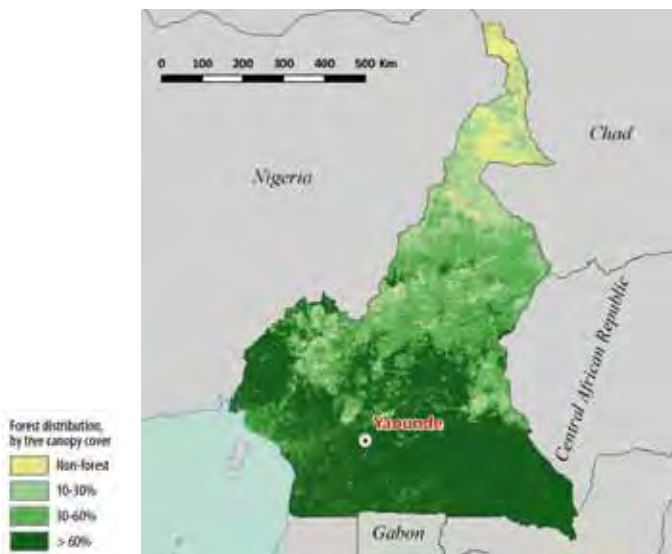
Cote d'Ivoire 72

Nigeria 124

**Democratic Republic of
the Congo 81**

Togo 135

CAMEROON



Forest resources

Cameroon has a land area of 47.5 million hectares and an estimated population in 2010 of 19.9 million people (United Nations Population Division 2010). Cameroon is ranked 153rd out of 182 countries in UNDP's Human Development Index (UNDP 2009). The country stretches between latitudes 2° and 13° north from the Gulf of Guinea to Lake Chad. The coastal plain is about 600 km long and 100–200 km wide, its inland limit marked by slopes and steep scarps. The southern plateau, the site of Cameroon's major closed-forest area, is 500–800 m in altitude and the central Adamaoua high plateau is generally 1000 m or more above sea level. Estimates of forest area vary from 19.7 million hectares (MINFOF 2008), to 21.2 million hectares (Government of Cameroon 2009, FAO 2010), to 27.2 million hectares (de Wasseige et al. 2008). The latter estimate includes the categories forest–cropland mosaic and forest–savanna mosaic.

Forest types. Cameroon's forests are mainly tropical rainforests of two predominant types: lowland evergreen (54% of total forest area), and lowland semi-deciduous (28%).^a They are particularly rich in commercial species, including various species of Meliaceae, such as *Entandrophragma cylindricum* (sapelli) and *E. utile* (sipo). The evergreen forests can be divided into two broad categories: the Biafran forests, forming an arc around the Gulf

of Guinea, and the Congo Basin forests in Cameroon's south and southeast. The Biafran forest, which formerly covered the entire coastal lowland, has been largely cleared. Where it still exists it consists of secondary forests and degraded primary forests, characterized by species such as *Lophira alata* (azobé) and *Sacoglottis gabonensis* (ozouga). Mangroves are found along most of the Cameroonian coast, with a total area of about 120 000 hectares. The two largest areas are in the Rio del Rey estuary and the Bay of Douala (Spalding et al. 2010).

The Congo Basin forests differ from the Biafran forests in the absence of species of Caesalpiniaceae, with the exception of *Gilbertiodendron dewevrei*; another feature is the importance assumed by *Baillonella toxisperma* (moabi). Inland, semi-evergreen lowland forest gives way to a mosaic of degraded rainforest and secondary grassland. The medium-altitude closed semi-deciduous forests are marked by an abundance of Sterculiaceae, such as *Cola* spp, *Eribroma oblonga* (eyong), *Mansonia altissima* (bété) and *Triplochiton scleroxylon* (ayous). North of this is Sudanian woodland, with predominantly *Acacia* wooded grassland.

Permanent forest estate. The Forest Law (1994) divides the forest area into permanent and non-permanent forest areas (*domaine forestier permanent et non permanent*). The permanent forest includes the categories forest reserves, protected areas and council forests; non-permanent forest includes community forest and private forest (ITTO 2006). The Government of Cameroon (2010) estimated that there is 12.8 million hectares of natural-forest PFE, comprising 7.6 million hectares of production forest and 5.2 million hectares of protection forest (Table 1). The exact extent of protection PFE is unclear, however: figures vary between 3.9 million hectares and 7.2 million hectares (Government of Cameroon 2005).

Forest ecosystem health

Deforestation and forest degradation. Cameroon's net deforestation rate is relatively low (0.14% – about 270 000 hectares per year; Government of Cameroon 2008) compared with many other tropical countries, but it is among the highest in

Table 1 Permanent forest estate

Reporting year	Estimated total forest area, range (million ha)	Total closed natural forest ('000 ha)	PFE ('000 hectares)			
			Production		Protection	Total
			Natural	Planted		
2005*	13.3–23.8	19 985	8840	17	3900	12 757
2010	19.7–21.2	16 900**	7600‡	19	5200†	12 800

* As reported in ITTO (2006).

** Dense humid forest, including 120 000 hectares of mangroves (de Wasseige et al. 2008).

‡ Includes FMUs, other production forests, forest reserves and communal forests.

† Includes forest protected areas in IUCN categories I–IV (4.4 million hectares) and the area of conservation FMUs (800 000 hectares).

the Congo Basin. The Government of Cameroon (2008) cited the following as the main direct and indirect drivers of deforestation and forest degradation: the development of agricultural activities – both slash-and-burn subsistence agriculture and cash crops (e.g. cocoa); the illegal exploitation of timber outside the PFE; the exploitation of fuelwood, particularly around major urban centres; and the development of the mining sector (bauxite, cobalt), which attracts workers (and hence increased hunting and other environmental stressors) to forested areas. Population growth is a factor near towns and cities and in the coastal forest zone, where the rate is nearly 5% per year (ibid.).

According to a national forest inventory conducted in 2004, primary forests comprise about 18% and degraded primary forest nearly 50% of total forest cover (Table 2).

Vulnerability of forests to climate change. The Cameroonian agricultural sector is potentially vulnerable to climate change, raising concerns about future food security. According to McSweeney et al. (undated), the mean annual temperature in the country has increased by 0.7 °C since 1960, an average rate of increase of 0.15 °C per decade. Mean annual rainfall per month has decreased by around 2.9 mm (2.2%) per decade since 1960. Cameroon experienced particularly low rainfall between 2003 and 2006 (ibid.). Forests are a means for protecting soils and watersheds and can help

reduce the vulnerability of agriculture, and they can also serve as a social ‘safety valve’. Forest fires appear to have been increased in the last decade in the drier northern part of the country and there is anecdotal evidence that this is caused by the lengthening of the dry season.^b

SFM policy framework

Forest tenure. The PFE in Cameroon belongs to the state, although the state has transferred certain rights to legal communes for a portion of it (414 000 hectares of the 12.8 million hectares of PFE; Table 3). The permanent forest in the main forest zone in the south is nearly all state-owned under the categories of timber production, protected and protection forests. Generally, people living in forest areas fully retain their traditional user rights (ITTO 2009a). In the non-PFE (*domaine forestier non permanent*), a process for the allocation of tenure and user rights is under way (ibid.). Stakeholder disputes over forest ownership and the demarcation of boundaries have been common in the past (ITTO 2006) and remain so today.^a

Criteria and indicators. Cameroon adopted the ATO/ITTO principles, criteria and indicators (PCI) for the sustainable management of African natural tropical forests in 2004. However, only those companies that have been or are in a process of certification are applying the PCI as a tool

Table 2 Forest condition

	PFE	Non-PFE	Total
	'000 ha		
Primary forest	-	-	3250
Degraded primary forest	-	-	8600
Secondary forest	-	-	4500
Degraded forest land	-	-	-

Source: Government of Cameroon (2009).

Table 3 Forest area, by tenure

Ownership category	Total area	Of which PFE	Notes
	'000 ha		
State ownership (national, state or provincial government)	-	12 400	State forest: includes forest reserves (production and protection forests, reforestation areas and others) and protected areas.
Other public entities (e.g. villages, municipalities)	414	414	Forests owned by legal communes.
Total public	-	12 800	Only figures for PFE available.
Owned by local communities and/or Indigenous groups	652	0	In the non-PFE: area designated for communities and Indigenous peoples, including (in 2009) 171 community forests with signed contracts and simple forest management plans. ^a
Private owned by firms, individuals, other corporate	-	-	Private forests have never been inventoried and their area is unknown. ^a

Source: Government of Cameroon (2009).

for control and monitoring (ITTO 2009a). The Government of Cameroon used the ITTO C&I in its submission to ITTO for this report.^a

Forest policy and legislation. Cameroon's forest policy was published in 1993 and adapted over time. In 2005 the Forestry and Environment Policy Letter (Government of Cameroon 2005) was signed between the Ministry for the Environment and the Protection of Nature (MINEP) and the Ministry for Forestry and Wildlife, setting out the basic principles for sustainably managing Cameroon's forest estate (see also Topa et al. 2009). The Forestry Code was adopted in 1994 (Law 94/01) and the Environment Code in 1996 (Law 96/12). Cameroon's forest policy and strategic framework centres on the following aspects (Government of Cameroon 2005):

- The sustainable management of forests, with the creation of a PFE and the setting up of FMUs to replace forest permits.
- Contributing to economic growth and poverty alleviation by ceding part of the income from tax revenue to village councils, creating jobs and allocating community forests.
- Participatory management through consultation with civil society and the private sector, increasing the understanding of rural people about their responsibilities for forests, and permanent dialogue with the international community.
- The conservation of biodiversity through a national network of protected areas.
- Building the capacity of the public sector in the performance of its key functions and the transfer of productive functions to the private sector.

- Putting in place a legal framework conducive to the development of the private sector, based on long-term conventions and industrialization.
- The harmonization of the regional management system through a zoning plan.
- The improvement of governance through increased transparency and the systematic dissemination of information to the public.

Through close collaboration with its development partners, Cameroon has made significant achievements in implementing its forest policy, including the maintenance of a well-conserved forest resource and relatively good control over deforestation; the improvement of forest management practices in the formal forest industry; growing recognition of customary rights and the contribution of forests to social welfare; and effective collaboration between forest institutions and civil society, which has led to improved forest governance and transparency (Topa et al. 2009). Outstanding needs include an improved approach to addressing the needs of Indigenous peoples; greater attention to NTFPs; financing for forest conservation efforts; the reshaping of community forestry; and greater attention to small-scale forest management and domestic forest product markets (ibid.).

At the international level, Cameroon signed a FLEGT VPA with the European Union in May 2010 and the first VPA-licensed products were expected in December 2011. Cameroon is a signatory to the Yaoundé Declaration and a member of the Commission in Charge of Forests in Central Africa (*Commission en Charge des Forêts d'Afrique Centrale* – COMIFAC).

Institutions involved in forests. In December 2004 the Ministry of Environment and Forests (MINEF) was replaced by two successor ministries, the Ministry of Forests and Fauna (*Ministère des Forêts et de la Faune* – MINFOF) and MINEP, which is also responsible for the development of REDD+. MINFOF is primarily responsible for forest policy, the forest legislative framework and the enforcement of forest laws, as well as for international conventions with respect to forests and wildlife (ITTO 2009a).

Within MINFOF are three main technical directorates dealing with forestry: the Directorate of Forests (*Direction des Forêts*), which is responsible for forest management, inventories, law enforcement, reforestation and community forestry; the Directorate of Promotion and Transformation, which deals with the wood-processing industry, NTFPs, forest statistics and timber certification; and the Directorate of Wildlife and Protected Areas, which manages protected areas. MINFOF is represented in all provinces and the country's 58 divisions. It employs 101 people centrally and 930 people in total, including 220 forest engineers and 25 agronomists and technical engineers.^a The National Agency for Forestry Development (*Agence Nationale de Développement des Forêts* – ANAFOR) is a parastatal technical agency whose mandate is to promote forest plantations by individual farmers, communities and the private sector.^a

Forest research is conducted by several institutions (i.e. the Institute of Agricultural Research for Development – IRAD, the World Agroforestry Centre – ICRAF, the Center for International Forestry Research – CIFOR, and the International Institute of Tropical Agriculture – IITA) and forestry courses are offered by the universities of Dschang and Yaoundé, the Forestry School of Mbalmayo, the Wildlife School of Garoua and the regional agricultural teaching centre, *Centre d'Enseignement Spécialisé en Agriculture* (ITTO 2009a). Many national and international NGOs, including major international conservation NGOs, play a direct role in the forest sector through partnerships with governmental agencies or in support of civil society. International donor agencies coordinate their support for MINFOF through the coordination body, *Cercle de Concertation des Partenaires du MINFOF*.

Status of forest management

Forest for production

Law 94/01 provides a good basis for introducing SFM. It stipulates the compulsory preparation and implementation of long-term forest management plans in concessions and simple forest management plans (*plan simple de gestion*) in forests attributed to communities; the introduction of provisions for concession allocation; and the creation of forest brigades and an inspection panel at the national and provincial levels for forest control. Commercial forestry is implemented in the PFE mainly through concessions and timber-licence contracts between the state and private entrepreneurs. FMUs (*unités forestières d'aménagement*) are the basic unit of timber harvesting. They are limited to a maximum size of 200 000 hectares and allocated by public tender (ITTO 2006). A forest concession consists of one or several FMUs. A systematic bidding, management and business concept for the attribution and management of FMUs was introduced between 1998 and 2007. The procedures are described in ITTO (2006), and a detailed analysis on their effectiveness was carried out by Topa et al. (2009). In 2005, 32 of the 72 FMUs had approved management plans (ITTO 2006).

Today, the proportion of Cameroon's production forests covered by forest management plans is high compared with most tropical countries (Topa et al. 2009). In 2009, 103 FMUs had been attributed over a total area of 6.1 million hectares, of which 74 had an approved management plan; this corresponds to an area of just over 5 million hectares.^a Of the 74 FMUs with management plans, 41 (covering an area of 2.9 million hectares) have been managed under forest management plans for



Log landing in a Cameroonian concession.

more than five years.^a Poor logging practice, illegal logging and encroachment that had reportedly been common in the past (ITTO 2006) have been reduced in these managed FMUs in the last five years.^a

In addition to the allocation of large tracts of production forests to industrial investors through timber concessions, there are seven other types of timber-harvesting contracts, including community forest contracts and council contracts. For example, communities can manage community forests for timber and non-timber production (up to 5000 hectares) using simplified forest management plans. In 2008, six council forests covering an area of about 141 000 hectares had been allocated, four of them with fully formulated forest management plans, and 177 community forest contracts had been allocated for 632 000 hectares, 143 of which (covering an area of 546 000 hectares) had simple forest management plans (de Wasseige et al. 2008).

Silviculture and species selection. A 1998 decree of Law 94/01 stipulates silvicultural standards for forest management. The felling cycle is set at 30 years and minimum harvesting diameters are indicated for each species (ITTO 2006). The standards further describe a polycyclic management regime, which includes the designation of future crop trees, the tending of natural regeneration, thinning, enrichment planting and refinement (Topa et al. 2009). Cameroon has over 600 tree species, of which about 300 are fairly common in the humid forests. Of those, fewer than 30 are currently used in significant quantities for timber and fewer than a dozen species make up the bulk (80%) of domestic utilization and trade (ITTO 2006). Besides the five species listed in Table 4, other commonly harvested timber species are *Terminalia superba* (fraké), *Cylicodiscus gabunensis* (okan/adoum), *Distemonanthus benthamianus* (movingui), *Entandrophragma candollei* (kossipo) and *Pterocarpus* spp (red padouk) (MINFOF 2008).

Planted forest and trees outside the forest.

About 2000 hectares of new plantations were created between 2005 and 2009 (ITTO 2009a). Despite the newly created ANAFOR, which aims to support community and private investment in forest plantations, no information is available about private planted forests. There are extensive agro-industrial plantations, including more than 50 000 hectares of rubber.^a Many timber plantations were established during the 1950s, with species such as *Terminalia ivorensis*, *Aucoumea klaineana*, *Tectona grandis*, *Pinus* spp, various Meliaceae and eucalypts. In addition, *Gmelina arborea* was planted to produce matches. Fuelwood plantations, and plantations to protect soil and farmland and for other purposes, were started about 30 years ago with good results; species used include *Cassia siamea* and *Dalbergia sissoo* (ITTO 2006).

Forest certification. In 2005 there were no certified forests in Cameroon (ITTO 2006), but third-party certification has progressed rapidly in recent years. In July 2010, five concessions (Lokoundjé – 69 000 hectares; SFIL Decolvenare – 70912 hectares; TRC – 125 500 hectares; Palisso – 341 700 hectares; Cafeco Wijma – 71 800 hectares; and Wijma – 97 000 hectares) hold valid Forest Stewardship Council (FSC) forest management certificates (FSC 2010). An additional 1.2 million hectares of FMUs are in the process of certification (ITTO 2009a). Along with all other ITTO member countries in the subregion, Cameroon has been participating, since 2005, in a regional ITTO project that is helping to build capacity for the implementation of the ATO/ITTO PCI at the national level in African ITTO member countries. It aims to train at least 60 forestry staff in each country in the implementation of the PCI, develop an auditing framework for African forests, and train at least 60 trainers in the procedures for conducting audits based on the PCI at the FMU level. This project has contributed to the progress of certification in Cameroon.

Table 4 Commonly harvested species for industrial roundwood

Species	Notes**
<i>Triplochiton scleroxylon</i> (ayous)*	About 800 000 m ³ annually (35% of total production).
<i>Entandrophragma cylindricum</i> (sapelli)*	About 390 000 m ³ annually (17%).
<i>Erythrophleum ivorensis</i> (tali)	About 170 000 m ³ annually (7%).
<i>Lophira alata</i> (azobe, bongossi)*	About 5% of total production.
<i>Chlorophora excelsa</i> (iroko)*	About 4% of total production.

* Also listed in ITTO (2006).

** According to MINFOF (2008); average production for 2005–07.

Estimate of the area of forest sustainably managed for production. A significant volume of timber is now harvested in FMUs that are subject to rigorous regulations (Topa et al. 2009). The total area of FMUs that are FSC-certified is 705 000 hectares (as of July 2010). About 550 000 hectares of FMUs are close to certification.^b The area of certified forest and the area of forest close to certification comprise the estimated area of sustainably managed forest shown in Table 5.

Timber production and trade. The total annual roundwood production (2005–09) is estimated at about 14 million m³, of which 9.5–12 million m³ is fuelwood.^a According to ITTO (2011), the average annual industrial roundwood production in the period 2007–09 was 2.27 million m³, compared with 1.75 million m³ per year in 2004 and 2.65 million m³ in 1999. Average annual sawnwood production in 2007–09 was about 773 000 m³, compared with 702 000 m³ in 2004 and 600 000 m³ in 1999. Plywood production was 24 000 m³ in 2009, compared with 36 000 m³ in 2004 and a significantly higher 92 000 m³ in 1999. An estimated 79 000 m³ of veneer were produced in 2009, compared with 43 000 m³ in 2004 and 53 000 m³ in 1999.

The ratio of domestically used timber to exported timber is 2.4:1 (ITTO 2009b). The informal domestic market also provides timber to neighbouring Chad, Nigeria and Sudan. Cameroon is now the tenth-largest tropical timber exporter (it was the seventh-largest in 2005) and is still the second-largest timber exporter among African ITTO producer countries after Gabon. The main export destinations are the European Union (about 60% of all timber exports) and Asia (22%).

Non-timber forest products. The NTFP sector is expanding rapidly, but few reliable data are available on production and trade (ITTO 2009a). NTFPs are traded regionally, in particular with Nigeria. Bush meat is of major significance in

both rural and urban areas. The bark and fruits of *Garcinia kola* and *G. lucida* (onie and essok) are used as medicines and stimulants, and the leaves of *Gnetum* spp are consumed as a delicious meal and traded locally and regionally with Nigeria. Palm oil is extracted from the nuts of *Elaeis guineensis* (Eton palm) and palm wine is extracted from the upper part of the stem. *Irvingia* spp (andok or wild mango) and *Riciodendron heudelotii* (ezezung) are used as condiments and *Dacryodes edulis* (plum or assa) is a popular food. The bark of *Prunus africana* is sold to pharmaceutical companies for use in the treatment of prostate-related disorders. The powdered bark of *P. africanum* (also known as pygeum or *Pygeum africanum*) is also used worldwide to control urinary disorders in men and as a herbal supplement for benign prostatic hyperplasia. *Baillonella toxisperma* (moabi), a high-priced hardwood species of the Sapotaceae family, is traditionally used by forest-dwellers for the oil from its seeds. All these products, as well as extracts of *Tabernante iboga*, *Cinchona* spp, *Strophanthus* spp, *Voacanga africana*, *Rauwolfia vomitaria* and *Paunsinstalia yohimbe*, are commercialized in Cameroon, generally in local markets. There are reportedly conflicts in some forest areas between concessionaires and local people, in particular Pygmy communities, over the use of forest products, in particular in the cases of moabi and *Entandrophragma cylindricum* (sapelli) (ibid.).

Forest carbon. Gibbs et al. (2007) estimated Cameroon's national-level forest biomass carbon stock at 3454–3721 MtC, Eggleston et al. (2006) estimated it at 6138 MtC and FAO (2010) estimated it at 2696 MtC. Cameroon is participating in the Forest Carbon Partnership Facility and submitted a readiness idea note in 2008 (Government of Cameroon 2008), in which the main potential REDD strategies were listed as the development of integrated protected areas in the PFE; the strengthening of sustainably managed production forests; the fight against illegal logging; the effective distribution of revenues; and support

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

Reporting year	Natural					Planted		
	Total	Available for harvesting	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
2005*	8840	4950	1760	0	500	17	-	0
2010	7600	6100^a	5000	705	1255	19	2	0

* As reported in ITTO (2006).

for the agricultural sector to reduce pressure on forests. Table 6 shows the estimated forest carbon potential of the country. There is good potential to reduce forest degradation and enhance forest carbon sinks, in particular through restoration and reforestation, but there is a need to strengthen inventory and monitoring capacities.

Forest for protection

Soil and water. No estimate of the extent of natural forest and planted forest set aside primarily for water and soil protection was available for this report.

Biological diversity. Cameroon is rich in biodiversity, accommodating more than 8300 plant species, about 297 mammal species and 848 bird species. Nearly half of all the bird and mammal species of Africa are present in Cameroon's forests (ITTO 2006).

Twenty-eight mammals, eleven birds, 50 amphibians, two reptiles, eleven arthropods and 246 plants found in forests are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species (IUCN 2011). Twenty-five plant species are listed in CITES Appendix II, including two tree species, *Pericopsis elata* (afroormosia) and *Prunus africana* (UNEP-WCMC 2011).

Protective measures in production forests. The forest management prescriptions have gradually been widened since 1998 to include measures to protect soil, biodiversity and the flow of water in concession areas. They also include a series of stand treatments to encourage the regeneration of commercial tree species in natural stands.

Extent of protected areas. An estimated 5.2 million hectares of closed and open forests are in reserves conforming to IUCN protected-area categories I–IV, comprising 15 national parks (2.7 million hectares, of which seven national parks are

located in the Sudanian savanna and woodland vegetation in the north of the country), six wildlife reserves (740 000 hectares), four wildlife sanctuaries (95 000 hectares) and 77 forest reserves covering 880 000 hectares. A further 867 000 hectares of former production FMUs have been set aside for conservation purposes (ITTO 2006).

In mid 2010, seven national parks and one wildlife reserve had approved management plans. Two transboundary protected areas are supported by ITTO: the Lobéké National Park (part of the tri-national Sangha transboundary conservation area); and the tri-national protected area of Dja-Odzala-Minkébé (TRIDOM), comprising forest in Cameroon, Congo and Gabon.

Estimate of the area of forest sustainably managed for protection. Although considerable progress has been made since 2005 in the preparation of management plans for protected areas and in re-classifying forest protected areas, it remains difficult to estimate the real extent of forest protected areas and in particular the area of protection PFE that is under SFM (Table 7). The Biosphere Reserve of Dja, which has received continuous support since 1992 by the ECOFAC (*Ecosystem Forestier d'Afrique Centrale*) program of the European Union, with a total area of 526 000 hectares, can be considered well managed, as can the nine conservation concessions (non-allocated FMUs) registered with MINFOF, totalling 895 000 hectares.

Socioeconomic aspects

Economic aspects. Forest products are a principal source of export income in Cameroon. The export value of timber was about 320 billion FCFA (US\$650 million) in 2004 (ITTO 2009a), up from US\$210 million in 2001. According to their licence contracts, forest concession-holders must link their concessions with industrial processing units, thus providing stable employment in remote

Table 6 Forest carbon potential

Biomass forest carbon (MtC)	% forest with canopy cover >60%	Deforestation/ degradation potential to 2030	Enhancement of carbon sink capacity to 2030	Forest area change monitoring capacity	Forest/ GHG inventory capacity	Importance of forest fire/ biomass burning	Engagement in international REDD+ processes
3454–3721	54	++	++	++	+	++	++

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

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

Reporting year	Protection PFE	Attributed to IUCN categories I-IV	Allocated for soil and water	With management plans	Sustainably managed
2005*	3900	2650	-	-	-
2010	5200	4400	-	2230**	1420

* As reported in ITTO (2006).

** MINFOF (2008).

rural communities and additional revenue flows for the state (ITTO 2006). An economic study in 2006 estimated the manpower engaged in the timber industry at 16 000^a; if the domestic wood sector is included, total forest-based employment is estimated at 45 000 (ITTO 2009a). Harvesting taxes provide an important revenue stream, which is shared between the state (50%), communes (40%) and local communities (10%). In 2005, for example, the total tax revenue was US\$26 million (ibid.). The amount has increased steadily over the years (Topa et al. 2009).

Livelihood values. Forests provide many local communities with foods, medicines and locally traded goods. Forests also have a major spiritual value for many ethnic groups. Forestry has been included in the country's poverty reduction strategy.^a

Social relations. Cameroon contains around 230 ethnic groups, many of them with a close association with forests. The Pygmy people, who are traditional hunters and gatherers, are the ethnic group most threatened in their traditional way of life by forest loss and degradation, restrictions on forest access and a lack of basic human rights (Government of Cameroon 2008). Progress has been made in recent years in the recognition of local user rights in forests, in the consultation process of opening-up new harvesting permits, and in the system for sharing tax revenues with local communities. Increasingly, permits are being granted to local communities to manage forests for timber and NTFPs.

Summary

Cameroon possesses significant forest resources and has confirmed over the past five years its considerable potential for SFM. The policy environment is sound and governmental responsibility for forests is vested in a single ministry, the Ministry of Forests and Fauna, MINFOF. A joint 2005 Forest and Environment

Sector Policy Letter defines the common responsibility for forests between MINFOF and the Ministry for Environment and Protection of Nature, the latter being responsible for climate-change adaptation and mitigation and REDD+. However, the capacity of both ministries to fully enforce the forest law and implement forest and environmental policies is low. Cameroon is progressing well towards SFM, in particular in some selected FMUs, but has yet to translate many of its ambitious forest management goals into practice and to effectively protect its PFE.

Key points

- Cameroon has an estimated 12.8 million hectares of PFE (similar to 2005), comprising 7.60 million hectares of natural production forests (compared with 8.84 million hectares in 2005), 5.20 million hectares of protection forests (compared with 3.90 million hectares in 2005) and 19 000 hectares of industrial timber plantations (compared with 17 000 hectares in 2005).
- At least 1.25 million hectares of natural-forest production PFE are estimated to be under SFM. Forest management plans have been developed for and are being implemented in 5.0 million hectares of the production PFE (compared with 1.76 million hectares in 2005). An estimated 1.42 million hectares of the protection PFE is under SFM.
- Despite considerable efforts in forest law enforcement in the past five years, the integrity of the PFE is threatened by encroachment, poaching and poor logging practices, including illegal logging, but no official data on the extent of these are available.
- Mining is an increasing threat to forest stability, as is population pressure, especially in coastal forests. Cameroon has good potential to develop REDD+ initiatives that address these threats.

- Forests are the living environment of many ethnic groups, particularly Pygmy communities. Ensuring the rights of these ethnic groups remains a major challenge for achieving SFM.

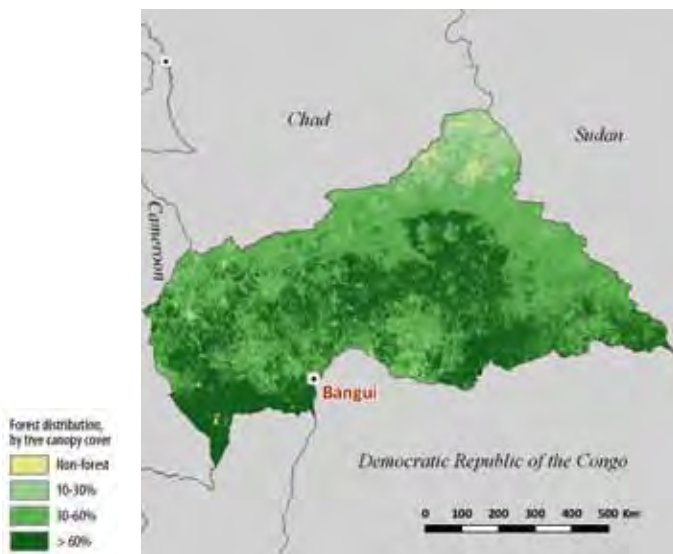
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CENTRAL AFRICAN REPUBLIC



Forest resources

The Central African Republic (CAR) has a land area of 62.3 million hectares and an estimated population in 2010 of 4.5 million people (United Nations Population Division 2010). Numerous political crises have seriously damaged the country's social and economic web and weakened economic capacity. As a result, CAR is one of the world's least-developed countries, ranked 179th out of 182 countries in UNDP's Human Development Index (UNDP 2009). Situated in the northern Congo Basin, this landlocked country comprises three broad bio-geographical zones. They are, from south to north, the humid Guinean zone, with annual precipitation between 1500 and 1800 mm and covered by dense humid forest; the Sudano-Guinean zone (including its drier component to the north), containing scattered semi-humid forests and open dry forests and savanna; and the Sahel zone, characterized by dry savanna and annual precipitation of less than 800 mm. The general relief of the country is formed by a plateau with altitudes varying between 500 m and 700 m and two separate basins, the Chad Basin in the north and the Congo Basin in the south. Estimates of forest area range from 22.7 million hectares (FAO 2010) to more than 30 million hectares (Government of CAR 2008; de Wasseige et al. 2009). The larger estimates include forest-savanna mosaic, forest-cropland mosaic and dense deciduous (miombo) forests.

Forest types. The forest types of CAR are very diverse. The major closed forest type is semi-deciduous rainforest, located in the southwestern and southeastern parts of the country (the southwestern massif and the *Forêt de Bangassou*), the latter covering about 6.5 million hectares.^a Large parts of these forests are unexploited. The semi-deciduous forests in the southwest, which form part of the Congo Basin rainforests, extend over an area of about 5.2 million hectares^a; they are among the richest in Africa, containing a high density of high-value timber species such as *Terminalia superba* (limba), *Entandrophragma cylindricum* (sapelli) and *Triplochiton scleroxylon* (ayous), as well as large mammals such as gorillas, forest elephants and bongo.

The total standing volume of timber in the southwestern forests was estimated in a forest inventory conducted in 1991–93 to be more than 127 million³ (ITTO 2006). North of the closed forest is a transition zone between forest and savanna which stretches in an east–west direction. Beyond this, gallery forests border large rivers. But by far the largest forest area is the open bushy savanna that gives way to the Sahel, covering about 17 million hectares (ibid.).

Permanent forest estate. The total PFE, as defined in the 2008 Forest Code, extends over about 5.8 million hectares and includes 5.2 million hectares of production PFE and 520 000 hectares of protection PFE. The PFE includes the inventoried forests in the southwest (3.8 million hectares) and the less known, largely unexploited forest of Bangassou in the southeast (1.9 million hectares).^a About 3.1 million hectares in the southwest has been allocated to forest concessions and the remaining closed forest area is protection PFE.^a Countrywide 46 classified forests (*forêts classées*), ranging in size from 20 to 120 000 hectares and covering a total area of 633 000 hectares, were set aside between 1948 and 1955 for conservation and production purposes. Many of these classified forests are no longer forested, however.

Table 1 shows the estimated PFE. The projected total PFE is larger in extent than the closed forest area determined by satellite imagery. There

Table 1 Permanent forest estate

Reporting year	Estimated total forest area, range (million ha)	Total closed natural forest ('000 ha)	PFE ('000 hectares)			
			Production		Protection	Total
			Natural	Planted		
2005*	22.9–29.3	4826	3500	3	300	3803
2010	22.7– 30.1**	4600**	5200†	3	560†	5763

* As reported in ITTO (2006).

** Dense humid forest, based on land cover data (de Wasseige et al. 2009). This figure is 8.69 million hectares when calculated using the ratio of forest with greater than 60% forest cover estimated by UNEP-WCMC (2010) and the estimated total natural forest area according to FAO (2010).

† Projected.

‡ Only the protected areas in the humid forest zone are counted here. The total protected area, most of which is located in savanna, is estimated at 6.04 million hectares.^a

is a significant area of degraded primary and secondary forest – nearly 1 million hectares in the southwestern forest area, in particular in the zone of Lobaye – that has the potential to be productive under SFM (ITTO 2006).

Forest ecosystem health

Deforestation and forest degradation. The annual deforestation rate in 1990–2000 was estimated at 0.19% (de Wasseige et al. 2009). Bushfires are widespread, particularly in the savanna and in the transition zone from forest to savanna and it is difficult to give a conclusive figure about the extent of deforestation (ITTO 2006). Forest degradation is significant in the production forest zone and in areas near urban centres that are under heavy pressure for fuelwood collection. The main direct causes of deforestation are the expansion of subsistence and cash agriculture, which particular affects gallery forests along waterways, human-induced wildfire in the savanna, wood-gathering around human settlements, and mining (for gold, diamonds and uranium) (Government of CAR 2008).

Table 2 indicates forest condition in the main southeastern forested region, based on the 1991–93 forest inventory (ITTO 2006). Due to intensive logging activities in the last 15 years, the share of primary forest has diminished today and the share of degraded and secondary forest has increased.

Vulnerability of forests to climate change. Given its location between the humid and dry tropics, agricultural production capacity is low in CAR and cannot satisfy the needs of the growing population, even without the effects of climate change (Government of CAR 2008). With the increases in temperature and decreases in precipitation projected by climate models, agricultural productivity will decline further, exacerbating poverty and reducing food security (ibid.). The semi-arid climatic zone is projected to become more arid, while in the humid zone a projected increase in the risk of periodic drought and wildfire will increase forest vulnerability. The forested zones have potential for agriculture in the face of climate-induced food shortages, which could lead to increased deforestation. The country's NAPA (MEFCPE 2008) prioritizes the prevention of forest

Table 2 Forest condition*

	PFE*	Non-PFE	Total
	'000 ha		
Area of primary forest	2400	-	2400
Area of degraded primary forest	900	-	900
Area of secondary forest	80	-	80
Area of degraded forest land**	220	-	220

* Southwestern forest area only.

** Partly savanna and raphia wetland.

Source: ITTO (2006).

degradation and the sustainable management of existing forests as options (among others concerning other sectors) to help in climate-change adaptation.

SFM policy framework

Forest tenure. All land belongs to the state (Table 3). The non-permanent forest estate is composed of communal, community and private forests.^a A legal framework specific to communal and community forests is yet to be produced.

Criteria and indicators. In 2009 the Government of CAR adopted the ATO/ITTO PCI for the sustainable management of African natural tropical forests as an instrument for monitoring progress towards SFM. With the support of a regional ATO/ITTO project, the CAR PCI were improved with a definition of the means of verification and related sources of information. The Government of CAR's submission to ITTO for this report was not in the ITTO C&I reporting format.^a

Forest policy and legislation. As part of its poverty reduction strategy, the government's aim is to enhance the transparency of forest and wildlife resource management while creating a more attractive business environment. A process is ongoing to replace the forest policy adopted in 1989 (see ITTO 2006) and to develop a sectoral policy for the sustainable management of forest resources that will rationalize their potential and use; protect biodiversity; combat desertification and its damaging effects; and increase the sector's contribution to economic growth and job creation.

The new Forest Code (*Code Forestier*, Law 08-022), which supersedes a 1990 forest code (Law 90-003), was prepared through a participatory approach that involved various stakeholders and was promulgated by the Head of State on 17 October 2008. Also

in 2008 a new environmental code (Law 07-018) was enacted. Several other reforms have been undertaken, including two decrees that appointed border control inspectors and created mobile 'forestry and wildlife' intervention and verification brigades. The main purpose of these inspectors and brigades is to control the movement of timber, secure forestry and wildlife revenues, and strengthen monitoring and control capacities. Another decree, issued in 2008, created the Forest Industry Observatory within the Ministry of Water, Forests, Hunting, Fishing and Environment (*Ministère des Eaux, Forêts, Chasses, Pêches et de l'Environnement* – MEFCPE), which will support decision-making and supply reliable and relevant economic information on the industry.

In 2009, two new decrees on the modalities of the implementation of the Forest Code and the allocation of timber concessions were introduced. Forestry and wildlife revenues are now being deposited in a bank account opened in the central bank in the name of communities in the affected areas. These revenues are supervised by a technical committee comprising representatives of the ministries concerned (the Ministry of the Interior, the Ministry of Finance and Budget, and MEFCPE) and it is intended that there will be local management of these funds. The principal task of the technical committee is to validate the employment programs developed by municipalities and to monitor projects financed from these funds as part of the campaign against rural poverty in communities in or bordering forest lands under operating permits. Such dynamic lawmaking activities are part of a sectoral adjustment program under the poverty alleviation strategy.

The Government of CAR is actively involved in various regional initiatives to promote SFM in the

Table 3 Forest area, by tenure

Ownership category	Total area	Of which PFE	Notes
	'000 ha		
State ownership (national, state or provincial government)	22 700	5763	
Other public entities (e.g. municipalities, villages)	0	0	
Total public	22 700	5763	
Owned by local communities and/or Indigenous groups	0	0	
Privately owned by individuals, firms, other corporate	0	0	Small areas of forest plantations are privately owned or owned by communities.

Source: Government of CAR (2010).

Congo Basin, in particular through COMIFAC. It recently requested formal discussions with the European Union for developing a VPA. In 2008, a FLEGT working group, which includes representatives of civil society, was set up, and formal negotiations commenced in 2009.

Institutions involved in forests. Forests are administered by the MEFCPE. While the overall mission of the MEFCPE has remained the same since 1982, there is political instability in leadership; between 2003 and 2008, for example, there were ten different ministers.^a The MEFCPE, through the General Forestry and Water Commission and the Wildlife and Protected Areas Department, is responsible for forest management and conservation as well as for the monitoring of forest resources. It enforces forest laws through its forestry and wildlife brigades. The Department of Forest Inventory and Management Planning deals with inventories and forest management planning.^a The total staff of the MEFCPE for forests and wildlife management, at both the central and decentralized levels, was about 190 in 2008 (de Wasseige et al. 2009).

Staff training and forestry research are undertaken by the University of Bangui and its Agronomic Research Institute. However, both are constrained by a lack of funds and capacity and most professional and technical training is provided on the job by forest companies (ITTO 2006). The Higher Institute for Rural Development trains technicians and engineers.^a A number of local NGOs, such as the Committee for the Integrated Development of Communities, Green Pavilion, *Amis de la Nature*, the *Mouvement Femmes-Environnement* and the *Organisation Centrafricaine de Défense de la Nature*, are also active in the forest sector, although they still play only a marginal role in forestry matters.^a WWF supports staff training, C&I development and certification efforts.^a A number of development partners, including

the African Development Bank, GTZ and the International Monetary Fund, also support the development of the forest sector.

Status of forest management

Forest for production

Large-scale industrial harvesting started in 1968 in the southwestern forests, following an intensive inventory. A second forest inventory carried out in 1991–1993 estimated the standing volume of the 18 most important species at 93 million m³. Based on a 30-year rotation, the commercial volume harvestable per hectare was estimated at 15–20 m³ per year (ITTO 2006).

Harvesting in the PFE is carried out in large-scale concessions using a permit known as a PEA (*permis d'exploitation et d'aménagement*). Under the 2008 Forest Code, artisanal logging is allowable in production forest in areas of ten hectares or less, although permits (*permis artisanal*) need to be renewed annually. PEAs that in the past had been awarded for the lifetime of the company (ITTO 2006) are now valid for only one harvesting rotation, generally 30 years.^a They are allocated through an open bidding process and subject to long-term forest management plans, five-year business plans (*plans de gestion quinquennaux*) and annual operational plans.^a

In early 2010, twelve timber companies had been allocated concessions in the southwest of the country over a total area of 2.3 million hectares of PEA. At least three more concessions may be leased out, which would increase the allocated southwest production forest area to 3.1 million hectares.^a The size of forest concessions varies between 156 000 and 475 000 hectares. One small concession of 42 000 hectares still operates under a special cutting permit.^a As of September 2010, eight companies had finalized the preparation of their long-term forest management plans over a total area of 2.4

Table 4 Commonly harvested species for industrial roundwood

Species	Estimated annual log production
<i>Entandrophragma cylindricum</i> (sapelli)*	300 000 m ³
<i>Triplochiton scleroxylon</i> (ayous)*	90 000 m ³
<i>Aningeria</i> spp (aniegré-longhi)*	30 000 m ³
<i>Entandrophragma utile</i> (sipo)*	25 000 m ³
<i>Chlorophora excelsa</i> (iroko)*	20 000 m ³

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



Log landing in a concession in the Central African Republic.

million hectares and management planning was progressing for another 580 000 hectares (D. Hubert, pers. comm., 2010).

PEAs stipulate that local people living in or adjacent to concessions must be involved in the process of establishing permits (ITTO 2006). With recent investments in a wider sector adjustment program, the MEFCPE has increased its capacity to oversee the management of the PFE and to enforce the law^a; its effectiveness still needs to be proven, however. Concession-holders pay rent on the area and a flexible fee related to the volume produced and exported.^a

Silviculture and species selection. While the 1990 Forest Code made specific reference to silvicultural management criteria, including quantitative limits on logging to avoid creaming and favour natural regeneration (see ITTO 2006), the 2008 Forest Code only includes general guidance on forest management planning. In principle, PEAs are renewable; long-term management and harvest planning should therefore be possible. There are about 300 potential timber species in the closed forest area but only 34 species are harvested.^a Table 4 lists the five species that made up 85% of production between 2005 and 2008. Other

important species that are increasingly harvested are *Entandrophragma candollei* (kossipo), *Guarea cedrata* (bossé), *E angolense* (tiama), *Pterocarpus* spp (padouk) and *Lovoa trichilioides* (dibétou bibolo).

Planted forest and trees outside the forest.

Planted forests cover an estimated 1800–3000 hectares. In addition, the country's single *Hevea brasiliensis* (rubber) plantation covers about 1000 hectares. There are no reports of new plantations established since 2005.

Various tropical hardwoods, including *Tectona grandis* and *Gmelina arborea*, have performed quite well in experimental trials, but these have not been scaled up (ITTO 2006). Small community-based fuelwood plantations of eucalypts, *Acacia mangium* and *Cassia siamea* are important in non-forested areas. In drier areas, trees planted outside forests are of some importance, including neem, *Butyrospermum parkii* (karité), *Anacardium excelsum* and *Acacia albida* (ibid.).

Forest certification. As of mid 2010, no forest had been certified as well managed in CAR (e.g. FSC 2010). ITTO (2006) referred to one concession, *Industrie Forestière de Batalimo*, 186 000 hectares in size, that was in an advanced process of

certification, but it has not achieved certification to date. One company – OLB – operating in a forest of 195 000 hectares, has had a certificate of timber origin and legality since 2007. The Government of CAR is actively engaged in the VPA process and negotiations with the European Commission on a VPA were expected to be reaching a conclusion in late 2010 (Anon. 2010).

Estimate of the area of forest sustainably managed for production. The objective of the Government of CAR is that, by 2011, all forests are under forest management plans.^a In 2009, of the eleven PEAs operating in the southwestern part of the PFE, eight were operating under full management plans and three were developing their management plans.^a This indicates significant progress towards SFM, since in 2005 only two companies with concessions totaling about 650 000 hectares were working under comprehensive forest management plans (ITTO 2006). However, the MEFCPE still lacks the know-how and capacity to monitor the implementation of these management plans effectively.^a With finance from the African Development Bank a major project is under way in the southwestern forest area with the overall aim of achieving the sustainable management of forests and woodlots by communities.^a Despite these positive developments, a lack of strong evidence of the extent to which management plans are being implemented means that no forest can be classified as under SFM (Table 5).

Timber production and trade. Total roundwood production in 2008 was an estimated 3 million m³, of which at least 2.5 million m³ was fuelwood.^a CAR produces relatively low volumes of mostly high-value timbers. In 2009, total industrial timber production amounted to an estimated 533 000 m³, slightly more than the 509 000 m³ produced in 2004 (ITTO 2010). The country produced 95 000 m³ of sawnwood in 2009, up from 67 000 m³ in 2004. About 81 000 m³ of logs were exported in 2009, compared with 93 000 m³ in 2004. The decline in log exports was matched by an increase in sawnwood exports, from 11 000 m³ in 2004 to 22 000 m³ in 2009 (ITTO 2010). CAR's exports face numerous constraints: as a land-locked country it needs to transport its products either through neighbouring Congo by train or by road through Cameroon. The main export destinations are China and Hong Kong (37%), European Union countries (40%), Turkey and, increasingly, Cameroon.^a

Non-timber forest products. The forests play a fundamental role in the lives of many people in CAR, including by providing medicinal and edible plants, fruits and fungi, game, timber and fuelwood.^a Bush meat is the most economically important forest product besides fuelwood and timber. Many foodstuffs, medicinal plants and condiments – including *Piper guineense* (forest pepper), *Xylopia aethiopica* and *Aframomum* spp – are collected in closed and savanna forests and sold locally or exported (ITTO 2006). No quantitative data were available on NTFP production and trade.

Forest carbon. The total carbon stock in forests and woodlands in CAR is estimated at 5500 MtC, of which about 900 MtC are in the closed humid forests (de Wasseige et al. 2009). Gibbs et al. (2007) estimated the national forest biomass carbon stock at 3176–4096 MtC, Eggleston et al. (2006) estimated it at 7405 MtC and FAO (2010) estimated it at 2861 MtC.

The Government of CAR is participating in the Forest Carbon Partnership Facility and submitted a readiness idea note in 2008 (Government of CAR 2008). Proposed REDD+ strategies include in particular the further development and financing of integrated protected areas; improved fuelwood management in peri-urban areas; and improved management of forest mosaics and savanna. Table 6 indicates the country's forest carbon potential. Capacity needs to be strengthened considerably if the country is to implement REDD+. There is considerable potential to reduce GHG emissions and enhance carbon sinks, in particular through the improved control of wildfire in the savanna.

Forest for protection

Soil and water. A number of small areas totalling about 5700 hectares has been set aside for catchment protection purposes (*mise en défense*) (ITTO 2006).

Biological diversity. CAR contains more than 3600 plant species, 224 mammal species and 668 bird species. Seven mammals, one bird and eight plants found in forests are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species (IUCN 2011). One non-tree plant species is listed in CITES Appendix I and two in Appendix II (UNEP-WCMC 2011).

Several other mammals are locally threatened. The elephant population, for example, has reportedly

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

Reporting year	Natural					Planted		
	Total	Available for harvesting	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
2005*	3500	2920	650	0	186	3	-	0
2010	5200	3100	2320	0**	0	3	0	0

* As reported in ITTO (2006).

** A certificate of legality has been issued for 155 000 hectares of forest, however.

Table 6 Forest carbon potential

Biomass forest carbon (MtC)	% forest with canopy >60%	Deforestation/ degradation potential to 2030	Enhancement of carbon sink capacity to 2030	Forest area change monitoring capacity	Forest/ GHG inventory capacity	Importance of forest fire/ biomass burning	Engagement in international REDD+ processes
3176-4096	38	+	++	+	+	+++	+

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

decreased to a critical level due to unabated poaching, especially in the north. Nevertheless, the country probably still has the highest densities of lowland gorillas and forest elephants in Africa (de Wasseige et al. 2009).

Protective measures in production forests.

The 2008 Forest Code makes provisions for the protection of biodiversity and to set aside ecologically fragile zones in PEAs (articles 83 and 87). Protective measures must be described in the long-term and mid-term forest management plans.

Extent of protected areas. The first forest conservation areas to protect the now locally extinct white rhinoceros were created in 1925 (Réserve de Zimongo and the parks of Baminigui, Bangoran and Manovo-Gonda-Saint Floris), covering more than 1 million hectares of open savanna (ITTO 2006). The total area in IUCN protected-area categories I-IV is now about 6 million hectares, including one integral reserve (IUCN category I),

five national parks (category II), and two special reserves, five wildlife reserves and two biosphere reserves (category IV).^a These mostly comprise savanna and dry shrub land. The Dzanga Sangha Special Reserve, the Dzanga Ndoki National Park (CAR's part of a tri-national protected area between CAR, the Republic of the Congo and Cameroon), and two smaller reserves are the only forested protected areas, covering a total of about 560 000 hectares.^a

Estimate of the area of forest sustainably managed for protection. Few data are available on the status of forest management in CAR's production PFE. Considerable efforts have been made to protect the 122 000-hectare Dzanga-N'doki National Park, which provides habitat for large mammals such as forest elephants, bongos and gorillas. The Dzanga-N'doki National Park is counted in Table 7 as under SFM.

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

Reporting year	Protection PFE	Attributed to IUCN categories I-IV	Allocated for soil and water	With management plans	Sustainably managed
2005*	300	3090	6	-	-
2010	560	6040**	6	120	120

* As reported in ITTO (2006).

** UNEP-WCMC (2010).

Socioeconomic aspects

Economic aspects. The main exports of CAR are coffee, cotton, diamonds, gold and timber, with diamonds and timber representing almost 80% of total export revenues (International Monetary Fund 2009). Forest taxes account for about 14% of state revenues and its contribution to GDP rose from 2.6% in 1997 to 5% in 2005.^a About 4000 people are employed directly in the formal forest sector (ITTO 2006). Rents and felling taxes on forest harvesting are required to be distributed among beneficiaries as follows: 30% to the Treasury, 40% to the Forest and Tourism Development Fund, and 30% to communities (ITTO 2006). There is an important artisanal timber sector. The bush-meat industry has a turnover of more than 2% of GDP (de Wasseige et al. 2009).

Livelihood values. Bush meat and the gathering of edible fruits, nuts, insects and roots are of great importance for local communities dependent on forests, in particular Pygmy communities. Yams (*Dioscorea* spp) are a staple food of the Pygmies (ITTO 2006).

Social relations. The population of CAR is ethnically diverse and the unifying factor is Sangö, the national language. The 2008 Forest Code recognizes the traditional rights of local users and mentions, in particular, the rights of Indigenous peoples in PEAs. However, there are restrictions on forest use in protected areas (articles 14–18).

Summary

CAR is one of the poorest countries in the world. Forest products play an important role in generating state income but also in the livelihoods of the majority of the people. The largest proportion of forests is savanna woodland; closed humid forests are found in the south and southwestern part of the country. Nearly the entire closed forest area is either occupied by timber concessions or has some form of protected-area status. Progress has been made in recent years to improve the quality of forest concession management and to regulate protected areas.

Key points

- CAR has an estimated 5.78 million hectares of PFE (compared with 3.80 million hectares in 2005), comprising 5.2 million hectares of

natural production forest (compared with 3.50 million hectares in 2005) and 560 000 hectares of protection forest (compared with 300 000 hectares in 2005).

- No part of the production PFE is considered to be under SFM. Nevertheless there has been a dramatic increase in the area of production forest covered by forest management plans, from 650 000 hectares in 2005 to 2.32 million hectares. An estimated 122 000 hectares of protection PFE is under SFM.
- Twelve privately owned timber companies manage a total area of 2.3 million hectares of production PFE in the southwestern part of the country. Management permits (*Permis d'exploitation et d'aménagement*) are now valid for only one harvesting rotation, generally 30 years.
- There are no community forests, but the 2008 Forest Code provides for the establishment of community and municipal forests. The ministry in charge of forests, MEFCPE, lacks capacity to oversee management of the PFE and to enforce the law.
- Forest production provides important export revenue and contributes 5% or more to GDP. The forest sector generates about 14% of state revenues through logging activities. According to the Forest Code, a significant share of revenues generated by forest taxes is to be redistributed to local communities. However, such revenues are unevenly distributed between and within such communities.

Endnote

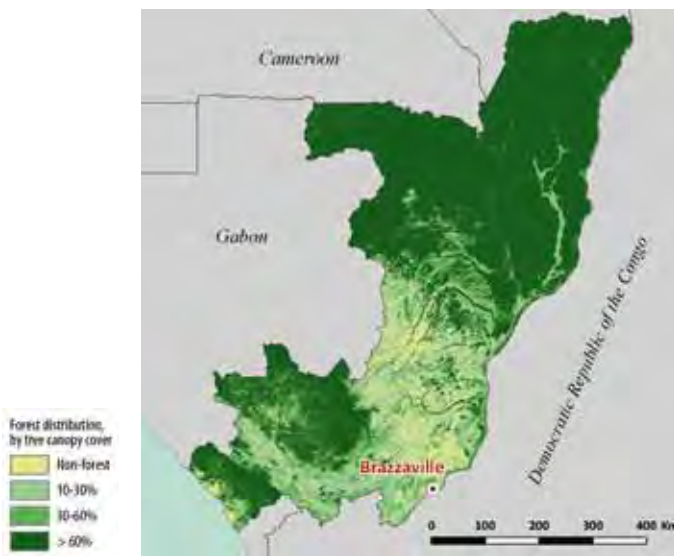
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CONGO



Forest resources

The Congo (officially known as Republic of the Congo) has a land area of 34.2 million hectares. In 2010 it had an estimated population of 3.7 million people (United Nations Population Division 2010). Congo is ranked 136th out of 182 countries in UNDP's Human Development Index (UNDP 2009). Stretching from 3° north to 5° south, it can be divided into three broad biogeographical zones: the southern zone, which covers the forested Mayombe and Chaillu mountains and savanna; the central zone, which consists of the Bateke Plateau highlands, wholly covered by grass or shrub savanna apart from gallery forests and scattered forest islands; and the northern zone, located mostly north of the equator, which consists of three heavily forested subregions, from south to north Cuvette, Sangha and Likouala.

The total forest area is estimated at about 22.4 million hectares (CNIAF 2008; FAO 2009). de Wasseige et al. (2009) estimated the extent of dense humid forests on the basis of land-cover data at 18.5 million hectares, and there was an additional 8.4 million hectares of forest–cropland mosaic, forest–savanna mosaic and semi-deciduous miombo forests. Congo has an estimated 1670 hectares of mangroves (Spalding et al. 2010).

Forest types. The Mayombe forest, originally rich in *Aucoumea klaineana* (okoumé), has been heavily cleared due to colonization along the

road between Brazzaville and Pointe-Noire and repeated logging. It covers less than 1 million hectares, including extensive secondary forests (ITTO 2006). The Chaillu forest area, covering about 3.4 million hectares, is rich in okoumé, *Terminalia superba* (limba), *Pycnanthus angolensis* (ilomba) and *Entandrophragma utile* (sipo); it has been locally over-harvested and is increasingly encroached upon by farmers. Together, these two forest areas form the southern sector. The northern forests contain redwoods, especially sipo, *Entandrophragma cylindricum* (sapelli) and *Millettia laurentii* (wengé), as well as light hardwoods (e.g. *Triplochiton scleroxylon* – ayous); they cover 16.5 million hectares, about 40% of which is situated on soils that are flooded for a large part of the year (ITTO 2006).

Permanent forest estate. The PFE includes forests in the national forest estate, forests owned publicly, communes and other local collectives (articles 5 and 6, Law16/2000). The non-permanent forest estate comprises non-gazetted protected forests (Article 13, Law16/2000). Since the 1960s, Congo has divided its national forest estate into three sectors and a variable number of forest management units (*unités d'aménagement forestier* – UFAs); virtually all closed natural forest is contained within Congo's PFE (Table 1). Some UFAs in the south and in the centre are subdivided further into forest logging units (*unités forestières d'exploitation* – UFEs). In mid 2009, 52 forest management/forest logging units covering an area of nearly 12 million hectares had been established, the majority in the north. The plan is that 15.2 million hectares will be allocated for production forestry. An area of about 3.2 million hectares of PFE is unallocated. UFAs can be managed for both production and protection.

Forest ecosystem health

Deforestation and forest degradation. Congo is a country with high forest cover and low rates of deforestation and forest degradation. The Government of Congo (2010b) estimated the annual deforestation rate at 0.03% (67 000 hectares per year) and the annual degradation rate at 0.01%. Deforestation is more intense in the south; the north is only sparsely populated

Table 1 Permanent forest estate

Reporting year	Estimated total forest area, range (million ha)	Total closed natural forest ('000 ha)	PFE ('000 hectares)			
			Production		Protection	Total
			Natural	Planted		
2005*	20.3–22.1	22 000	18 400	72	2860	21 300
2010	22.4–26.9	18 500**	15 200‡	85	3650	18 900

* As reported in ITTO (2006).

** Based on de Wasseige et al. (2009).

‡ Data on the extent of the production PFE are contradictory, even within the same ministry. This figure is estimated according to the plan for the PFE set out by MEF.

and to a large extent inaccessible. The main direct causes of deforestation and forest degradation are unsustainable slash-and-burn practices; unsustainable fuelwood production and consumption; unsustainable and illegal logging; and urban development. These direct causes are compounded by underlying factors such as a lack of a common land-planning vision among stakeholders; rural poverty; population growth; a lack of alternative sources of energy adapted to low incomes; inefficient charcoal production and use; and weak forest governance (Government of Congo 2010b). Table 2 provides an estimate of forest condition.

Vulnerability of forests to climate change. Congo has not submitted a NAPA to the UNFCCC and no information was available for this report on the country's strategy to adapt to climate change. Increasing vulnerability in Congo may be expected in peri-urban areas, particularly with regard to a dwindling water supply and associated health risks. A drying of the climate would likely increase the incidence of forest fire in the southwest and in the savanna.

SFM policy framework

Forest tenure. Under Article 35 of the Forest Code (2000) the state recognizes the ownership rights of private forest owners, based on tenure titles or customary tenure rights, as recognized by the 1991

Sovereign National Conference. Theoretically, state forest can belong to government, local councils (*collectivités locales*) and public bodies. Once declared, any community or communal forest is registered as the private domain of the relevant group. Although the principle of ownership rights for local communities is in effect, no transfers have been implemented. As for individuals, the registration of customary titles remains an issue. The presumption of ownership remains with the state, which is still the sole owner and manager of forests (Table 3).

Criteria and indicators. Congo developed its own set of PCI based on those of ITTO and ATO in 2007. The Government of Congo used the ITTO C&I in its submission to ITTO for this report.^a

Forest policy and legislation. The legal framework for government policy on forests and the environment mainly includes: Law 003/91 (1991), on environmental protection; Law 20/96 (1996, amending the 1984 law), instituting Tree Day; Law 16/2000 (2000), which sets out the Forest Code; Law 17/2000 (2000), on tenure; Law 10/2004 (2004), providing for the State Estate Code; and Law 37/2008 (2008) on fauna and protected areas. The Forest Code, the law on fauna and protected areas and all other laws developed after the United Nations Conference on Environment and Development in 1992 integrate wider concerns to ensure the economic, environmental and

Table 2 Forest condition

	PFE	Non-PFE	Total
	'000 ha		
Area of primary forest	7500	-	7500
Area of degraded primary forest	15 100	-	15 100
Area of secondary forest			
Area of degraded forest land*	-	-	-

Source: Government of Congo (2010a).

Table 3 Forest area, by tenure

Ownership category	Total area	Of which PFE	Notes
	'000 ha		
State ownership (national, state or provincial governments)	22 100	18 787	The exact extent of the state forest area is not known.
Other public entities (e.g. municipalities, villages)	113	113	Refers to allocated <i>réserves communautaires</i> .
Total public	22 200	18 900	
Owned by local communities and/or Indigenous groups	-	-	
Private owned by individuals, firms, other corporate	-	-	The area of planted forest by the private sector is unknown.

Source: ITTO estimate based on Government of Congo (2010a).

social sustainability of natural resources (land, forest, water and fauna). Under the Forest Code, development plans must be prepared for each UFA. The Forest Code describes the bidding process for the allocation of UFAs and, through subsequent decrees, regulates forest management planning and makes specific technical management directives, including on community development. National standards for additional studies (e.g. socioeconomic and environmental) were added by decree in 2005.

The forest policy is linked with the wider development agenda of the country. The National Land Planning Scheme (2005), the Poverty Reduction Strategy Paper (2008) and the National Action Plan (2008) all include forests as an important element in the country's development. Congo is a signatory to the Treaty on the Conservation and Sustainable Management of Forest Ecosystems in Central Africa (signed in Brazzaville in 2005; ratified by Congo in Law 35/2006, 2006) and participates in COMIFAC.

Institutions involved in forests. The mission of the former Ministry of Forestry Economy and Environment (*Ministère de l'Economie Forestière et de l'Environnement*) has been reassigned to the Ministry of Forest Economy (*Ministère de l'Economie Forestière* – MEF) and the Ministry of Tourism and the Environment. MEF is responsible for forest policies and strategies, the monitoring of forest management, the forest economy, the supervision of rural forestry, the management of wildlife resources, and training and research. The total staff assigned for these tasks is about 750, of whom 350 are technicians. MEF lacks the human and material resources to manage the country's large forest estate effectively. There are four state agencies with specific tasks: the Forestry Fund

(*Fonds Forestier*); the National Reforestation Service (*Service National de Reboisement*); the National Centre for the Inventory and Management of Forest and Wildlife Resources (*Centre National d'Inventaire et d'Aménagement des Ressources Forestières et Fauniques* – CNIAF), which is in charge of developing forest management plans and the monitoring of their implementation; and the Monitoring Service for the Export and Import of Forest and Wildlife Products (*Service de Contrôle des Produits Forestiers et Fauniques à l'Exportation et l'Importation*), which has outsourced offices in the country's main production forest areas. Law enforcement is carried out by MEF's departmental directorates.

Research and technological development from ministries and NGOs is coordinated by a specific body, the Office for Scientific and Technological Research (*Délégation Générale de la Recherche Scientifique et Technique*). There are two training institutes, the *Ecole Nationale des Eaux et Forêts* in Mosendjo and the *Institut de Développement Rural*. Several international NGOs operate in Congo in close partnership with MEF, including the Wildlife Conservation Society in protected-area management, and the World Resources Institute, which supports the monitoring of commercial forestry operations.

Status of forest management

Forest for production

Timber has been harvested commercially in southern Congo since 1910 and in northern Congo since the 1970s.³ Today, 70% of timber production occurs in the sparsely populated northern Congo, which contains large areas of primary forest. Concessions in the UFAs are allocated either



Forest inventory at the CIB Pokola concession.

through an industrial processing agreement (*convention de transformation industrielle*), a management and processing agreement (*convention d'aménagement et de transformation*) or a special permit (*permis spécial*). In addition to these, Article 65 of the 2000 Forest Code specifies *les permis de coupe des bois de plantations* for the harvesting of plantations. Enterprises that are candidates for the development of a UFA are selected by tender. Harvesting is carried out in designated areas according to an AAC, which corresponds to the maximum annual volume authorized by the forest administration.

In mid 2009, 52 UFAs and UFEs covering an area of nearly 12 million hectares had been established, about 8 million hectares of which were in the north as large-scale concessions and about 4 million hectares of which were in the south and on the plateau, often divided into UFEs that are, on average, about 50 000 hectares in size.^a Forest management is very different in the southern Mayombe and Chaillu regions compared with the northern part of Congo. Southern forests are degraded, and current timber harvesting is often the third or fourth re-entry into logged-over forests (ITTO 2006). In addition, the former UFAs have been divided into smaller logging units, providing mainly national extractors with access to the resources. Many of these logging units have been subcontracted to logging operators without

knowledge of, interest in or capital for forest management, and damage is widespread.^a

In northern Congo, in contrast, the integrity of large UFAs has been maintained and the average size of UFAs is about 400 000 hectares. These concessions have been allocated to large industrial companies with an annual production capacity of over 100 000 m³, large enough to warrant investment in wood-processing units (ITTO 2006). The concessionaires already implement or are preparing forest management plans. In theory, these plans are to be prepared by the forest administration in close collaboration with the forest concession-holders, but, in practice, the concession-holders undertake most of the work (ibid.). By mid 2009, forest management plans had been finalized for 3.83 million hectares of concessions and was ongoing for an additional 6.84 million hectares. It is estimated that, by 2012, about 13.4 million hectares of production forests will be under management plans (Government of Congo 2010a).

Silviculture and species selection. Congo has a long tradition of forest research and education, and there is broad scientific knowledge of silviculture and forest dynamics in natural and planted forests. Under the 2000 Forest Code, forest management plans must specify the species selected for felling and for conservation, silvicultural treatments, including enrichment planting, and the silvicultural planning schedule for each harvesting plot. Felling cycles may vary between 25 and 50 years and harvestable diameters between 60 and 80 cm according to species (ITTO 2006). Harvesting in UFAs for which a management plan has not yet been approved should be preceded by a felling inventory for the specified area (ibid.).

In northern Congo, 20–25 timber species are harvested, primarily for the export market. The five major timber species listed in Table 4 make up nearly 80% of total production and, with an additional four species (*Triplochiton scleroxylon* –ayous, *Millettia laurentii* – wengé, *Terminalia superba* – limba and *Chlorophora excelsa* –iroko), made up 90% of log production between 2006 and 2009.^a In the south, the production is more diverse and involves mostly secondary forest species, such as *Aucoumea klaineana* (okoumé) and *Gambeya africana* (longhi).

Planted forest and trees outside the forest. The total area of planted forests has been estimated at

Table 4 Commonly harvested species for industrial roundwood

Species	Notes
<i>Entandrophragma cylindricum</i> (sapelli)*	More than 40% of total production, 100% for export.
<i>Aucoumea klaineana</i> (okoumé)	About 23% of total production, exported mainly to Asia.
<i>Entandrophragma utile</i> (sipo)*	About 6%, decorative species, important for veneer.
<i>Guarea cedrata</i> (bossé)	About 4% of total production.
<i>Entandrophragma candollei</i> (kossipo)	About 3% of total production.

* Also listed in ITTO (2006).

Source: Government of Congo (2010a).

about 85 000 hectares.^a A special unit develops agroforestry plantations and enrichment planting in logged-over and degraded forests; since 1996, 12 000 hectares of enrichment plantings have been established using local hardwood species. Where follow-up treatments are carried out (e.g. in the *Congolaise Industrielle des Bois* – CIB – concession), these enrichment plantings develop well.^b Most afforestation has been established in low-fertility savannas by introducing eucalypts (e.g. in the region of Pointe Noire).

A 40 000-hectare clonal eucalypt plantation, which is planned to be extended to 60 000 hectares, is being developed by a private firm (Canadian-owned Mag-Industries) in conjunction with the construction of a woodchip factory (de Wasseige et al. 2009). There are also oil-palm and rubber plantations in southern Congo but their extent is unknown.

Forest certification. Three main concessions in northern Congo, owned by *Industrie Forestière d'Ouessou* and CIB, hold valid FSC forest management certificates over an area of 1.91 million hectares (FSC 2010). Since June 2010, the Mokabi concession of Rougier (586 000 hectares) has received a certificate of legality and is progressing towards forest management certification. Congo and the European Union signed a VPA in May 2010.

Estimate of the area of forest sustainably managed for production.

The three concession areas owned by *Industrie Forestière d'Ouessou* and CIB operating with FSC certification, and the Mokabi concession of Rougier, which currently holds a Timber Legality and Traceability Verification (TLTV) certificate, are counted here as sustainably managed (Table 5).

Timber production and trade. Total annual roundwood production is estimated at 2.55 million m³, of which 1.98 million m³ was industrial roundwood in 2009 (ITTO 2010). In 2009, nearly 80% of the entire industrial roundwood harvest was undertaken by three Malaysian-owned and three European-controlled firms.^a

Timber companies must process at least 85% of their production in the country or pay a surcharge on log exports.^a Sawnwood production was 369 000 m³ in 2009, up from 200 000 m³ in 2004 and 109 000 m³ in 2000 (ITTO 2010). Log exports increased from 209 000 m³ in 1999 to a peak of 844 000 m³ in 2004; in 2009, 769 000 m³ of logs were exported (ibid.). The volume of sawnwood exports increased from 31 000 m³ in 1994 to 283 000 m³ in 2007; in 2009, 264 000 m³ of sawnwood were exported. About 8700 m³ of veneer were exported in 2009. The cost of exporting timber is relatively high in Congo compared to other countries in the Congo Basin. Timber produced in northern Congo must be

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

Reporting year	Natural					Planted		
	Total	Available for harvest	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
2005*	18 400	8440	1300	0	1300	72	45	0
2010	15 200	11 980	8270**	1908	2494	85	45	0

* As reported in ITTO (2006).

** Includes the area managed under approved forest management plans and areas that have management plans in advanced preparation.

transported more than 1000 km by road to the port of Douala in Cameroon, and labour costs are the second-highest in the region (after Gabon; ITTO 2006).

Non-timber forest products. The commercial harvesting of NTFPs (*produits accessoires*) is regulated through special permits (in particular for firewood and charcoal). Many foods, medicinal plants and condiments are collected in closed and savanna forests, and are mainly sold domestically. Fibres such as raphia and rônier leaves (*Borassus aethiopum*) are traded with neighbouring countries. Mammals (especially antelopes), invertebrates, snails and fish are important sources of protein for forest-dwelling communities. The trade in bush meat now involves many species, including protected species such as apes and elephants in northern Congo. Hunting for bush meat has become a major problem since the opening-up of the forests to commercial logging (ITTO 2006).

Forest carbon. The total forest carbon stock was estimated by de Wasseige et al. (2009) at about 4200 MtC, of which about 3300 MtC are in closed humid forests. Gibbs et al. (2007) estimated the national forest biomass carbon stock at 3458–4739 MtC, Eggleston et al. (2006) estimated it at 5472 MtC and FAO (2010) estimated it at 3438 MtC. Congo has submitted a readiness idea note to the Forest Carbon Partnership Facility and prepared a draft readiness preparation plan. The country's proposed REDD+ strategy includes enhancing forest-tenure security; sustainably managing forest resources; improving agricultural production systems; streamlining fuelwood production and use; and addressing extra-sectoral factors that lead to deforestation and degradation. Table 6 summarizes Congo's forest carbon potential. The large area of intact forest suggests significant potential for the conservation of existing forest carbon stocks.

Forest for protection

Soil and water. In southern and central Congo, about 3.66 million hectares of forests are managed primarily for soil and water protection (ITTO 2006). However, no maps or specific management plans have been prepared for these forests.^a

Biological diversity. Congo is host to more than 6500 plant species, 200 mammal species, more than 600 inventoried bird species, 45 reptile species, 36 amphibian species, 103 fish species and at least 800 butterfly species.^a Seven mammals, one bird and six plants found in forests are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species (IUCN 2011). Seven plant species are listed in CITES Appendix II, including one hardwood timber species, *Pericopsis elata* (UNEP-WCMC 2011).

Protective measures in production forests. Forest management plans prescribe measures to protect water resources, biodiversity and soils. Within timber concessions, areas are set aside to protect biodiversity. In 2009, the combined area of such protected forests was about 600 500 hectares.^a

Extent of protected areas. About 3.5 million hectares, or nearly 11% of the country's total area, has been classified as protected areas. There are three national parks: Odzala-Kokoua National Park (126 000 hectares) dating from 1935; Nouabale-Ndoki National Park (410 000 hectares), created in 1993; and the Conkouati-Douli National Park (505 000 hectares), created in 1999. These three national parks and three sanctuaries have protected-area status equivalent to IUCN categories I and II over a total area of 2.47 million hectares, of which about 2.07 million hectares is lowland evergreen broadleaved rainforest. Four wildlife reserves, two hunting reserves, one biosphere reserve and one community reserve (IUCN categories V and VI) cover a forest and savanna area of about

Table 6 Forest carbon potential

Biomass forest carbon (MtC)	% forest with canopy cover >60%	Deforestation/ degradation potential to 2030	Enhancement of carbon sink capacity to 2030	Forest area change monitoring capacity	Forest/ GHG inventory capacity	Importance of forest fire/ biomass burning	Engagement in international REDD+ processes
3458–4739	68	++	++	++	+	+	+++

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

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

Reporting year	Protection PFE	Attributed to IUCN categories I-IV	Allocated for soil and water	With management plans	Sustainably managed
2005*	2860	2470	3660	380	380
2010	3650	2470**	3660	536	536‡

* As reported in ITTO (2006).

** UNEP-WCMC (2010).

‡ Comprises Odzala National Park and Nouabale-Ndoki National Park, as well as the protected areas within the certified UFAs in northern Congo.

1.2 million hectares. Of the 14 protected areas, twelve are linked by forest corridors (ITTO 2006). The Conkouati-Douli National Park faces several threats, notably from illegal logging and mining, road access, and a relative high population density around the park; there is intensive poaching and commercial bush-meat hunting.^b

Estimate of the area of forest sustainably managed for protection. The Nouabale-Ndoki National Park (410 000 hectares) is covered by a management plan that is being implemented effectively; CIB is harvesting timber in the buffer zone and implementing measures to further protect the integrity of the park. This national park is therefore considered to be under SFM. Due to its remoteness and its 80 years of existence, the Odzala National Park is also considered to be under SFM (Table 7).

Socioeconomic aspects

Economic aspects. Forestry contributes about 6% of GDP and 3% of tax income. About 15 000 people obtain their income from forestry, not counting the informal sector, in particular in fuelwood and charcoal production and local carpentry. Forestry is particularly important as an employer in northern Congo.

Livelihood values. Bush meat and the gathering of edible fruits, nuts and roots are of great importance for forest-dependent local communities, particularly Pygmies in closed forest. Leaves of *Gnetum* spp are widely used as vegetables. Fruits of *Irvingia gabonensis*, *Gambeya africana* and others are also eaten. The government's procedures for forest management plans contain provisions for the local use of NTFPs (ITTO 2006).

Social relations. In northern Congo, communities living in or near forests rely heavily on hunting for subsistence, but this is often affected by logging and particularly the presence of logging camps.

Over-hunting occurs in areas with rapid population growth caused by the opening-up of the forest frontier. Indeed, the bush-meat question and social relations between Indigenous forest-dwellers and migrants attracted by the forest industry are possibly the biggest constraints to SFM in northern Congo (ITTO 2006). Local populations often benefit from the long-term presence of forest companies, which construct roads that can be used for the transport of goods. Such companies also establish medical services and schools and, to some extent, provide services that normally are the responsibility of government (ibid.).

Summary

Congo has a large forest resource, supportive government policies and considerable technical and financial support from international development partners. There is little population pressure in its main forest area, and a growing number of concessionaires are advancing along the path to SFM. The stage therefore seems set for the forest sector to expand the area of forest under SFM, provided that issues related to Indigenous communities and the commercial over-hunting of certain mammal species can be addressed. Most progress towards high standards of forest management is occurring in the northern part of the country; a major challenge is to extend this to the forests in the south.

Key points

- Congo has an estimated PFE of 18.9 million hectares (compared with 21.3 million hectares in 2005), comprising 15.2 million hectares of production forest (compared with 18.4 million hectares in 2005), 3.65 million hectares of protection PFE (compared with 2.86 million hectares in 2005) and about 85 000 hectares of planted forests.

- Management plans exist or are at an advanced stage of development for about 8.27 million hectares of production PFE. An estimated 2.49 million hectares of the natural production PFE and an estimated 536 000 hectares of protection forests are under SFM.
- The over-hunting of bush meat within concessions, and social relations between Indigenous forest-dwellers and migrants, are possibly the biggest constraints to SFM in northern Congo.
- There is potential for carbon conservation in natural forests and sequestration in planted forests under REDD+.

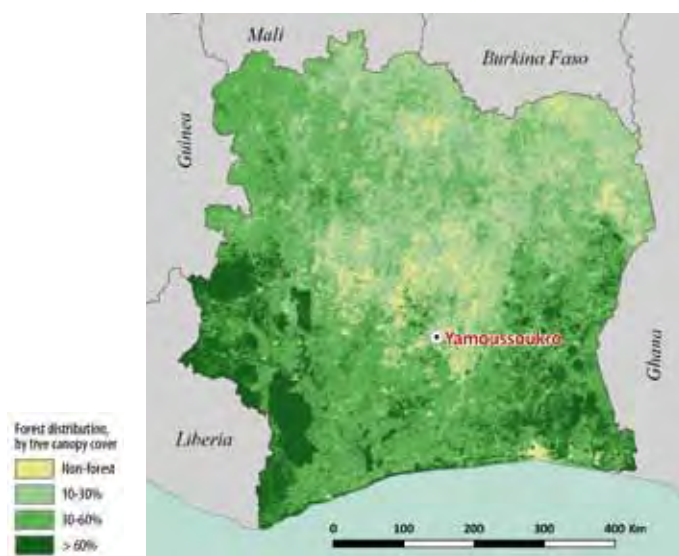
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CÔTE D'IVOIRE



Forest resources

Côte d'Ivoire, which is situated in the Gulf of Guinea, has a total land area of 32.2 million hectares and an estimated population in 2010 of 21.5 million people (United Nations Population Division 2010). It is ranked 163 out of 182 countries in UNDP's Human Development Index (UNDP 2009). The tropical moist forest belt (commonly called the *zone forestière*) extends inland from the coast for more than 250 km (to about 8° north), beyond which there is extensive savanna (*domaine soudanais*). The western part of the country is in the Guinea highlands, where the highest summits rise to more than 1500 m above sea level. With the exception of small areas of remaining primary forests (e.g. in the Taï reserve and the western mountains), forests are heavily degraded. FAO (2010a) estimated forest cover at

10.4 million hectares (32% of the land area), which is a slight increase over the estimate for 1990.

Forest types. Two main forest types can be distinguished in the south: wet evergreen, and semi-deciduous. The former is poorly stocked in commercial timber, although it contains species such as *Uapaca* spp, *Guarea cedrata* (bossé), *Tieghemella heckelii* (makoré), *Tarrietia utilis* (niangon) and *Triplochiton scleroxylon* (samba). The semi-deciduous forests, occurring in the central and northern parts of the *zone forestière*, was once rich in valuable timber species, including samba, *Mansonia altissima* (beté), *Nesogordonia papaverifera* (kotibé) and *Khaya ivorensis* (acajou). Outside a small number of effectively protected areas, most forests of both forest types are heavily degraded or are at an early stage of secondary growth.^a In the *domaine soudanais* there are some dry forests and gallery forest containing species such as *Daniella oliveri*, *Isobertinia doka* and *Azelia africana*. There are about 10 000 hectares of mangrove forests, characterized by *Rhizophora racemosa* and *Avicennia germinans* (Spalding et al. 2010).

Permanent forest estate. The PFE officially comprises the 231 classified forests (*forêts classées*) zoned for production and protection, which cover an area of 4.2 million hectares. However, only about 1.95 million hectares of these are still forested (Table 1).^a There are nearly 2.1 million hectares of forest in protected areas. Outside the PFE, in the rural forest domain (*domaine forestier rural*) there were 385 forest harvesting areas (*périmètres d'exploitation forestière* – PEFs) in 2008; 80–90% of the entire timber production of the country comes from these areas (ITTO 2008).

Table 1 Permanent forest estate

Reporting year	Estimated total forest area, range (million ha)	Total closed natural forest ('000 ha)	PFE ('000 hectares)			
			Production		Protection	Total
			Natural	Planted		
2005*	7.1–11.7	3248	3400	167	734	4301
2010	7.52–10.4**	1760[‡]	1950[†]	180	2090	4220

* As reported in ITTO (2006).

** Area of public forests and dense forests in *domaine forestier rural* estimated at 7.52 million hectares.

[‡] Calculated using the ratio of forest with greater than 60% forest cover estimated by UNEP-WCMC (2010) (16.9%) and the total natural forest area estimated by FAO (2010a).

[†] Estimated actual forested area in the *forêts classées*. The large decrease compared with 2005 is based on a 2008 assessment of the extent of forest in the *forêts classées* (Government of Côte d'Ivoire 2009).

Forest ecosystem health

Deforestation and forest degradation. According to FAO (2010b), the deforestation rate in Côte d'Ivoire was insignificant in the period 2005–10 but was 15 000 hectares per year in 2000–05. Deforestation is caused mainly by land-use change to agriculture: 7.5 million hectares of former forest land are used today for swidden agriculture, and about 3.3 million hectares of former forest land are used for the production of commercial crops such as coffee, cocoa, palm oil, rubber and pineapple.^a Timber theft and illegal logging are widespread and are the primary reasons for the degradation of natural forests in the *forêts classées* and the *domaine forestier rural* (ITTO 2006). Bushfire is common in Côte d'Ivoire's savanna and transitional forest–savanna. Fire in the *zone forestière*, mainly human-induced, affects more than 25 000 hectares annually (ITTO 2008). Table 2 summarizes forest condition; more than 90% of remaining forests in Côte d'Ivoire are secondary or degraded primary forests.^b

Vulnerability of forests to climate change. Côte d'Ivoire has prepared a detailed national report on climate change. As in other countries in West Africa, rainfall in Côte d'Ivoire depends on the monsoon system associated with the inter-tropical convergence zone. The surface temperatures in the Atlantic and Indian Oceans, as well as the El

Niño phenomenon, will be significant drivers of West Africa's future climate. The mean annual temperature in Africa is projected to increase over the next 60 years by 3–4°C (IPCC 2007). There may also be an increased frequency of heavy rainstorms and drought, which could lead to an expansion of agricultural areas to the detriment of forests and increases in migration, uncontrolled fire and conflict over access to forest land.

SFM policy framework

Forest tenure. There are two main categories of natural-forest ownership:

- Public (state-owned) forests, which are divided into two kinds of land use: the permanent forest domain (*domaine forestier permanent*), which includes the reserved forest area and protected areas; and the *domaine forestier rural*, which includes PEFs and forests reserved for agricultural purposes.
- Community forests, which are based on traditional customary rights recognized in all forest areas in the country. There are 6705 registered sacred forests (*forêts sacrées*) covering a total area of 36 435 hectares; these are under the full jurisdiction of local communities.^a Many more forests may have cultural or spiritual value but are not registered.

Table 2 Forest condition

	PFE	Non-PFE	Total
	'000 ha		
Area of primary forest	625	10	630
Area of secondary forest/degraded primary forest	3260	6110	9380
Area of degraded forest land	-	-	-

Source: Government of Côte d'Ivoire (2009) and FAO (2010a).

Table 3 Forest area, by tenure

Ownership category	Total area	Of which PFE	Notes
	'000 ha		
State ownership (national, state or provincial government)	6125	-	4.2 million hectares in 231 <i>forêts classées</i> and 1.9 million hectares in 13 protected areas.
Other public entities (e.g. municipalities, villages)	-	-	
Total public	6125	-	
Owned by local communities and/or Indigenous groups	-	-	
Private owned by individuals, firms, other corporate	12	-	Privately owned forest plantations (mainly teak).

Source: Government of Côte d'Ivoire (2009).

Criteria and indicators. ITTO's C&I are used in Côte d'Ivoire as an instrument for forest management planning. The Government of Côte d'Ivoire used the ITTO C&I in its submission to ITTO for this report.^a Côte d'Ivoire finalized its set of ATO/ITTO PCI in 2006. The training of 25 Ivoirians in the use of the ATO/ITTO PCI was organized by a regional ITTO project on the promotion of SFM in Africa. The Government of Côte d'Ivoire extended this training to 30 additional senior forest officers.

Forest policy and legislation. The Forest Code (Law 65/425) dates from 1965. Since then, all major decisions on land use, forest management, the organization of the forest service and the commercialization of forest products have been made through decrees or ministerial orders (*arrêtés*), including Decree 78/231 (1978), which prescribes the management of the PFE, and Decree 94/385 (1994), which sets out forest-harvesting reforms. A process to revise the Forest Code began in 2002 with support from FAO and was finalized in 2005. Since then, a series of stakeholder workshops have been held and a process to finalize the new forest code is under way prior to its introduction to the National Assembly for adoption.^a

The main law on wildlife protection and hunting also dates from 1965 (Law 65/255). Additional elements relating to the financing and management of national parks and other protected areas are specified in Law 102/02 (2002).^a

A forest master plan (*plan directeur forestier*) was formulated in 1988 for a span of 25 years. This was evaluated in 1998 and the Framework Program on Forest Management (*Programme Cadre de Gestion des Forêts*) was developed in 1999, valid for 14 years (ITTO 2006). Systematic improvements in forest management were hindered up to 2008 by severe socio-political crises and the division of the country into two parts. After the signing of the Ouagadougou Peace Accord in 2007 the country gradually re-formulated its state policies and re-organized its institutions. The forest policy was revised in 2010 and a strategic plan for its implementation in 2010–15 approved. This plan includes, among other things, the creation of a forest development fund (*Fonds de Développement Forestier*), the continuation of the revision of the forest code, a new direction for reforestation and new prescriptions for the management of the

domaine forestière rural.^a The impact of the most recent political crisis on forest policy is unclear but is unlikely to have been positive.

Institutions involved in forests. Under Decree 06/310 (2006), the Ministry for Environment, Water and Forests (*Ministère de l'Environnement, des Eaux et Forêts* – MINEEF) is responsible for the management of the forest estate. To manage the forests of the *domaine forestière rural*, MINEEF is supported by the Directorate for Water and Forests, which has four central divisions, ten regional directorates, 54 forest offices (*cantonnements des eaux et forêts*) and 70 forest posts (*postes des eaux et forêts*). MINEEF also oversees four specialist institutions, including the Forest Development Agency (*Société de Développement des Forêts* – SODEFOR) and the National Office for National Parks and Nature Reserves (*Office Ivoirien des Parcs et Réserves Naturelles* – OIPR) for the management of protected areas.

SODEFOR was created in 1966 and is entrusted today with the management of the 231 *forêts classées* and with technical advisory functions for planted forests and social forestry. MINEEF has a staff of about 1600 people, of whom nearly 700 are employed by SODEFOR and 250 by OIPR.

In 2008, a specialized agency for forest development (*Agence Nationale de Développement des Forêts*) was created with the task of improving the management of remaining forests in the *domaine forestier rural*. Previously, forest harvesting in the *domaine forestier rural* was conducted exclusively by the private sector.

The forest industry is organized in syndicates and is quite effective in defending its interests. A number of national and international NGOs are engaged in forest conservation and village development, including reforestation and agroforestry. Civil society is not actively involved in forest management (ITTO 2006).

Status of forest management

Forest for production

Two forest management systems are employed. In production forests, the management of *forêts classées* is carried out by SODEFOR, while in the *domaine forestier rural* it is carried out by private concession-holders. In the past, timber was harvested mainly in reserved forest areas, but excessive extraction over



Ceiba pentandra logs await processing in an Ivorian plywood mill.

the past 35 years has led to their depletion. Today, nearly 90% of timber is extracted from the *domaine forestier rural* (ITTO 2008).

Until 2002 forest harvesting in the *domaine forestier rural* was based on a licence system called the PTE (*permis de transformation et d'exploitation*), which allocated areas of up to 2500 hectares to a large number of concessionaires. With a policy revision in 2004, the PTE system was abolished and replaced by a system based on PEFs. By law, a PEF is at least 25 000 hectares in size and is allocated for 15–20 years; it can be renewed if management by the concession-holder is satisfactory. Concession-holders are obliged to present a forest management plan that includes a reforestation scheme and social investments in rural communities in or adjacent to the PEF. Management plans must also include prescriptions for sustained-yield harvesting and the silvicultural treatment of harvested forests, and measures against wildfire. However, few management plans have been prepared and harvesting is still based mainly on high-grading the remaining high-value timber.^c

As of 2007, 373 PEFs had been attributed to 112 concessions, covering a total area of about 1.4 million hectares of productive forest.^a In the past ten years the average timber harvest was 1.6 million m³ per year.^a

SODEFOR prepares and implements forest management plans for the *forêts classées*. Since 2005

it has been possible for such forests to be managed by private concession-holders in partnership with SODEFOR. A total of 40 *forêts classées*, covering more than 1.2 million hectares, are so managed.^a Limited information about the quality of this management is available. Forest management plans have been or are being prepared for 89 of the 231 existing *forêts classées* (in 2002, 25 forest reserves had an approved management plan and 1.5 million hectares were being managed). The size of the units varies, the smallest (Semien) being 3381 hectares and the largest (Rapids-Grah) 315 000 hectares. Forest reserves are to be managed in perpetuity (ITTO 2006). In a process to clarify the extent of forest, shifting cultivation and commercial agricultural crops within the *forêts classées*, in 2008 SODEFOR determined that only 1.947 million hectares of such forest remained.^a

Despite the scarce forest resources, some large international timber companies of French, Italian and Lebanese origin still operate in Côte d'Ivoire. Due to the earlier log export ban and the growing scarcity of the resource, these companies have invested in downstream wood-processing. The French company, Inprobois, for example, holds seven PEFs totalling 366 000 hectares and manages *forêts classées* of 22 000 hectares in partnership with SODEFOR. The company is pursuing FSC certification for this forest, which benefits from a management plan prepared by SODEFOR. Almost all the company's production, which specializes in

plywood and veneer, is for export. Other foreign companies possess several PEFs that add up to large areas. For example, SNG has licences to 480 000 hectares of forest, CIB has licences to 628 000 hectares and SIFCI has licences to 505 000 hectares.^c

Silviculture and species selection. Silvicultural prescriptions were developed in the 1990s and have been fully applied in some *forêts classées* (e.g. Irobo, Tene and Mopri), but not yet in the entire PFE. To date, no silvicultural directives have been applied in the *domaine forestier rural*. The forests of Côte d'Ivoire contain more than 700 hardwood species, about fifty of which are commonly used. Besides those listed in Table 4, the most valuable species are *Terminalia ivorensis* (framiré), *Entandrophragma candollei* (kossipo), beté, *Entandrophragma angolense* (tiama), *Lovoa trichilioides* (dibetou), bossé, kotibé, *Pterygota macrocarpa* (koto), *Canarium schweinfurthii* (aiélé), makoré, *Pycnanthus kombo* (ilomba), *Azelia africana* (lingué), *Lophira alata* (azobé), niangon and planted teak. Côte d'Ivoire has made efforts to explore the silvicultural behaviour of and to market lesser-known species such as *Copaifera salikounda* (etimoé) and *Chrysophyllum* spp (aniégré).

Planted forest and trees outside the forest. The planted forest area has been estimated at 180 000 hectares (ITTO 2008) and 212 000 hectares^a; the latter is an estimate of forest plantations in the *forêts classées* and *domaine forestier rural*. Outside forests, the most important non-forest tree plantations are oil palm (about 160 000 hectares), rubber (70 000 hectares) and coconut (30 000 hectares). The National Reforestation Programme (*Programme National de Reboisement*), created in 2005, is the main policy instrument for promoting reforestation in the *forêts classées* and by communities.

Plantation development started in 1926 with enrichment plantings of hardwood species such as acajou, fraké, niangon, sipo and later teak, bossé and other species. By 1945 about 8000 hectares had been established. Between 1966 and 1988, 20 000 hectares of mainly teak plantations were developed and another 90 000 hectares were planted between 1990 and 2007 (ITTO 2008). Due to a requirement since 1995 that PEF-holders invest in forest plantations, most planted forests (about 70 000 hectares) are located in the *domaine forestier rural*. There is, however, insufficient control and a lack of data to assess the state and quality of these plantations.

More than 35 species have been planted in the *forêts classées*. Today the most widely planted species is teak, with a total area of about 67 000 hectares in 2007.^a Other important species are fraké, 25 800 hectares; framiré, 14 000 hectares; *Cedrela odorata*, 10 100 hectares; *Gmelina arborea*, 8000 hectares; samba, 3600 hectares; acajou, 2900 hectares; sipo, over 2200 hectares; and niangon, 7800 hectares.^a About 27 000 hectares are registered as mixed hardwood plantations. Of the estimated 60 000 hectares or more of planted forest in the *domaine forestier rural*, about 15 000 hectares have been created as community forests, often to produce firewood.

Forest certification. There is no forest certification scheme nor any certified forests in Côte d'Ivoire (e.g. FSC 2010). One company, Inprobois, is pursuing FSC certification for the management of 22 000 hectares in a *forêt classée*, in partnership with SODEFOR.

Estimate of the area of forest sustainably managed for production. In the *domaine forestier rural*, where the majority of timber is cut, there is virtually no management and the already degraded forests are being further depleted. The situation is

Table 4 Commonly harvested timber species for industrial roundwood

Species	Notes
<i>Ceiba pentandra</i> (fromager)*	Often off-reserve harvesting; more than 360 000 m ³ harvested in 2008.
<i>Triplochiton scleroxylon</i> (samba, ayous)*	White wood, also planted; 170 000 m ³ harvested in 2008.
<i>Terminalia superba</i> (fraké)*	More than 70 000 m ³ harvested in 2008.
<i>Chlorophora excelsa</i> and <i>C. regia</i> (iroko)	Nearly 70 000 m ³ harvested in 2008.
<i>Khaya ivorensis</i> and <i>K. anthotheca</i>	About 63 000 m ³ harvested in 2008.

* Also listed in ITTO (2006).

Source: Government of Côte d'Ivoire (2009).

better in the *forêts classées*, which are managed by SODEFOR, but even in forests where the necessary elements of good forest management appear to be present, law enforcement is poor and illegal logging and deforestation widespread.^c As of 2008, management plans had been prepared in 89 out of the 231 forest reserves, 26 of which, covering an area of 1.36 million hectares, had been approved. About 200 000 hectares are considered to be well managed (Table 5), comprising the *forêts classées* of Cavally, Besso, Bossematié and Haut-Sassandra.

Timber production and trade. The forest industry is composed of several hundred small processing units and there are 18 enterprises with a processing capacity of more than 10 000 m³ per year; 70% of the industry is foreign-owned (ITTO 2008). Total annual roundwood production per year in the period 2004–08 was estimated at about 21.5 million m³, of which nearly 20 million m³ was for fuelwood and charcoal.^a

Industrial log production in Côte d'Ivoire fell from 5.3 million m³ in 1977 to 3.3 million m³ in 1985, 1.9 million m³ in 2003, 1.5 million m³ in 2007 (ITTO 2008) and 1.47 million m³ in 2009 (ITTO 2010). Total sawnwood production was about 471 000 m³ in 2009, veneer production was 396 000 m³ and plywood production was 81 000 m³ (ITTO 2010). In 2009 an estimated 125 000 m³ of logs were exported, as were 252 000 m³ of sawnwood, 103 000 m³ of veneer and 11 000 m³ of plywood (ibid.). Exports went mainly to Europe (80%), the United States, Japan, the Maghreb and

neighbouring countries (ITTO 2008). Since 1994 there has been a ban on the export of logs of several high-value timber species obtained from natural forests.

Non-timber forest products. MINEEF taxes commercial collectors for the harvest of 44 NTFPs.^a Many more NTFPs are traded locally and used for subsistence. Among the most important are bamboo, *Laccosperma* spp (rattan) and *Raphia* spp (raphia palm) for basketry, furniture and housing, and the leaves and fruits of *Thaumatococcus danielli* (feuille d'attiéké) for medicinal purposes and as a sweetener.

Forest carbon. Gibbs et al. (2007) estimated the national-level forest biomass carbon stock at 750–1238 MtC, Eggleston et al. (2006) estimated it at 3355 MtC and FAO (2010a) estimated it at 1842 MtC. Despite the absence of Côte d'Ivoire in REDD+ readiness programs (e.g. the Forest Carbon Partnership Facility and UN-REDD), the country's engagement in the UNFCCC is high; it has conducted its first GHG inventory and has considerable capacity for monitoring forest-area change. The proportion of intact forests is relatively low, as well as the proportion of tree cover over 60% (an estimated 16.9% of the total forest area; UNEP-WCMC 2010). There is potential to enhance carbon stocks through forest restoration and reforestation in heavily degraded *forêts classées*. Table 6 summarizes Côte d'Ivoire's forest carbon potential.

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

Reporting year	Natural					Planted		
	Total	Available for harvesting	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
2005*	3400	1870	1110	0	277	167	120	0
2010	1950	1950	1360	0	200	180	133	0

* As reported in ITTO (2006).

Table 6 Forest carbon potential

Biomass forest carbon (MtC)	% forest with canopy cover >60%	Deforestation/ degradation potential to 2030	Enhancement of carbon sink capacity to 2030	Forest area change monitoring capacity	Forest/ GHG inventory capacity	Importance of forest fire/ biomass burning	Engagement in international REDD+ processes
750–1238	17	+	++	+	++	++	+

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

Forest for protection

Soil and water. A total area of 374 000 hectares is set aside for the protection of soil and water in the 26 *forêts classées* that are managed according to forest management plans prepared by SODEFOR.^a A number of small *forêts classées* in the vicinity of Abidjan, such as Angédédou (5600 hectares), and the National Park of Banco (3400 hectares), have specific functions in catchment protection.^a

Biological diversity. Côte d'Ivoire has a very high level of biodiversity, with over 12 000 forest-dependent species, including 1265 animal species (232 mammals, 712 birds, 134 reptiles, 76 amphibians and 111 fish) and 8200 plant species, including over 3500 tree species.^a Eighteen mammals, ten birds, twelve amphibians, two reptiles and eight plants found in forests are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species (IUCN 2011). Seven plant species are listed in CITES Appendix II, including one hardwood timber species, *Pericopsis elata* (UNEP-WCMC 2011). Thirty tree species, including iroko and acajou, are considered vulnerable.^a

Protective measures in production forests.

Timber harvesting is limited in swampy areas, on steep slopes and along streams (for the latter, a strip of between 100 m and 1 km in width, depending on the size of the stream, is excluded from harvesting). Detailed prescriptions for biodiversity conservation are applied in the 26 *forêts classées* managed by SODEFOR.

Extent of protected areas. Côte d'Ivoire has eight national parks and six nature reserves, one wildlife reserve and 17 botanic reserves. In addition, parts of 26 *forêts classées* totaling 374 000 hectares are managed for soil and water conservation. Combined, the protection PFE is estimated to be 2.09 million hectares, which is 6% of the country's

land area. Of the protection PFE, two national parks (Comoé, 1.15 million hectares; and Taï, 457 000 hectares) account for more than 60% of the area. Comoé, created in 1983, is one of the largest protected areas in West Africa. Taï, created as a *forêt classée* in 1926, was designated as a national park in 1972 and added to the list of Natural World Heritage Sites in 1982; it contains one of the last major remnants of primary tropical forest in West Africa. There are also two transboundary protected areas, one on the border with Guinea and Sierra Leone and the other in the Tano River Basin on the border with Ghana.

Estimate of the area of forest sustainably managed for protection.

Poaching and other illegal activities are thought to be a significant problem in many forested reserves^c, due largely to a lack of sufficient financial resources for field-level enforcement (ITTO 2006). About 840 000 hectares of protection PFE are covered by management plans that are being implemented effectively. This comprises forests managed for soil and water conservation in *forêts classées* administered by SODEFOR (374 000 hectares), the Taï National Park (457 000 hectares), a number of small protected areas managed primarily for water and soil conservation, and the reserve at Mount Nimba (9000 hectares). This constitutes the estimate of protection PFE under SFM shown in Table 7.

Socioeconomic aspects

Economic aspects. Until about 1985, timber was Côte d'Ivoire's third most important export by value, but the industry has declined as the forests have been logged and depleted of commercially valuable trees. In 2006 the economic contribution of the formal forest sector was estimated at 1.9% of GDP.^a The total annual value of wood production (timber and fuelwood) is estimated at US\$323 million.^{a,b} No assessment has been carried out on

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

Reporting year	Protection PFE	Attributed to IUCN categories I-IV	Allocated for soil and water	With management plans	Sustainably managed
2005*	734	734	195	345	150
2010	2090	2090	374**	840	840

* As reported in ITTO (2006).

** Technically this area is part of the production PFE because it is within *forêts classées*.

the economic value of NTFPs, carbon, water or biodiversity.

Livelihood values. Forests are important for sustaining the livelihoods of many people in Côte d'Ivoire. Edible and medicinal plants are collected in great quantities. Bush meat remains a major source of protein in rural areas, even though hunting regulations are very restrictive; the harvested volume is estimated at more than 120 tonnes per year.^a The consumption of fuelwood, including charcoal, is estimated at more than 20 million m³ per year (ITTO 2008, Government of Côte d'Ivoire 2009).

Social relations. The 1965 Forest Code, which is still in force, does not specify the direct involvement of local people in forest management, although articles 16 and 20 set forth rights for riverine populations within *forêts classées*. Nevertheless, local people may collect wood and NTFPs in all forests. Social considerations have been taken into account in various recent governmental decrees concerning forests. Relationships between concession-holders and local people are often strained. In some areas, local communities help protect *forêts classées* from encroachment and bushfire. Local cooperatives and villages also often engage in reforestation activities.

Summary

Deforestation and forest degradation are major problems in Côte d'Ivoire, and most natural forest is considered degraded or secondary. The country's 231 state-owned *forêts classées* have been over-harvested and have become depleted of timber; natural forests in the *domaine forestier rural* and planted forests are providing an increasing part of the timber supply. The level of enforcement of existing laws and decrees appears to be low in much of the PFE. Forest management plans are under preparation or have been prepared for the *forêts classées*, but few have been prepared for the *domaine forestier rural*. While the recorded area of well-managed protection forest has increased, this is most likely due to improved information rather than a general improvement in forest management. Systematic improvements in forest management have been hindered in recent years by socio-political crises and a lack of political will. Illegal logging is thought to be widespread.

Key points

- Côte d'Ivoire has an estimated PFE of 4.22 million hectares (compared with 4.30 million hectares in 2005), comprising 1.95 million hectares of natural production forest (compared with 3.40 million hectares in 2005), 2.09 million hectares of protection forest (compared with 734 000 hectares in 2005) and 180 000 hectares of planted forest (compared with 167 000 hectares in 2005).
- An estimated 200 000 hectares of the production PFE is under SFM, no forest is certified, and an estimated 840 000 hectares of protection PFE is under SFM.
- Forest administration is currently the responsibility of the Ministry for Environment, Water and Forests (MINEEF), which operates under the 1965 Forest Code and subsequent decrees. A process to revise the Forest Code has been under way for many years but has not yet resulted in a new legislative framework. The implementation capacity of MINEEF is low.
- There is a discrepancy between the standards applied in the forest reserves of the PFE and in the *domaine forestier rural*, where most harvesting takes place.
- There is conflict between communities and harvesting operators over the use of forests. Poaching and timber theft are significant problems.

Endnotes

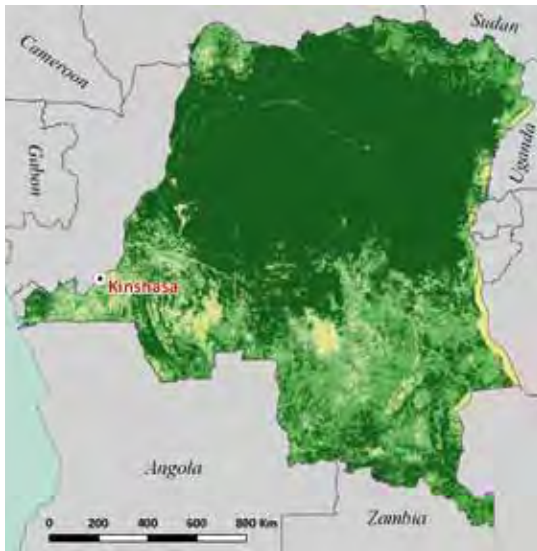
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- b ITTO estimate.
- c Personal communications with various officials of the Government of Côte d'Ivoire, 2010.

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DEMOCRATIC REPUBLIC OF THE CONGO



Forest resources

The Democratic Republic of the Congo (DRC) has a land area of 233 million hectares and, in 2010, an estimated population of 66 million people (United Nations Population Division 2010). DRC is ranked 176th out of 182 countries in UNDP’s Human Development Index (UNDP 2009). It lies entirely within the Congo Basin, with only 42 km of coastline on the Atlantic Ocean, and mostly comprises plateaux that are 600–800 m above sea level in the north and 1000–2000 m in the south. The highest peaks reach 4500 m in the Virunga volcanic massif on the border with Rwanda and exceed 5000 m in the Ruwenzori Mountains on the border with Uganda. About 77% of the country is above 1000 m above sea level. Estimates of total forest cover include 112 million hectares^a and 154 million hectares (FAO 2010a).

Forest types. Lowland evergreen and semi-deciduous forests occupy much of DRC’s central and western regions, with moist evergreen forests accounting for about one-third of the country’s forests. Submontane and montane closed forests include about 7 million hectares of montane rainforests. Swamp forests extend over about 9 million hectares of the central basin and are characterized by species such as *Guibourtia*

demeusei, *Entandrophragma palustre* and *Garcinia* spp. DRC has one of the world’s largest contiguous areas of swamp forest.

Permanently flooded swamp areas host almost monospecific stands of *Raphia* palm. The total area of dense humid forests (lowland and montane) is about 98 million hectares (forest types 1–4 in Box 1). Open forests, including miombo woodland, cover about 56 million hectares (forest types 5–6 in Box 1). They also include montane and submontane sclerophyllous forests of *Grewia* spp, *Carissa edulis* and *Euphorbia* spp, which cover the eastern part of the country.

Box 1 Forest area, by forest type, DRC

	Forest type	Area ('000 ha)	% of forest area
1	Lowland humid tropical forest (<i>forêt dense de basse altitude</i>)	83 700	54
2	Submontane forest (900–1500 m) (<i>forêt sub-montagnarde</i>)	6000	4
3	Mountain forest (>1500 m) (<i>forêt de montagne</i>)	1000	1
4	Swamp forest (<i>forêt marécageuse</i>)	8200	5
5	Forest–savanna mosaic (<i>mosaïque forêt–savane</i>)	28 600	18
6	Semi-deciduous dry forest (<i>miombo</i>)	28 000	17

Source: Based on De Wasseige et al. (2009).

Although DRC has only 42 km of coastline, the large estuary of the Congo River is lined with mangroves, covering a total area of about 193 000 hectares (Spalding et al. 2010).

Permanent forest estate. DRC does not have an officially adopted land-use plan, which impedes a proper classification of the forest estate.^a The state forest area (*domaine forestier de l’Etat*) comprises three forest-use categories:

- *Classified forests*, which are subject to legal restrictions regarding user and harvesting rights. They generally include reserves and protected areas.

- *Protected forests*, which have a less restrictive legal regime than classified forests. They include community forests, small-scale concession contracts and forest–subsistence–farming mosaics.
- *Permanent production forests*, which include previously allocated forest concessions and newly identified production forests (allocated and unallocated concessions). These forests are reserved for industrial-scale logging under an SFM regime.

Table 1 shows the estimated PFE. It comprises those permanent production forests that had valid concession agreements in 2009, and the area of classified forests. There is potential to classify much larger areas as PFE – up to 87 million hectares – mainly in the provinces of Équateur, Orientale, Bandundu and Maniema.^a However, the process needs to be harmonized with overall land-use planning in the newly decentralized governance regime.^b

Forest ecosystem health

Deforestation and forest degradation. FAO (2010b) reported the deforestation rate in DRC in the period 1990–2010 at 311 000 hectares

(0.2%) per year, similar to the rate reported by the Government of DRC for the period 2005–10 of 320 000 hectares per year.^a Deforestation and forest degradation are not distributed homogeneously over the country: deforestation hot spots occur near large cities in the savanna belt, the Basin and the Albertin Rift zone (Government of DRC 2010). Countrywide, slash-and-burn agriculture and fuelwood-harvesting are the most important drivers of deforestation. Commercial logging and mining cause forest degradation and also facilitate migration into forest areas. For example, the road network developed for commercial logging constitutes 38% of all roads in the Congo Basin (Government of DRC 2010). Table 2 indicates forest condition based on satellite image interpretation in 2008.^a

Vulnerability of forests to climate change. The Government of DRC submitted a NAPA to the UNFCCC in 2007. Subsistence rain-fed farming and non-timber forest activities support 70% of the population. Extreme weather is already the cause of regular humanitarian alerts as households have little adaptive capacity. Assuming similar changes in climate to those projected for Cameroon and Gabon, climate change will affect food production and water regimes. Forests and trees in agroforestry

Table 1 Permanent forest estate

Reporting year	Estimated total forest area, range (million ha)	Total closed natural forest ('000 ha)	PFE ('000 hectares)			
			Production		Protection	Total
			Natural	Planted		
2005*	128–135	126 200	20 500	55	27 000	47 500
2010	112–154	87 800**	22 500^{‡,a}	67^a	25 800	48 300

* As reported in ITTO (2006).

** Calculated using the ratio of forest with greater than 60% forest cover estimated by UNEP-WCMC (2010) (65.5%) and the total natural forest area estimated by FAO (2010a).

‡ Allocated production forest area covers 12.3 million hectares. Ten million hectares of potential production PFE remain unallocated and are still under review.^b

Table 2 Forest condition

	PFE	Non-PFE	Total
	'000 ha		
Area of primary forest	-	-	79 000
Area of degraded primary forest	-	-	17 000
Area of secondary forest	-	-	13 000
Area of degraded forest land	-	-	3000

Source: Government of DRC (2009).

systems will undoubtedly play an important role in reducing vulnerability to the negative effects of climate change.

SFM policy framework

Forest tenure. According to Law 021/1973, the state is the sole owner of land, and this is confirmed by Law 11/2002 (the 'Forest Code') (Table 3). Although the state owns the forests, the law details different procedures for its use by local people and concessionaires (de Wasseige et al. 2009). Local users may collect forest products within the framework of user rights. In protected forests they may also practice shifting cultivation, although a permit issued by the provincial governor is required to clear an area of more than two hectares (de Wasseige et al. 2009). Communities and municipalities have customary rights over the forests within their jurisdictions and are able to become long-term concession-holders of such forests. The state can also allocate forests to local communities as community forests, although there are no clear examples of this having occurred.^b

Criteria and indicators. In December 2010, DRC, with the support of WWF and ITTO, completed a process to develop PCI based on the ATO/ITTO PCI for the sustainable management of African natural tropical forests as an instrument for monitoring progress towards SFM. An ITTO C&I workshop was held in August 2010. The Government of DRC used the ITTO C&I in its submission to ITTO for this report.^a

Forest policy and legislation. The 2002 Forest Code, which succeeded colonial legislation dating from 1949, became law in August 2002. DRC's new Constitution (2006) reorganized the country's

administrative structure. Twenty-five provinces and the town of Kinshasa are provided with legal status and are able to exercise local authority. Designing forest-sector activities of national interest (e.g. forest conservation) remains the responsibility of the national government, but the design of natural resource programs, including forestry, agriculture and mining, are now the responsibility of the provinces. Given that the Forest Code was approved prior to the approval of the Constitution, the effect of the new decentralized entities, or of planned future decentralized entities (sectors and chiefdoms in the forest sector), on governance in the forest sector is unclear. The extent to which these entities are able to represent local interests will be crucial for the implementation of SFM (Government of DRC 2010).

The Forest Code describes the institutions and responsibilities regarding forest management and lays down prescriptions for national forest planning and forest management. For example, it devotes an entire chapter to forest management and another to local community rights. It alludes to the concept of community forests, but there are no procedures to put this into effect. A difficulty with the application of the Forest Code is the fact that customary rights are exercised by local people who do not know its provisions; this results in frequent conflicts between concessionaires and local stakeholders.^b

Institutions involved in forests. The Ministry of Environment, Nature Conservation and Tourism (*Ministère de l'Environnement, Conservation de la Nature et du Tourisme – MECNT*) is in charge of forests and employs about 840 people. Structural reform undertaken in 2009 reduced the number of technical services from 24 to twelve.^a They include

Table 3 Forest area, by tenure

Ownership category	Total area	Of which PFE	Notes
	'000 ha		
State ownership (national, state or provincial government)	112 000	38 200	According to the 2002 Forest Code, all forests belong to the state.
Other public entities (e.g. villages, municipalities)	-	-	The law makes provision for community and municipal forests, but no data are available.
Total public	112 000	38 200	
Owned by local communities and/or Indigenous groups	-	-	
Private owned by individuals, firms, other corporate	-	8	Some small forest plantations – e.g. the CDM-funded plantation in Batéké.

Source: Government of DRC (2009).

the Directorate of Forest Management (*Direction de la Gestion Forestière*), which is responsible for monitoring forest management and harvesting, the *Direction des Inventaires et de l'Aménagement Forestier*, which is responsible for forest inventories and the formulation of management norms, and the *Direction de la Conservation de la Nature*, which is responsible for biodiversity conservation and international conventions.^a Also under the MECNT is the Congolese Institute for the Conservation of Nature (*Institut Congolais pour la Conservation de la Nature – ICCN*), which has the overall task of ensuring the protection of wildlife and flora in natural reserves and national parks; ICCN employs more than 2000 people.^a Nevertheless, the lack of trained and motivated staff to manage and regulate forests is a crucial bottleneck in building an effective institutional framework for SFM.^a

The main training institutions with forestry curricula are the University of Kisangani, *l'Institut Supérieur d'Etudes Agronomiques* (in Bengamissa) and the University of Kinshasa. There is a research institute for forest research, *l'Institut pour l'Etude et la Recherche Agronomique*, which was established in 1948. Today, several hundred NGOs and associations are involved in forest-related activities. The forest-management reform process is particularly supported by DRC's development partners, such as the European Union, a number of European states, the African Development Bank, the Global Environment Facility, the United Nations Development Programme and UNEP-WCMC. Some multinational NGOs, including Conservation International, the Wildlife Conservation Society and WWF, have also been engaged in the process, as well as in forest conservation. The National Forest and Nature Conservation Programme was launched in 2009 by a coalition of development partners, including the World Bank, to increase the capacity of government and other stakeholders to manage forests sustainably and equitably. The SGS (formerly, *Société Générale de Surveillance*) Forestry Monitoring Programme signed a five-year contract with MECNT in early 2010 to develop an integrated forest control system for monitoring and verifying logging, chain-of-custody and forest product exports.

Status of forest management

Forest for production

Being relatively accessible, the western forests have been logged heavily since colonial times. More recently, harvesting has moved into the central basin, where subsistence agriculture accompanies the opening up of forests. Farther inland, outside concession areas, forest harvesting mainly consists of the often illegal removal of trees of the most profitable species. According to the 2002 Forest Code, industrial forest concessions are awarded by tender (Article 83) or sometimes by mutual agreement (Article 86). Concessions may be allocated for 25 years and are renewable. The maximum area of a forest concession is 500 000 hectares. One requirement of the Forest Code is the preparation of forest management plans. For these, technical standards on inventories, mapping, low impact logging, silviculture and consultation, among others, have been and are being prepared through ordinances and decrees, with the technical and financial support of development partners.

In 2003 about 20 million hectares of the 22.5 million hectares of production PFE were allocated to commercial forest operations and there were plans that this area would be extended to 50 million hectares (ITTO 2006). In 2004, however, the Government of DRC issued a moratorium on new logging concessions and announced a review of the status of existing concessions in order to apply the environmental, forest management and social requirements that had been defined in the Forest Code. Between 2005 and 2009 a multi-stakeholder forest title conversion process and legal review was undertaken in order to convert old logging titles into new forest concessions. In 2009, of the initial 156 titles for which a request for conversion had been submitted to the DRC government, only 65 had been declared convertible by the Interministerial Commission, covering a total area of about 10 million hectares out of the 20 million hectares under review.^b The remaining titles were deemed illegal and subject to cancellation.^b This conversion process has set the groundwork for transparency, accountability and SFM in the DRC forest sector. Today, for the first time, complete information on logging titles is available publicly. Information on the progress, constraints, limitations and results of the entire forest titling process is also available in reports and on websites.^b

In mid 2010, 65 companies were operating with timber licences in an area of about 9.1 million hectares, the smallest concession covering 19 200 hectares and the largest 293 000 hectares.^b In 2009, 46 FMUs covering about 6.6 million hectares were preparing fully fledged management plans (de Wasseige et al. 2009). Nearly all timber exports are produced by only ten companies; two Swiss-based holdings (Danzer and North-South Timber Group) are responsible for two-thirds of production.

Silviculture and species selection. The only silvicultural prescriptions contained in the Forest Code (2002) are the determination of a minimum harvesting diameter by species, and specific requirements for certain timber species, including the preservation of seed trees. DRC's forests have an enormous diversity of tree species. The total number of commercial tree species is more than 200, of which about 25 are sold internationally. The five most important commercial timbers over the past few years are shown in Table 4. Other important species include *Chlorophora excelsa* (kambala, iroko), *Gambeya africana* (longhi), *Entandrophragma angolense* (tiama), *Entandrophragma candollei* (kossipo), *Guarea cedrata* (bossé), *Guibourtia* spp (benge), *Lovoa trichilioides* (dibetou), *Brachystegia* spp (bomanga), *Canarium schweinfurthii* (aiele), *Terminalia superba* (limba) and *Nauclea diderrichii* (bilinga).

Planted forest and trees outside the forest. Planted forests have been established to produce both timber and fuelwood and to protect land from erosion. The Government of DRC estimated the area of planted forest at 67 000 hectares, including about 8000 hectares of *Acacia auriculiformis* established in the late 1980s.^a *Terminalia superba* (limba) was once the main species used in plantations, the first of which were established in 1905. Agroforestry plantations (*taungya*) were introduced in the 1940s and are still widespread. Other species planted for industrial

wood production before the 1960s include *Ceiba pentandra*, *Bombax flammeum*, *Entandrophragma* spp, *Lovoa trichilioides*, *Eucalyptus* spp, *Grevillea robusta*, *Casuarina equisetifolia* and *Cupressus* spp. More recent plantations comprise fast-growing *Eucalyptus* and *Acacia* species. A new plantation area is being established under the Clean Development Mechanism (CDM) and under community forestry regimes. About 2500 hectares have been established under these schemes in the past three years; the objective is to establish 8000 hectares of community forest plantations by the end of 2012.^a Given the size of the country and its huge natural-forest resource, the development of planted forests is a low priority.

Forest certification. No forests have been certified in DRC (e.g. FSC 2010), but some foreign companies are undertaking baseline studies for certification. One company (SIFORCO) obtained a certificate of legality in 2007. Another company, Sodefor, recently went through an FSC pre-audit process. The Government of DRC participated in an ATO working group on an African certification scheme, and DRC is a candidate country for a VPA with the European Union.

Estimate of the area of forest sustainably managed for production. While some progress has been made towards SFM, no forest concession can yet be classified as sustainably managed. The status of three forest sites dedicated to forest research and education (totaling 284 000 hectares) and listed as sustainably managed in 2005 could not be verified in 2010 (Table 5).

Timber production and trade. Total estimated annual roundwood production is about 80 million m³ (FAO 2010a), the vast majority of it fuelwood. The timber resources of DRC are generally considered to be of low quality. Most forests are difficult to access and thus productivity is low relative to neighbouring Congo and Gabon.

Table 4 Commonly harvested species for industrial roundwood

Species	Notes
<i>Entandrophragma cylindricum</i> (sapelli)*	About 20% of total production (2006–08).
<i>Millettia laurentii</i> (wengé)*	Around 50 000 m ³ per year; about 15% of the total production.
<i>Pericopsis elata</i> (afromosia)	About 10% of total production.
<i>Entandrophragma utile</i> (sipo, lifaki)	About 10% of total production.
<i>Gossweilerodendron balsamiferum</i> (tola)*	About 8% of total production.

* Also listed in ITTO (2006).

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

Reporting year	Natural					Planted		
	Total	Available for harvesting	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
2005*	20 500	15 500	1080	0	284	55	40	0
2010	22 500	9100*	6590**	0	0	67	43	2†

* As reported in ITTO (2006).

** Management plans in advanced stage of preparation.

† CDM-certified (Batéké).

Average industrial timber production, produced by eleven concession-holders in the past three years, was approximately 300 000 m³ per year (up from 90 000 m³ in 2003); artisanal permits add another 25 000 m³ per year (de Wasseige et al. 2009). Timber produced by the informal sector for the local market and neighbouring countries is substantial, probably exceeding 2 million m³ per year.^b In 2009 DRC exported about 226 000 m³ of logs, compared with 101 000 m³ in 2004 (ITTO 2010). DRC produced 92 000 m³ of sawnwood in 2009 (of which 62 000 m³ were exported), up from 70 000 m³ in 2004. The European Union remains the main international timber market. The Asian market is increasing but still small.



Ayous in lowland forest, DRC.

Non-timber forest products. No statistics are kept on NTFP production and trade, with the exception of the collection of the bark of *Prunus africana*. NTFPs derived from closed forests are a cornerstone of the informal sector. Of particular importance is the production of charcoal and firewood and the collection of NTFPs for food (e.g. honey), medicinal use and as stimulants (e.g. cola).^a It is estimated that 90% of the population in DRC regularly uses one or more of the 500 medicinal plants growing in the forests of the Congo Basin.^a NTFPs are also used for construction (e.g. rattan, *Raphia* spp, *Elaeis guineensis*) and the wrapping of food (using *Fromomum* leaves). Bush meat is a major source of protein.

Forest carbon. Gibbs et al. (2007) estimated the national-level forest biomass carbon stock at 20 416–24 020 MtC, Eggleston et al. (2006) estimated it at 36 670 MtC and FAO (2010a) estimated it at 19 639 MtC. The total forest carbon stock, including all five forest carbon pools, has been estimated at 27 200–36 700 MtC (UN-REDD 2010). The REDD+ potential to 2030 has been estimated at about 20 MtCO₂e (about 5.4 MtC) for all forest-related activities (Aquino et al. 2010). The Government of DRC is actively engaged in the Forest Carbon Partnership Facility and UN-REDD processes and has benefited from ITTO assistance in this regard. In 2010 began implementing a national REDD+ strategy through a readiness preparation proposal. DRC has also been chosen by the Forest Investment Program as a pilot country for REDD+ investment. The country's REDD+ strategy includes activities with low opportunity costs, such as afforestation and reforestation, reducing demand for fuelwood, and improving subsistence farming (Aquino et al. 2010). A CDM community-based reforestation project is being implemented over an area of more

than 4000 hectares and an agreement for the sale of 2.4 MtCO₂ (0.6 MtC) over the next 30 years has been signed (Government of DRC 2010). Table 6 summarizes DRC's overall forest carbon potential.

Forest for protection

Soil and water. No specific measures to promote soil and water conservation in closed forest are in place, although the 2002 Forest Code cites the need to protect, among others, springs and streams and to conserve soils. Soil and water conservation is regulated by a 1958 decree. Some small plantations have been established for erosion control in the last 30 years (ITTO 2006).

Biological diversity. DRC has great biodiversity, at both the ecosystem (e.g. according to de Wasseige et al. 2009 there are 19 ecosystem types) and species levels. Of the more than 10 500 known species of plant in DRC, at least 1337 are considered endemic (de Wasseige et al. 2009). Forest inventories suggest that tree species number more than 700, and there are an estimated 415 mammal species and 1086 bird species (ITTO 2006). Twenty-three mammals, 20 birds, 14 amphibians, one reptile, two arthropods and 17 plants found in forests are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species (IUCN 2011). Although the country is large, poaching places enormous pressure on wildlife. Bush meat is in demand in rural and urban markets. The elephant population in the forest zone (numbering about 300 000 before 1980) had been reduced to less than 50 000 by 2000 (ITTO 2006). Eight plant species are listed in CITES Appendix I and 35 in Appendix II, including the tree species *Pericopsis elata* and *Prunus africana* (UNEP-WCMC 2011).

Protective measures in production forests. Article 48 of the 2002 Forest Code prohibits logging along streams and within 50 m of riverbanks and 100 m of springs. Measures have been described in new standards for forest management planning, which

include setting aside biodiversity conservation zones within forest concessions.^b

Extent of protected areas. The national objective is to reserve 15% of the national territory (about 35 million hectares) in protected areas.^a In 2010 the country had 14 integral nature reserves (IUCN category I), 14 national parks (IUCN category II) and 22 hunting reserves (IUCN category VI), totalling about 26.3 million hectares.^a Another 30% of the land area has high protective potential or potential as biological corridors.^a

Estimate of the area of forest sustainably managed for protection. Protected areas are generally without effective control, and encroachment, hunting for trophies and bush meat, and timber theft are widespread (ITTO 2006). None of the protected areas has an officially adopted management plan^a, with the exception of the Kahuzi-Biega park (600 000 hectares), where a management plan is being finalized. This park is located in eastern DRC and is one of the last refuges of the eastern lowland gorilla. Despite management efforts, it is likely that recent fighting in DRC has moved within the boundaries of the park, causing looting and forest fire.^b A management plan also exists for the Luki Biosphere Reserve (33 000 hectares), located 120 km from the Atlantic coast. However, this reserve is under heavy human pressure. None of the protection PFE, therefore, can be classified as sustainably managed (Table 7).

Socioeconomic aspects

Economic aspects. Recently the contribution of the forest sector to GDP has been about 1.4% or US\$100 million per year.^a Officially about 15 000 people derive their income from the forest sector. However, given the very large informal sector, the overall contribution of the forest sector to the national economy is likely much higher than suggested by official figures. The forest sector

Table 6 Forest carbon potential

Biomass forest carbon (MtC)	% forest with canopy cover >60%	Deforestation/ degradation potential to 2030	Enhancement of carbon sink capacity to 2030	Forest area change monitoring capacity	Forest/ GHG inventory capacity	Importance of forest fire/ biomass burning	Engagement in international REDD+ processes
20 416–24 020	66	++	++	+	+	++	+++

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

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

Reporting year	Protection PFE	Attributed to IUCN categories I-IV	Allocated for soil and water	With management plans	Sustainably managed
2005*	27 000	9320	-	-	0
2010	25 800	16 300	-	630	0

* As reported in ITTO (2006).

could become a pillar of economic development in DRC given a stable political and macroeconomic environment.^b

Livelihood values. Seventy percent of the people live in rural areas, the great majority of them on less than US\$1 per day (Aquino et al. 2010). Natural forests play a major role in the livelihoods of many people, in particular as a source of food and energy (ITTO 2006).

Social relations. The 2002 Forest Code (articles 111–113) requires that the local population be consulted before any area is awarded as a concession or given protected status. The local population also has the right to be compensated through specific arrangements with concession-holders (through a *cahier de charge*).^a However, the Code does not address local rights governing the use of forest resources. There is widespread frustration among rural communities because forest concessions generally only benefit local leaders, who often do not share the benefits with the wider community (ITTO 2006). On the other hand, in remote areas in particular, forest concessions are sometimes the only providers of primary-school education and health care, and forest roads have improved access to many remote villages (ITTO 2006).

Summary

DRC has the potential to develop its forest economy, both through a timber industry based on a sustainable resource base and through conservation. Although notable progress has been made in recent years, civil conflicts make it difficult to realize this potential. The institutional reform process is in its early stages and the legal framework – including the decentralization process – needs to be further developed and harmonized. Despite its large forest resource and considerable human resources, DRC is the smallest timber exporter in the region and the country has limited capacity to add value to its enormous forest resources. SFM has not yet been achieved on the ground, although management plans have been developed for some

forests in the production and protection PFE. DRC has become engaged in the development of a national REDD+ mechanism.

Key points

- DRC has more than 112 million hectares of closed tropical forests and a relatively low level of conversion of forest to other uses. The forest sector, however, is in disarray as the country emerges from civil conflicts. Structural and social adjustment is ongoing, with considerable effects on the development of the forest sector.
- DRC has an estimated 48.3 million hectares of PFE, comprising 22.5 million hectares of production PFE (compared with 20.5 million hectares in 2005) and 25.8 million hectares of protection PFE (compared with 27.0 million hectares in 2005). The PFE could be substantially increased once land-use planning is undertaken in the various provinces.
- None of the natural-forest production PFE is being managed sustainably, although some progress has been made in the establishment of forest management plans. Of the 9.1 million hectares of allocated forest concessions in 2010, about 6.59 million hectares have been subject to detailed forest management planning. No protection PFE is considered to be under SFM.
- Although not under formal management, large areas of DRC's forests are currently under no threat from deforestation or other significant human-induced disturbance due to their remoteness.
- The increased engagement of the international community and of civil society in the country has improved transparency and accountability and also brought knowledge and monitoring technology to the forest sector. The difficulty is translating reform proposals in the field due to a lack of capacity and an effective decentralized governance structure.

- The volume of timber harvested in DRC is only a tiny fraction of the potential sustainable yield, even accounting for likely significant levels of illegal logging.

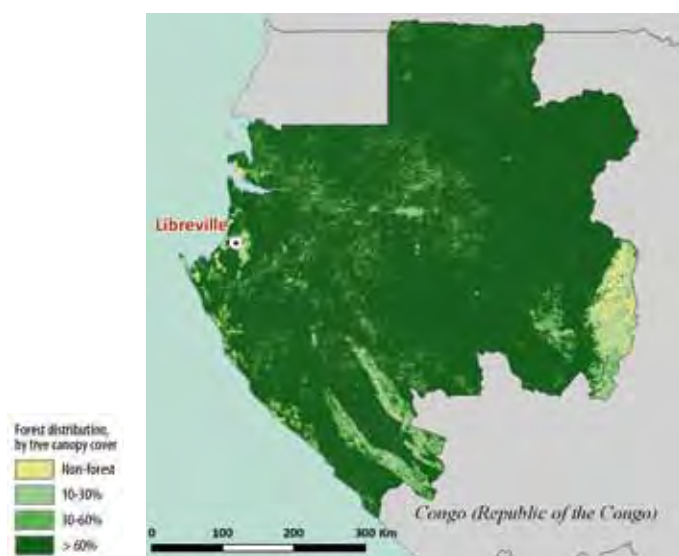
Endnotes

- a Government of DRC (2009).
- b Information derived from the report of, and discussions with participants at, a training workshop on ITTO criteria and indicators, held 15-19 August 2010, Kinshasa, attended by representatives of government, civil society and the private sector.

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GABON



Forest resources

Gabon has a land area of 26.8 million hectares and an estimated population in 2010 of 1.5 million people (United Nations Population Division 2010). It is ranked 103rd out of 182 countries in UNDP's Human Development Index (UNDP 2009). The country is in the western part of the Congo Basin and is characterized by three biogeographic regions: a coastal sedimentary basin containing forest and savanna; a medium-altitude Precambrian plateau (averaging 600 m above sea level), which covers about two-thirds of the country and is largely forested apart from savanna in the east; and almost entirely forested granite massifs in the north and south – Cristal Mountains, Mayombe and Chaillu – where altitudes range between 800 m and 1000 m. FAO (2010) estimated Gabon's total forest area at 21.7 million hectares, which is nearly 85% of the land area, and de Wasseige et al. (2009) estimated

it at about 24.6 million hectares. Gabon has an estimated 160 000 hectares of mangroves (Spalding et al. 2010).

Forest types. There are three major forest types: evergreen rainforest in the west, which has been heavily harvested, degraded and in some areas reduced to secondary forest characterized by an abundance of *Aucoumea klaineana* (okoumé) and *Dacryodes buettneri* (ozigo); the central Gabonese forest, covering most of the country, which is very similar to the closed humid forest found elsewhere in the Congo Basin and also in Liberia, with many of the same tree species (e.g. *Canarium schweinfurthii* – aiélé, *Lophira alata* – azobé, *Entandrophragma* spp, *Khaya* spp and *Triplochiton scleroxylon* – ayous); and a semi-deciduous forest type in the northeast, characterized by a predominance of Maranthaceae in the sub-layer and trees such as *Terminalia superba* (limba), *Millettia laurentii* (wengé) and ayous.

Permanent forest estate. The PFE is estimated at 13.5 million hectares (Table 1).^a

Forest ecosystem health

Deforestation and forest degradation. With a low overall population density and 60% of the population living in urban areas, there is little anthropogenic pressure on Gabon's forests. The Government of Gabon (2008) indicated an average annual deforestation rate of 0.12% (about 10 000 hectares per year) and an average degradation rate of 0.09%, based on satellite coverage between 1990 and 2000. Most of the forest estate is still composed of primary forest (Table 2). The main causes of deforestation are small-scale agriculture established

Table 1 Permanent forest estate

Reporting year	Estimated total forest area, range (million ha)	Total closed natural forest ('000 ha)	PFE ('000 hectares)			
			Production		Protection	Total
			Natural	Planted		
2005*	25.8	21 800	10 600	25	2700	13 325
2010	21.8–24.6	18 700	10 600^a	25^a	2900	13 525

* As reported in ITTO (2006).

Table 2 Forest condition

	PFE	Non-PFE	Total
	'000 ha		
Area of primary forest	-	-	20 400
Area of secondary forest and degraded primary forest	-	-	4200
Area of degraded forest land*	-	-	-

Source: ITTO estimate.

along the roadways and urban development. The main causes of forest degradation are industrial mining and illegal logging in opened-up areas.

Vulnerability of forests to climate change. Given its low population density and large forest area, Gabon is less vulnerable to climate change than many other countries in Africa. The mean annual temperature has increased by 0.6 °C since 1960, an average rate of 0.14 °C per decade. Model projections all indicate increases in the frequency of 'hot' days and nights (McSweeney et al. undated). Mean annual rainfall has decreased at an average rate of 3.8 mm per month (2.6%) per decade since 1960. All models indicate a considerable decrease in rainfall over the next 50 years (ibid.).

SFM policy framework

Forest tenure. All forest is owned by the state (Table 3). The 2001 Forest Code divides forests into two distinct categories. The first includes the production PFE managed by private concessionaires and the protection PFE managed directly by the state. The second, the non-PFE, known as the *domaine rural*, includes open-access forests for hunting, agriculture, mining and the gathering of NTFPs; sacred forests; and community protected areas (generally land and forest for which usage rights are limited to local communities). Rural communities and forest-dwellers are free to exercise

their customary rights in the *domaine rural*, provided they respect all conditions imposed by the forest administration. The production PFE is exclusively owned and administered by the state.

Criteria and indicators. Gabon finalized its own set of PCI in 2006 on the basis of the ATO/ITTO PCI for the sustainable management of African natural tropical forests. Since then Gabon has worked to develop a country-wide certification system and has harmonized its PCI with the standards set by the Program for Endorsement of Forest Certification schemes (PEFC). The orientation of the timber sector towards export markets, particularly environmentally sensitive European markets, helps to explain interest in certification.

Forest policy and legislation. Forest and wildlife management are governed by the Forest Code (Law 16/01), which was enacted in December 2001. The Code contains two major elements: SFM, and forest industry development (including the allocation of forest concessions and fiscal aspects). It also provides for the creation of community forests (Article 156). A 2008 decree (011/PR08) modified certain elements of the Forest Code, including the abolishment of the monopoly of the state-owned *Société Nationale des Bois du Gabon* (SNBG), the commercialization of okoumé and ozigo and the process for the allocation of forest permits. Other

Table 3 Forest area, by tenure

Ownership category	Total area	Of which PFE	Notes
	'000 ha		
State ownership (national, state or provincial government)	13 500	13 500	Production and protection PFE.
Other public entities (e.g. municipalities, villages)	8300	0	Area owned by the state, but with extended user rights (non-PFE, <i>domaine rural</i>).
Total public	21 800	13 500	
Owned by local communities and/or Indigenous groups	-	-	Could include sacred forests, but their extent is unknown.
Private owned by individuals, firms, other corporate	-	-	Some small plantations, community or privately owned, but no data are available on their extent.

Source: Government of Gabon (2009).

important legal texts are the 1993 Environment Law (Law 16/93), the Mining Code (Law 05/2000) and the land-ownership regime, which dates back to 1963 (Law 15/63). A law approved in 2007 (Law 003/2007) governs the management of national parks.

Gabon's forest policy was adopted in May 1996. It focuses on maximizing the economic contribution of forests while ensuring a lasting resource base through the implementation of forest management programs and national capacity-building. Phase 1 of the policy (1998–2002) focused on the preparation of forest management plans and the establishment of sustainable management standards. Phase 2 (2002–10) focuses on the nationwide implementation of the plans. The initial aim to have 4 million hectares under management plans by 2010 was almost achieved; there is a further aim that 5 million hectares will be under SFM by 2025. Under the forest policy the government also plans to have a total of 200 000 hectares of private-sector and state-managed plantations by 2025.

Institutions involved in forests. The Ministry of Water and Forests (*Ministère des Eaux et Forêts* – MEF) was created in January 2011 with a mission to develop and implement the government's policy on fisheries, forests, wildlife and protected areas (excluding national parks, which are managed by a separate agency). The ministry in charge of forests has changed several times in the last three years, from the Ministry for Forest Economy, Inland Waters and Fisheries in Charge of the Environment and National Parks (*Ministère de l'Économie Forestière, des Eaux, de la Pêche, Chargé de l'Environnement et des Parc Nationales*), to the Ministry for Forest Economy, Inland Waters, Fisheries and Aquaculture (*Ministère de l'Économie Forestière, des Eaux, de la Pêche et de l'Aquaculture*), to the Ministry of Inland Waters, Forests, Environment and Sustainable Development (*Ministère des Eaux et Forêts, de l'Environnement et du Développement Durable*).

MEF has four technical directorates: the General Directorate of Forestry (*Direction Générale des Forêts*); the General Directorate for Wildlife and Protected Areas (*Direction Générale de la Faune et des Aires Protégées*); the General Directorate for Aquatic Ecosystems (*Direction Générale des Écosystèmes Aquatiques*); and the General Directorate of Forest Industries, Timber Trade and Value Addition of Forest Products (*Direction Générale des*

Industries, du Commerce du Bois et de la Valorisation des Produits Forestiers). At time of publication the Cabinet was considering a restructure of the MEF, including a possible reduction in the number of directorates to three.

The Ministry of Environment, Sustainable Development and Nature Protection, Prevention and Management of Natural Disasters (*Ministère de l'Environnement, du Développement Durable et de la Protection de la Nature, Prévention et Gestion des Calamités Naturelles*) is in charge of the development of REDD+. In 2007 the Agency for National Parks (*Agence Nationale des Parcs Nationaux* – ANPN) was created to manage protected areas under the Ministry of Tourism and National Parks.

Besides the technical agencies, a number of other actors are involved in the development of SFM, including the state timber enterprise, SNBG, which is now under MEF and which, until recently, had a monopoly over the export of logs of the two main species, okoumé and ozigo. There are five research institutions dealing with forest-related issues and one forest training institute, *Ecole Nationale des Eaux et Forêt*; the later operates under the auspices of MEF. International development partners (the European Union, the French Development Agency – *Agence Française de Développement*, and USAID) are strong supporters of Gabon's forest reform agenda, as are international environmental NGOs such as the Wildlife Conservation Society, WWF and the World Resources Institute, and national civil-society organizations such as Brainforest and *Croissance Saine*. The Government of Gabon is an active member of COMIFAC; it also has an agreement with Global Forest Watch to support the monitoring of illegal logging in the country.^a

Status of forest management

Forest for production

In the production PFE, all concessionaires must, within three years of allocation, submit a forest management plan that includes timber and wildlife management and socioeconomic studies. It must also include consultation between concessionaires, the forest administration and local people. Two types of management permits are issued:

- Forest concession under SFM (*concession forestière sous aménagement durable* – CFAD),

which has a minimum size of 50 000 hectares and a maximum size of 600 000 hectares. A CFAD must have a forest management plan and an industrialization plan and is awarded through auction.

- Associated forest permit (*permis forestier associé* – PFA), which is also awarded by auction but is reserved exclusively for Gabonese nationals. A PFA can be integrated into an existing CFAD or managed on its own as a concession. The minimum size is 15 000 hectares and the maximum size is 50 000 hectares.

Under the 2001 Forest Code, forest in the *domain rural* (non-PFE) may be set aside as community forests. Community forests should be managed for timber and NTFPs according to a simplified forest management plan developed with support from the DGF. The community must prepare supply contracts with local processing companies (de Wasseige et al. 2009). Cutting permits are also available to Gabonese nationals in the non-PFE for up to 50 trees.

The forest area open to timber harvesting has been divided into three zones. The first comprises the coastal plains and is rich in okoumé and characterized by relatively easy transport. Most of this zone has been harvested 1–3 times since the end of the 19th century (ITTO 2006). The second zone is less rich in okoumé and access is more difficult. It has now been almost completely harvested for the first time (ibid.), facilitated by the establishment of the *Transgabonais*, the railway that has granted access to a large part of the centre and east of the country. Still less okoumé is found in the forests of the third zone, where the species reaches the limits of its distribution.

There has been a significant increase in the area of forest allocated for production since 2005, including apparently outside the PFE. In March 2009, 48 concession areas were leased over a total area of 10.3 million hectares and another 212 other permits were also active over an area of about 3 million hectares.^a In 2010 an estimated 6.27 million hectares of production forests were active as industrial timber production areas^a, up from 4.55 million hectares in 2002 (ITTO 2006). In 2002 about 1.46 million hectares of forest were covered by forest management plans (ibid.) but, in March 2009, 4.14 million hectares had been inventoried and about 3.45 million hectares had fully developed



An example of limba in production forest, Gabon.

and approved management plans.^a As of 2009, ten foreign operators had the lion share of industrial concessions in Gabon – they were from Europe (France, Italy and Portugal), Asia (China, India and Malaysia) and Lebanon. World Resources Institute (2009) contains a detailed analysis of the forest concessions in Gabon.

Silviculture and species selection. Timber harvesting is selective and focuses on high-value species. At present, only 4–5 m³ is extracted, on average, per hectare. In the first and second harvesting zones this is due to previous overcutting of okoumé; in the third, high transport costs mean it is only economically viable to harvest the most valuable tree species. Table 4 shows the five most harvested species in the past few years. Ayous, *Testulea gabonensis* (izombe), *Guibourtia demeusei* (kevazingo), *Piptadeniastrum africanum* (dabéma) and *Baillonella toxiperma* (moabi) are among a number of species that are being harvested in increasingly large volumes. It is anticipated that the number of species acceptable to international markets will continue to increase from the current 20 or so to 35–40 species in coming years.^a

The gross standing volume of trees with diameter at breast height (dbh) greater than 10 cm is estimated at 250 m³ per hectare in unexploited forest and

Table 4 Commonly harvested species for industrial roundwood

Species	Notes
<i>Aucoumea klaineana</i> (okoumé)*	Average annual production of about 939 000 m ³ (2006–08).
<i>Triplochiton scleroxylon</i> (ayous)	Up to 40 000 m ³ produced annually on average (2006–08).
<i>Cyclodiscus gabunensis</i> (okan)	More than 20 000 m ³ produced annually.
<i>Distemonanthus benthamianus</i> (movingui)	Nearly 20 000 m ³ produced annually.
<i>Dacryodes buettneri</i> (ozigo)*	Production is declining, to less than 15 000 m ³ annually.

* Also listed in ITTO (2006).

Source: Government of Gabon (2009).

220 m³ per hectare in logged-over forest (ITTO 2006). The commercial standing volumes are 55 m³ per hectare and 42 m³ per hectare, respectively.

Generally, forest resources can be divided into two main categories: forests with okoumé and ozigo, which regenerate well, and forests without large amounts of those two species. In its range, okoumé is the predominant species, with an average standing volume of about 10 m³ per hectare. A specific silvicultural system is applied in okoumé forests, the *méthode okoumé*, based on favouring natural regeneration and continuous thinning until there are 80 stems per hectare with a dbh of over 70 cm. Gabonese forests regenerate well and, if management prescriptions are followed, they will maintain their productive value over several rotations (Drouineau & Nasi 1999).

While the number of hardwood species being used by industry is increasing, to a large extent the financial viability of SFM is based on the high quantity and quality of okoumé. The appropriate silvicultural management of okoumé forest is therefore important for ensuring the continued abundance of this species because it is the backbone of Gabon's forest development. There are signs, however, that silvicultural treatments are not being conducted to the full extent needed (de Wasseige et al. 2009).

Planted forest and trees outside the forest.

Planted forests cover about 25 000–30 000 hectares (Government of Gabon 2009; de Wasseige et al. 2009). The government plans to increase the area of planted state forest to 100 000 hectares and to promote the establishment of an additional 100 000 hectares of private plantations, but planting rates are presently minimal.^a Agro-industrial plantations include about 11 000 hectares of rubber and some small plots of oil palm and coconut (ITTO 2006). Reforestation and enrichment planting are generally not undertaken in logged-over forests due to the

relative ease of natural regeneration (ibid.). Existing plantations are mainly on former natural-forest sites and consist primarily of okoumé and, to a limited extent, *Terminalia superba* (limba). There are also some plantations of pines and clonal eucalypts (ibid.).

Forest certification. After more than five years of intensive work, the Gabonese Pan African Forest Certification Scheme (*Système Panafricain de Certification Forestière*) was endorsed for a period of three years by the PEFC Council in April 2009. This first-ever approved African national standard provides buyers with evidence that the timber they buy was harvested in well-managed forests. In addition to this overall national approach to forest certification, as of June 2010 six forest concessions, covering a total area of 1.874 million hectares, were certified under the FSC (some of them also had ISO 14001 and Keurhout certificates). A FLEGT process is under way in Gabon and the Government of Gabon has shown interest in developing a VPA with the European Union.^a

Estimate of the area of forest sustainably managed for production.

The entire FSC-certified forest area of 1.8 million hectares and two additional forest concessions that are in a process of forest management certification and have TLTV certificates covering an area of about 622 000 hectares (de Wasseige et al. 2009) are counted in Table 5 as under SFM.

Timber production and trade. The total standing timber volume (dbh >10 cm) is estimated at 2.60 billion m³ and the possible sustainable annual yield of potentially marketable timber species is an estimated 12–15 million m³ (ITTO 2006). An estimated 3.4 million m³ of industrial logs were harvested in 2009, similar to the 3.5 million m³ estimated to have been produced in 2004 (ITTO 2010). Note that okoumé accounted for nearly 30% of total production.

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

Reporting year	Natural					Planted		
	Total	Available for harvesting	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
2005*	10 600	6923	2310	1480	1480	25	10	0
2010	10 600	10 300	3450**^a	1870	2420	25	10	0

* As reported in ITTO (2006).

** Comprising only areas with approved management plans in March 2009.

An estimated 1.87 million m³ of logs were exported in 2009, up from 1.51 million m³ in 2004; 157 000 m³ (roundwood equivalent) were exported as sawnwood in 2009, up from 124 000 m³ in 2004. The log market for okoumé and ozinga is mainly oriented towards Asia, while dark hardwood species are often exported to Europe. In 2009 Gabon was the second-largest exporter of tropical hardwood logs (after Malaysia), Central Africa's largest timber producer and the world's largest supplier of okoumé. However, the Government of Gabon issued a ban on unprocessed timber exports in January 2010 to encourage value-adding to timber products. In mid 2008, Gabon had 48 operating sawmill facilities, nine peeling units and three plywood plants with a potential annual processing capacity of about 1.7 million m³ of logs (de Wasseige et al. 2009), about half of total production.

Non-timber forest products. As in the other countries of the Congo Basin, many foodstuffs, including bush meat, roots, fruits, leaves and nuts, as well as medicinal plants and condiments, are collected in forests. They are an integral part of the subsistence of local people and some, such as the fruits of *Irvingia*, lianas of *Gnetum*, and plants and nuts of *Garcinia* species, are also marketed at the national level. Bamboo and fibres such as Marantaceae (rattan), raphia and the leaves of *Borassus aethiopum* (rônier) are important products

that are also traded regionally. Trade data on NTFPs were unavailable for this report. Charcoal-making supplies a small but efficient informal market (ITTO 2006). NTFPs are mentioned in the 2001 Forest Code and forest management plans must include information on the potential of NTFPs in concession areas.

Forest carbon. Gibbs et al. (2007) estimated the national-level forest biomass carbon stock at 3063–4114 MtC, Eggleston et al. (2006) estimated it at 4742 MtC and FAO (2010) estimated it at 2710 MtC. de Wasseige et al. (2009), taking into account all five carbon pools, estimated the forest carbon stock at about 4300 MtC. Gabon was one of the founding members of the Forest Carbon Partnership Facility and submitted a readiness idea note in 2008; by mid 2010, however, there had been no progress on a readiness preparation proposal. As laid out in Government of Gabon (2008), the government's REDD strategy includes the pursuit of sound land-use management and intensive agricultural production, including agroforestry; the strengthening of sustainably managed production forests; and the conservation of forests through effective protective-area management. The country's REDD+ potential lies particularly in the sustainable management of production and protection forests and conservation of the existing forest carbon stocks. Table 6 summarizes Gabon's forest carbon potential.

Table 6 Forest carbon potential

Biomass forest carbon (MtC)	% forest with canopy cover >60%	Deforestation/ degradation potential to 2030	Enhancement of carbon sink capacity to 2030	Forest area change monitoring capacity	Forest/ GHG inventory capacity	Importance of forest fire/ biomass burning	Engagement in international REDD+ processes
3063–4114	87	+	++	++	++	++	++

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

Forest for protection

Soil and water. No forests are set aside specifically to be managed primarily for the protection of soil and water.^a

Biological diversity. Gabon contains more than 6500 plant species, 320 mammal species and 617 bird species. Ten mammals, two birds, one reptile, three amphibians and 47 plants found in forests are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species (IUCN 2011). Seven plant species are listed in CITES Appendix II, none of which is a hardwood timber species (UNEP-WCMC 2011). Although Gabon is sparsely populated, some fauna species are under pressure in some areas due to an increasing demand for bush meat (ITTO 2006).

Protective measures in production forests. Under the 2001 Forest Code, forest management plans must include measures to protect soil, biodiversity and water resources in forest concession areas. Provisions designed to protect wildlife specify the zones where hunting is permitted and the length and dates of the hunting season. However, hunting is a major problem within and in the vicinity of forest concessions.^a

Extent of protected areas. Gabon has 13 national parks and a special presidential park, two hunting zones and wildlife reserves – most of them forested – covering about 2.9 million hectares.^a In mid 2009, four parks (Plateaux Batéké, Minkébé, Lopé and Moukalaba-Doudou) had provisional management plans.^a A National Biodiversity Observation Board was created in 2000 to support the implementation of the GEF-assisted National Strategy and Action Plan for Biodiversity (ITTO 2006). With the creation of the ANPN, the national park network has clearly been strengthened. More than 2.1 million hectares of forest are now in reserves classified in IUCN

categories I–IV, compared with 570 000 hectares in 2005. ITTO and WWF continue their joint work with the government to manage the Minkébé Forest Reserve, which together with the Minkébé National Park makes up an ITTO-supported transboundary conservation area linked to the Mengame protected area in Cameroon.

Estimate of the area of forest sustainably managed for protection. The total protection PFE under SFM is estimated at at least 1.23 million hectares (Table 7), comprising the ITTO-supported Minkébé National Park (750 000 hectares) and the Lopé National Park (484 000 hectares, part of which is savanna). These areas (which were also classified as sustainably managed in 2005) are considered to be managed and protected effectively, although poachers continue to be a threat to these and other protected areas.

Socioeconomic aspects

Economic aspects. National resource use, including oil extraction, timber harvesting and mining, is the cornerstone of Gabon's economy (de Wasseige et al. 2009). Oil alone generates 42% of GDP, followed by timber (about 6% of GDP^a). The forest sector is the primary employer in the private sector with about 13 000 employees, not counting the informal sector.^a The forest service itself employs about 600 officers and support staff.^a

Livelihood values. Forests are the main source of subsistence for Indigenous peoples living in the forests of Gabon. The law stipulates that local people have free access to all forests as long as they possess appropriate customary rights and do not jeopardize the sustainability of the forest products they collect. Industrial forest management requires the consent of the local population.^a Bush meat and edible fruits such as aïéle, leaves of *Gnetum* species, and nuts and roots (igname) are of great importance for forest-dependent local communities, particularly

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

Reporting year	Protection PFE	Attributed to IUCN categories I–IV	Allocated for soil and water	With management plans	Sustainably managed
2005*	2700	570	0	491	1090
2010	2900	2191**	0	1230[‡]	1230[†]

* As reported in ITTO (2006).

** UNEP-WCMC (2010).

‡ Provisional management plans.

† Pertains to the same two national parks considered under SFM in 2005, but new data (World Resources Institute 2009) suggest a slightly larger park area.

Pygmies. Bush-meat availability may be threatened locally because of over-hunting.

Social relations. The community forests allowed under the 2001 Forest Code replace the former ‘family logging’ rights. The Forest Code specifies that there should be a zone around each production forest to accommodate the customary rights of surrounding communities. While a memorandum (*lettre de politique*) of forest policy published by the government in May 2004 indicated an intention to increase the future role of local users in community forest management, little progress has been made in the last five years to introduce community forest management.

Summary

Undeniable progress has been made in Gabon towards SFM. The government continues to improve its legal and institutional framework to regulate and monitor production forests and to effectively manage protected areas. The 2001 Forest Code is complemented by additional regulations and field-based actions, including an improved forest monitoring system. Principles, criteria and indicators have been formulated and adapted to the conditions in Gabon and voluntary forest-management certification is well-developed. Forestry will remain one of the pillars of Gabon’s economic and social development. Based on clear policy measures from the government, the private sector is a major driver of industrial forest development and the export of semi-finished forest products. The government has introduced a system to institutionalize community forestry as a way of meeting local needs for timber and other forest products, although this system is yet to be implemented. The country is engaged in REDD+ processes, and it has a low deforestation rate. Problems remain, mainly in governance; for example, there is little civil advocacy and few participatory processes in the forest sector.

Key points

- Gabon has a large forest resource with a relatively low risk of conversion to other uses.
- Gabon has an estimated PFE of 13.5 million hectares (compared with 13.3 million hectares in 2005), comprising 10.6 million hectares of natural production forest (the same as in 2005), 2.90 million hectares of protection forest (compared with 2.70 million hectares in 2005) and 25 000 hectares of planted forest (the same as in 2005).
- An estimated 2.42 million hectares of the natural production PFE is under SFM, including 1.87 million hectares of certified forest. An estimated 1.23 million hectares of protection PFE is under SFM.
- Forest management plans are fully developed in 3.45 million hectares of forest in concessions and were under preparation for another 6 million hectares of forest in concessions. High standards for concession management have been developed on paper, but still need to be fully introduced on the ground.
- Gabon has the largest area of certified natural forests in Africa.
- The new national park network has great potential and an increased focus will need to be given to developing and implementing long-term management plans.
- Community forests may be created in the *domain rural*, but their development has been insignificant to date.
- Management for bush meat and other NTFPs is still largely uncontrolled, even though these issues must be addressed in forest management plans.

Endnote

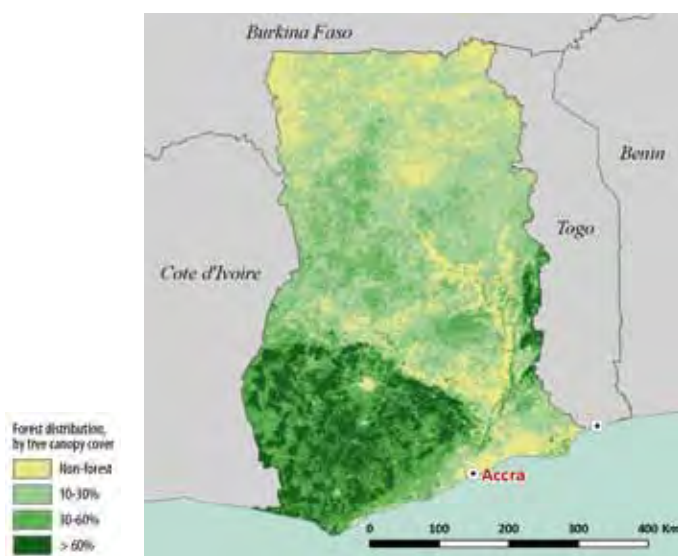
a Government of Gabon (2009).

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GHANA



Forest resources

Ghana is located on the west coast of Africa, bordered by Togo in the east, Côte d'Ivoire in the west, Burkina Faso in the north and the Atlantic Ocean in the south. It has a land area of 23.9 million hectares and in 2010 it had an estimated population of 24.3 million people (United Nations Population Division 2010). The country is ranked 152nd out of 182 countries in UNDP's Human Development Index (UNDP 2009).

Ecologically Ghana is divided into a high-forest zone in the south, accounting for about one-third of the land area (8 million hectares), a savanna zone (14.7 million hectares), mostly in the north, and a transition zone (1.1 million hectares). FAO (2010) estimated that Ghana had 4.68 million hectares of

natural forest in 2010, which is about 20% of the land area. Spalding et al. (2010) estimated the total area of (mostly degraded) mangroves at 13 700 hectares.

Forest types. The high forest zone is divided into nine forest types: wet evergreen; moist evergreen; moist semi-deciduous (southeast); moist semi-deciduous (northwest); dry semi-deciduous (inner zone); dry semi-deciduous fire zone; upland evergreen; southern marginal; and southern outlier.^a The semi-deciduous and evergreen forests constitute the main timber-producing areas. The main species in the semi-deciduous forests are *Triplochiton scleroxylon* (wawa), *Mansonia altissima* (mansonia), *Nesogordonia papaverifera* (danta) and *Khaya ivorensis* (mahogany); in the evergreen forests the main species are *Guarea cedrata* (guarea), *Tieghemella heckelii* (makore), *Tarrietia utilis* (niangon) and *Uapaca* spp (assam) (ITTO 2006). Box 1 shows Ghana's vegetation zones.

Permanent forest estate. Ghana's forests are divided into forest reserves and 'off-reserve' areas: of the 266 forest (production) reserves, 216 occur in the high-forest, timber-producing zone, and the remainder occur in the savanna. Forest reserves were originally established by the state to promote ecological stability while seeking to guarantee the flow of goods and services for socioeconomic development (Bird et al. 2006).

Ghana's PFE is estimated at 1.43 million hectares, which is the area of forest in forest reserves plus the area of planted forests and the area of forest in protected areas (Table 1). The total is 170 000 hectares less than that reported in 2005.

Table 1 Permanent forest estate

Reporting year	Estimated total natural forest area, range (million ha)	Total closed natural forest ('000 ha)	PFE ('000 hectares)			
			Production		Protection	Total
			Natural	Planted		
2005*	2.72–6.34	1634	1150	97	353	1600
2010	4.68	838**	774^a	164[‡]	396^a	1334

* As reported in ITTO (2006).

** Calculated using the ratio of forest with greater than 60% forest cover estimated by UNEP-WCMC (2010) (18%) and the estimated total natural forest area.

‡ FAO (2010) estimated the total planted forest estate at 260 000 hectares.

The area of protection PFE reported for 2010 is about 43 000 hectares more than the figure reported in 2005. With recent activities to revise and write new management plans for globally significant biodiversity areas (see below), some areas that were previously not demarcated or measured have now been demarcated, which might explain some of the increase.^b

Forest ecosystem health

Deforestation and forest degradation. The condition of Ghana's forests has been in decline for many years, particularly since the 1970s. Many forest reserves are heavily encroached and degraded, and the off-reserve stocks are being rapidly depleted. Immediate drivers include forest industry over-capacity; policy/market failures in the timber sector; burgeoning populations in both rural and urban areas; increasing local demand for agricultural and wood products; high demand for wood and forest products on the international market; heavy dependence on charcoal and woodfuel for rural and urban energy; and limited technological development in farming systems and continued reliance on cyclical slash-and-burn methods to maintain soil fertility (Forestry Commission 2010).

Deforestation in Ghana usually commences with the degradation of well-stocked forests by excessive (often illegal) logging, slash-and-burn agriculture, mining and quarrying, and fuelwood collection. Degraded forests are then often completely deforested by wildfire, illegal occupation and/or land-use changes. These destructive forces are influenced by population pressure and poverty and also by infrastructure and economic development programs. Road construction near or within forest reserves facilitates encroachment. Internal migration to the western forests for cash-crop cultivation accounts for the high rate of degradation in those forests. An estimated 395 000 hectares of primary forest remain in Ghana, but no estimates were available of the area of degraded primary forest, secondary forest or degraded forest land (Table 2). Almost

all forests have suffered depletion, creating eroded hillsides in some cases and destroying genetic diversity in others (ITTO 2006). FAO (2010) reported a change in natural forest area of 677 000 hectares between 2005 and 2010, an annual average loss of 135 000 hectares. An estimated 66 500 hectares of wet evergreen, moist evergreen and moist semi-deciduous forest (in the southwest) in the PFE were formally converted to agriculture in the most recent five-year reporting period.^a

Forest fires affect an estimated 500 000 hectares of forest per year, the majority (80%) of which are unplanned (FAO 2010). Excessive logging can make the forests more vulnerable to fire by causing the accumulation of residues, which become readily flammable when dry. Illegal forest activities, including the use of portable chainsaw mills, are widespread in the high-forest zone, particularly in off-reserve areas. The invasion of woody weeds affects an estimated 50 000 hectares.

Vulnerability of forests to climate change.

According to McSweeney et al. (undated), the average annual temperature in Ghana has increased by 1.0 °C since 1960, an average rate of 0.21 °C per decade; daily temperature data indicate that the frequency of 'hot' days has also increased significantly. The mean annual temperature is projected to increase by 1–3 °C by 2060 and by 1.5–5.2 °C by 2090. Rainfall trends are difficult to identify; rainfall was high in the 1960s but decreased to particularly low levels in the late 1970s and early 1980s, resulting in an overall decreasing trend (ibid.). According to the second communication to the UNFCCC (in preparation), two sectors are particularly vulnerable to the effects of climate change in Ghana: health, due to an increase in tropical diseases; and land management, due to reduced crop production, including cocoa and root crops, decreasing soil fertility and moisture, particularly in savanna areas, decreased freshwater availability, biodiversity loss, and coastal erosion. In the forest zone, a species' shift is occurring through a process of competitive

Table 2 Forest condition

	PFE	Non-PFE	Total
	'000 ha		
Area of primary forest	395 ^a	0	395
Area of degraded primary forest	-	-	-
Area of secondary forest	-	-	4285 ^a
Area of degraded forest land	-	-	-

displacement, which, with increased warming, deforestation and degradation, could be dramatic (Dixon et al. 1996).

SFM policy framework

Forest tenure. Land-tenure systems vary significantly from area to area in Ghana, with major regional differences between the north and south and between the Akan and related peoples of south and southwest Ghana and the neighbouring Ewe-speaking populations in the southeast. The territories of the Akan people largely coincide with the high-forest zone. Nearly all their land is under some form of ownership, and most lands in the Akan areas are under the authority of the chieftaincy (the 'stool'). This is a titular authority, conferring the right to tribute and, in appropriate instances, a share of land-based revenues. It is not a full proprietary interest (Government of Ghana 2008). Such lands may be managed directly by the stool, or by sub-chiefs and other 'captains' who, either by themselves or via their ancestors, have obtained a claim over particular blocks of land within their natal chieftaincies (ibid.). Some areas, including forest reserves, have been acquired by the government, though ultimately 'owned' by the chieftaincy; these are referred to as 'vested lands'.

Thus, in Ghana, forests are owned by communities vested in traditional authorities, held in trust for them by the state, and logged by private contractors; traditionally owned forest lands are known variously as 'stool land' or 'skin land'. However, both Government of Ghana (2010) and FAO (2010) report that forests are entirely in public ownership (Table 3), since they are 'held in trust' by the state. Ownership arrangements are also reflected in the Timber Resource Management Act,

1997, the 1998 Timber Resources Management Regulations, and the Forestry Commission Act, 1999 (Act 571). The Timber Resource Management (Amendment) Act, 2002 (Act 617), also recognizes private tree ownership rights.

Criteria and indicators. The Government of Ghana (2010) used the ITTO C&I in its submission to ITTO for this report. In September 2010, with the support of a regional ATO/ITTO project, Ghana finalized the harmonization process of its SFM standards according to the ATO/ITTO PCI for the sustainable management of African natural tropical forests. The ITTO C&I and the ATO/ITTO PCI are incorporated in the Forestry Commission's various forest-management manuals and guidelines, providing a cornerstone for natural forest management.

Forest policy and legislation. The first forest policy was established in 1947; this was revised in line with Ghana's 1992 Constitution and approved in 1994 as the Forest and Wildlife Policy. No significant changes have been made to forest laws, policies or regulations since the last report. However, the government is in a consultative process to review the Forest and Wildlife Policy and the 1996 Forestry Development Master Plan (which spans 1996–2020).

Two laws have been enacted recently by Parliament with potential implications for forests. These are the:

- Minerals and Mining Act, 2006 (Act 703), which may have a bearing on national objectives for forests and on the control of illegal activities in forests.
- Lands Commission Act, 2008 (Act 767), which established the Lands Commission to integrate,

Table 3 Forest area, by tenure

Ownership category	Total area	Of which PFE	Notes
	'000 ha		
State ownership (national, state or provincial government)	0	0	
Other public entities (e.g. municipalities, villages)	4680	1430	Forests are owned by communities vested in traditional authorities, held in trust for them by the state. They may be logged by private contractors.
Total public	4680	1430	
Owned by local communities and/or Indigenous groups	0	0	
Privately owned by individuals, firms, other corporate	0	0	

Source: Government of Ghana (2010), FAO (2010).

subject to the Constitution, the operations of public-service land institutions under the Commission in order to secure effective and efficient land administration and to provide for related matters. This Act may have implications for national forest objectives, forest tenure and property rights, and the control of illegal activities in forests.

The Government of Ghana listed 28 forest-related acts and decrees and 24 forest-related regulations, some of which overlap, duplicate or contradict.^a The fines for breaches of forest-related laws and regulations have not been reviewed for many years and are outdated. A single, consolidated forest law would be desirable, and the governance and control system needs to be reformed to improve its efficiency and effectiveness. There is a need for enabling legislation to provide for the voluntary establishment of dedicated off-reserve forests and to promote private-sector plantations.^a

Institutions involved in forests. The main institution in charge of forests is the Ministry of Lands and Forestry (MLF) supported by the Forestry Commission, which was established in 1980, and the Forestry Commission divisions of Forest Services, Wildlife, Timber Industry Development, Wood Industries Training Centre and Resource Management Support Centre. The Forestry Commission, which employs about 550 professional and technical forestry personnel, is responsible for coordinating, implementing and enforcing policies, laws and regulations for the development, management and regulation of the use of forest and wildlife resources.^a

The main institutions involved in forestry research are the Forestry Research Institute of Ghana (FORIG) under the Ministry of Environment, Science and Technology; the Renewable Natural Resources Institute of Ghana; and the University of Ghana. FORIG employs about 90 people.^a Overall, an estimated 3576 people were employed in public forest-related institutions in 2008, 51 of whom had university degrees, including 19 with doctorates (FAO 2010).

Community participation in forestry is being facilitated through community forest committees: the Forestry Commission aims to create 100 such committees.^a Active NGOs include Friends of the Earth Ghana (15 employees), the Ghana Association for the Conservation of Nature

(three employees), Green Earth (19 employees), and Tropenbos International (twelve employees).^a The Timber and Wood Workers Union of the Trade Union Congress of Ghana is also an important stakeholder. However, there are often problems of coordination between the trade union, NGOs and government forestry agencies (ITTO 2006).

Status of forest management

Forest for production

The 1994 Forests and Wildlife Policy abolished the existing concession system and replaced it with a new system intended to promote efficiency, transparency and accountability. Under the system there are two types of permits: competitive bidding and administrative permits.

- *Competitive bidding:* the allocation of forest resources through competitive-price bidding for timber rights is a fundamental feature of the 1994 Forest and Wildlife Policy, which calls for the “award of timber rights on the basis of competitive bidding and periodic audit of forest utilization operations to ensure compliance with forest management specifications and environmental protection standards”. The regulations governing competitive bidding for timber rights in the form of timber utilization contracts (TUCs) are outlined in the Timber Resource Management Act, 1997 (Act 547), as well as the accompanying Timber Resources Management Regulations (1998; LI 1649). Competitive bidding is mandatory in the awarding of all timber rights in the form of TUCs on both reserve and off-reserve areas. Under the competitive bidding framework, the allocation of TUCs is made on the basis of public bidding for rights to harvest timber in each area on the basis of an annual timber rights fee. TUCs for forest reserves have a term of 40 years, while TUCs for other lands have a term of five years.

All applications for the granting of timber rights are evaluated by the Timber Rights Evaluation Committee (TREC) to determine those entities that are pre-qualified for the granting of timber rights. All TUCs require parliamentary ratification and timber rights acquired under a TUC cannot be transferred without the written consent of the minister. All applications for such transfer should be evaluated by TREC.

- *Administrative permits*: there are two types of administrative permit
 - *Timber utilization permits*: timber may be allocated through timber utilization permits (TUPs; LI 1649). Based on an application by a district assembly, town committee, any rural community group or an NGO and subject to such conditions as the Forestry Commission may determine, the Forestry Commission may issue a TUP exclusively for harvesting a specified number of trees in an area of land not subject to a TUC. Any timber harvested or converted to lumber under a TUP may be used only for social or community purposes and may not be sold or exchanged. Thus, any timber harvested for commercial purposes that was allocated under a TUP does not qualify as legal timber.
 - *Salvage felling permits*: permits may be issued for the salvage of trees from an area of land undergoing development such as road construction, the expansion of human settlement or the cultivation of farms. No such permit is issued in respect of land under a TUC. Salvage felling permits are subject to corruption and other forms of abuse: since timber from TUPs cannot be distinguished from other timber in the commercial market, a major challenge is to prevent timber harvested under TUPs from entering the commercial market.⁴

Timber harvesting is used as both a silvicultural and a management tool. National forest inventories were undertaken in forest reserves in 1985–1992 and 2002, and the data from these have been used for, among other things, setting the AAC. Forest protection strategies have been incorporated and described in the 1995 Manual of Procedures for Stock Survey and Yield Allocation and backed by the 1998 Logging Manual.

The Manual of Procedures for Stock Survey and Yield Allocation documents the steps to be taken and operations to be carried out to ensure that trees in production forest reserves are felled on a sustained-yield basis. The Logging Manual prescribes the code of timber-harvesting practice and technology that all holders of timber utilization rights are required to adhere to. The manual is



Fuelwood-gathering in western Ghana.

written primarily to guide timber contractors on planning and operational aspects of timber harvesting and provides basic information for a code of good working practice. To ensure that harvesting meets the required forest management standards, the following criteria have been set:

- Each TUC area in a forest reserve should have a harvesting schedule.
- Permanently and temporarily protected areas as well as conversion and research areas should be excluded from the schedule.
- The period of the schedule should be 40 years.
- The duration of each felling coupe should not exceed five years.
- Each five-year coupe should be allocated one-eighth ($\pm 10\%$) of the area of all compartments in the TUC area.
- The harvesting schedule should be practical.

A compartment is not released for logging if it does not appear in the harvesting schedule.

The Forest Services Division of the Forestry Commission is responsible for supervising and monitoring TUCs. The Division's district forest manager and regional staff are responsible for ensuring that contractors follow the guidelines of the Logging Manual and fully adhere to the timber operational specifications and the social responsibility agreement specified in contracts. In particular the field staff must ensure that compartment plans are followed, that the conditions for forest protection are adhered to, and that payments are made in accordance with contract agreements.

The Forestry Commission also uses the 1998 Manual of Procedures for Forest Resource Management Planning in the High-forest Zone, under which logging plans are prepared by the contractor and the forest reserves are divided into compartments of 128 hectares each (1600 m x 800 m). The 2002 Law on Timber Resource Auctioning establishes that timber rights will be awarded by tender. The Forestry Commission allocates the volumes to be harvested annually based on an 'interim yield formula', which depends on the size of the TUC. One hundred percent of the boundaries of forest reserves have been demarcated.^a

A national AAC of 500 000 m³ has been set for forest reserves using results of inventories and a harvesting rotation of 40 years. This AAC is applied to 64 economic species, grouped in accordance with their level of harvesting in relation to their total stocks: 18 Scarlet Star species, comprising the main traditional commercial timbers now under threat of economic extinction, where the level of cut is greater than 200% of the sustainable level; 16 Red Star species, for which the level of cut is 50–200% the level considered to be sustainable and which will eventually become economically extinct without a major reduction in harvest; and 30 Pink Star species, some of which are being exploited but not at a rate to cause concern – i.e. less than 50% of the sustainable cut.^a

The estimated total AAC of 683 100 m³ (comprising 115 900 m³ of Scarlet Star species, 208 700 m³ of Red Star species and 358 500 m³ of Pink Star species – see Table 4) was rounded down to 500 000 m³ because many Pink Star species are currently regarded as unsaleable. The AAC has been set at 1.5 million m³ for off-reserve forests, giving a total national AAC of 2 million m³.^a

The AAC in forest reserves (500 000 m³) has been criticized as being unsustainable, partly because "the timber industry has failed to heed repeated warnings to shift exploitation from [traditional, high-value] species to lesser-used species" (Bird et al. 2006). Outside the forest reserves, the annual production of timber by illegal chainsaw milling is reported to be as high as 2.5 million m³, five times the total AAC in the formal sector (Marfo 2010).

In the past, forest management plans have not been very successful in protecting the forest from degradation and over-exploitation. In line with new thinking about forest management, new

management plans are being prepared. Twenty-one plans have been developed covering an area of just over 400 000 hectares of the PFE, and their implementation was scheduled to begin in January 2010. If the implementation of these initial 21 plans is successful, a second phase will involve the development of plans for the remaining production forest reserves. The introduction of low impact logging techniques is under consideration. Constraints to SFM encountered in the past include inadequate funding; institutional weaknesses; a lack of adequate equipment; the poor implementation of management plans; increasing demand for forest resource use, sometimes resulting in conflicts; and encroachment and unapproved harvesting.^a

A range of measures has been put in place to help reduce the impact of fire, including wildfire management plans, the establishment of a green fire belt, incentive schemes for fighting fires (volunteer schemes), education and awareness creation, and arrests and prosecutions. Such measures have helped to reduce the incidence of wildfire in some fire-prone communities.^a

The management of many forest reserves is thought to be quite good. In others, however, inadequate control of TUCs has allowed over-harvesting. Repeated re-entries take place depending on demand for logs, often facilitated through salvage permits. There is inadequate surveillance to safeguard the integrity and ensure the security of the PFE. There are also inadequacies in survey records, maps and boundary maintenance (ITTO 2006).

The formal timber industry has traditionally concentrated on exports. Domestic supplies, therefore, are supplemented by illegal logging: according to one estimate, 84% of domestic timber (about 497 000 m³) is supplied by illegal chainsaw milling operations, and an additional 260 000 m³ of timber from such operations is exported to neighbouring countries (Marfo 2010). Most of the logs are obtained from off-reserve sources (including in concessions, at the expense of concession-holders), although there is anecdotal evidence that forest reserves are increasingly being raided (ibid.).

Measures have been put in place to reduce illegal forest activities, including the formation of a military task force, which patrols the forest; increased arrests and prosecutions; a ban on the sale of chainsaw lumber; and the development of a

VPA with the European Union (see below). Such measures have enhanced the Forestry Commission's capacity to control legal and illegal forest activities.^a

Another potential measure is a new timber-tracking system, which is currently being piloted. This system is designed to monitor the movement of timber from standing trees in forests (including in forest reserves, off-reserve forests, and timber plantations) to processing facilities, or from point-of-import to processing facility, and to local sales outlets or export facilities. The system will enable the tracking of individual logs and consignments of processed products, and will include product labelling, physical inspections and documentary checks. It will have four main components:

- The identification and tagging of individual products or consignments using bar-coded labels or radio frequency identification devices (usually known as RFIDs).
- The incorporation of these tag numbers onto the statutory forms used for declarations, inspections and other relevant records and reports.
- The use of electronic technology for data collection and transmission.
- The development of a database to receive, analyse and report all wood production and movement.

The system will provide the full traceability of timber from both the PFE and the non-PFE and certify the origin and legal and regulatory compliance of all timber products. Initially the scope will be limited to information on forest and timber operations and will include:

- log production
- log movements from forest to mill
- mill inputs and outputs
- processed timber production and transport
- processed timber exports
- log and processed timber imports.

Silviculture and species selection. The silvicultural system used in natural forests is a polycyclic selection felling system using a cutting cycle of 40 years. The AAC in the natural forests is decided on the basis of stock surveys and size limits prescribed

for the different commercial species by the Forest Services Division of the Forestry Commission. Only 20% of the trees above the diameter limit are to be harvested (around three trees per hectare), with the rest retained for the next entry in 40 years. Post-logging silvicultural operations are also prescribed to promote growth and sustainability.

There are many hardwood timber species, but the more commercially valuable are becoming scarce. Table 4 shows the three groupings of species, and the harvesting volumes in each.

Planted forest and trees outside the forest.

The National Forest Plantation Development Programme, which was launched in early 2010, aims to encourage the development of a sustainable forest resource base that will satisfy future demand for industrial timber and enhance environmental quality. The program is being implemented under three main strategies. The first of these, the modified *taungya* system, involves the establishment of plantations by the Forest Services Division in partnership with farmers. The Forest Services Division provides technical direction and demarcates degraded forest reserve lands and supplies pegs and seedlings, while the farmers provide all the labour involved in site-clearing, pegging, planting, maintenance and fire protection. Farmers are permitted to cultivate their food crops, which are inter-planted with tree crops. In addition to the food crops they harvest, farmers earn a 40% share of the returns on investment. The government also receives a 40% share and the landowner and community earn a 15% and 5% share, respectively.

The second strategy uses hired labour and contract supervisors to establish industrial plantations. Plantation workers are hired and paid a monthly allowance to establish and maintain plantations, while plantation supervisors are given one-year renewable contract employment to supervise and offer technical direction. The Forestry Commission's Plantation Department exercises general oversight and monitors field activities to ensure compliance with quality standards for plantation establishment. This strategy is employed by the Government Plantation Development Programme, which is funded through the Highly Indebted Poor Countries initiative. The plantations developed under this scheme are owned by government and those landowners who are entitled to royalty payments.

Table 4 Commonly harvested species for industrial roundwood

Species grouping	Notes
Scarlet Star*	An estimated 115 900 m ³ are harvested each year in forest reserves, and 100 185 m ³ are harvested off-reserve.
Red Star**	An estimated 208 700 m ³ are harvested each year in forest reserves, and 41 778 m ³ are harvested off-reserve.
Pink Star [‡]	An estimated 358 500 m ³ are harvested each year in forest reserves, and 360 916 m ³ are harvested off-reserve.

* *Scarlet-star species comprise the main traditional timbers now under imminent threat of extinction: Albizia ferruginea, Aningeria altissima/robusta (also listed in ITTO 2006), Daniella ogea/thurifera, Entandrophragma angolense, E. cylindricum, E. utile, Guibourtia ehie, Khaya anthotheca/grandifolia, Khaya ivorensis, Milicia excels/regia, Nauclea diderrichii, Pericopsis elata, Pterygota macrocarpa and Tieghemella heckelii.*

** *Red-star species comprise other traditional timbers for which current rates of exploitation present a significant danger of extinction: Afzelia africana/bellea, Canarium schweinfurthii, Distemonanthus benthamianus, Rhodognaphalon/Bombax brevicuspe, Antiaris toxicaria, Antrocaryon micraster, Ceiba pentandra (also listed in ITTO 2006), Chrysophyllum spp, Entandrophragma candollei, Guarea spp, Heritiera utilis, Lophira alata, Lovaia trichilioides, Mansonia altissima, Piptadenisatrum africanum and Terminalia ivorensis,*

[‡] *Pink-star species comprise the following lesser-used species: Albizia adianthifolia, Anopyxis klaineana, Berlinia spp, Cynometra anatana, Erythropileum sauaveolens, Hallea spp/Mitragyna spp, Holoptelea grandis, Lannea welwitschii, Petersianthus macrocarpus, Strombosia glaucescens, Trichilia tessmannii, Albizia zygia, Alstonia boonei, Amphimas perocarpoides, Berlinia confusa, Celtis midbraedii/zenkeri, Coryanthe pachyceras, Cylicodiscus gabonensis, Dialium aubrevillei, Klaindoxa gabonensis, Mammea africana, Morus mesozygia, Ongokea gore, Parinari excelsa, Parkia bicolor, Pycnanthus angolensis, Rhodognaphalon/Bombax buonopozense, Ricinodendron heudelotii, Sterculia rhinopetala, Terminalia superba (also listed in ITTO 2006), Trilepisium madagascariense and Triplochiton scleroxylon (also listed in ITTO 2006).*

Source: Government of Ghana (2010).

The third strategy involves the release of degraded forest reserve lands by the Forestry Commission to private entities after vetting and endorsing their reforestation and business plans. The operations of these private developers are then monitored through periodic field visits by the Plantation Department to ensure compliance with the approved reforestation plans. The private investor earns 90% of the total proceeds from the plantation while the Forestry Commission, landowner and community earn 2%, 6% and 2%, respectively.

The estimated area of planted forest in 2010 was about 260 000 hectares (FAO 2010). Ghana began planting *Tectona grandis* (teak) in the Volta region in 1875, and teak is the most dominant species in today's plantation estate. Teak yields average 8–10 m³ per hectare per year on a 25-year cycle, and there is a ready demand for teak timber, both in domestic and export markets. The indigenous species planted are mainly *Mansonia altissima*, *Terminalia superba*, *T. ivorensis*, *Entandrophragma angolense*, *Khaya ivorensis*, *Ceiba pentandra*, *Heritiera utilis* and *Triplochiton scleroxylon*. Other than teak, the exotic species are predominantly *Cedrela odorata* and *Eucalyptus camaldulensis*.^b

A total of 68 558 hectares of plantation were established in the period 2005–08.^b As of the end of 2008, 9095 hectares of plantation were covered

by management plans and a further 15 031 hectares were confirmed to be covered by reforestation plans. For the remaining areas, a validated figure could not be readily obtained.^b

Forest certification. Ghana has been engaged in the development of forest certification for more than a decade. There is interest in developing a national scheme partly because FSC-accredited certification bodies, using their generic standards, have been unable to certify significant areas of forests in Ghana because existing TUPs and contracts might be in conflict with recent laws. Another reason is that management plans written by the Forestry Commission are at various stages of consultation (i.e. drafts) and are unapproved (Purbawiyatna & Simula 2008). As of February 2011 a small area of teak plantation and about 150 000 hectares of natural forest was certified by the FSC (FSC 2011).

Estimate of the area of forest sustainably managed for production. On the basis of information supplied by the Government of Ghana, FAO (2010) reported that 1.38 million hectares of forest was under sustainable management. ITTO (2006) estimated that 270 000 hectares of natural forest was being managed in a manner consistent with sustainability, including the operation of Samartex, a Ghana company with FSC

controlled-wood certification for 150 308 hectares of natural forest in Samreboi. Controlled-wood certification certifies that the wood supply does not include wood that is illegally harvested; harvested in violation of traditional and civil rights; harvested in forest management units in which high conservation values are threatened by management activities; harvested in areas in which forests are being converted to plantations or non-forest use; or harvested from forests in which genetically modified trees are planted. This area, and the area contained in the Bobiri Forest Reserve, are included in the estimated area of forest under SFM presented in Table 5.

Timber production and trade. Total industrial roundwood production in 2009 was 1.32 million m³, little changed from the 1.37 million m³ recorded in 2004 (ITTO 2011). Sawnwood production was 532 000 m³ in 2009, compared with 490 000 m³ in 2004 and 454 000 m³ in 1999. About 191 000 m³ of plywood was produced in 2009, compared with 140 000 m³ in 2004 and 75 000 m³ in 1999; 274 000 m³ of veneer was produced in 2009, compared with 301 000 m³ in 2004 and 150 000 m³ in 1999 (ITTO 2011). The estimated export value of primary timber products was US\$207 million in 2009, comprising logs (US\$17.3 million – presumably teak and other plantation logs), sawnwood (US\$70.0 million), veneer (US\$63.4 million) and plywood (US\$56.0 million) (ITTO 2011).

The export of round and square logs (other than plantation teak) has been banned since 1997 and levies imposed on exports of air-dried timber of nine important species. In 2008 Ghana reported exports of 191 000 m³ of sawnwood (including 20 700 m³ to the United States, 18 700 m³ to Germany, and 13 800 m³ to Italy) and 69 700 m³

of veneer (including 21 400 m³ to the United States and 9450 m³ to Italy) (ITTO 2010). In that year it exported 8220 m³ of teak logs to India; the total export volume of teak logs was 87 100 m³ but the destination of most of these was unreported (ibid.).

Non-timber forest products. An estimated 380 000 tonnes of bush meat are consumed annually, mainly from forests, at an estimated value of about US\$350 million.^a Animal and plant products used in traditional medicine and cultural practices have an estimated value of about US\$13 million.^a Over 600 000 women in northern Ghana collect about 130 000 tonnes of nuts yearly, about 40% of which is exported. This contributes about US\$30 million annually to the national economy (Osei-Tutu et al. 2010).

Efforts are being made to market, internationally, at least two Ghanaian NTFPs: thaumatin, a sweetener from seeds of *Thaumatococcus danielli*, which is reputed to be easy to cultivate under plantation trees; and novella, an oil/margarine from seeds of *Allanblackia parviflora*. A small-scale processing facility for thaumatin production is being established; the value of exports of this product in 2004 was reportedly \$430 million (Okeke 2009). The contribution of ecotourism, including in forests, to Ghanaian GDP is 12%.^a

Forest carbon. Ghana is developing a comprehensive low-carbon growth plan that will address climate change as part of a national and sectoral development strategy and set REDD+ in a wider development context (Anon. 2010). Estimates of national-level forest biomass carbon stocks vary from 381 MtC (FAO 2010) to 610–890 MtC (Gibbs et al. 2007), to 2100 MtC (Eggleston et al. 2006). There is no recent estimate of the net emissions of GHGs caused by deforestation and

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

Reporting year	Natural					Planted		
	Total	Available for harvesting	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
2005*	1150	1035	1150	0	270	97	97	0
2010	774	1124**	774^{†,a}	150	155[†]	164	24	1.8

* As reported in ITTO (2006).

** Assumed to be the area classified as 'production' in FAO (2010).

† Total area under 'old' management plans. Recently, new forest management plans have been developed for 408 000 hectares of the PFE and are in the early stages of implementation.

† Comprising the certified forest area and the Bobiri Forest Reserve, where a management plan and a TUC operational plan are being implemented effectively.^b

degradation; estimates made in 1994 suggest that 40% of the country's emissions may come from deforestation (Government of Ghana 2008). Ghana is actively engaged in the Forest Carbon Partnership Facility and is developing a national REDD+ strategy. It has also been chosen as a pilot country of the Forest Investment Program for up-scaled REDD+ investment. The initial REDD+ strategy comprises two broad and overlapping thematic areas:

- Timber policy and supply – approaches will focus on traditional timber-sector operations, processes, policies and laws and on the potential for broadening public participation.
- Wider aspects of forest policy, including agroforestry and other carbon-conserving activities.

Table 6 summarizes Ghana's overall forest-based carbon capture and storage potential.

Forest for protection

Soil and water. The Government of Ghana (2010) reported that the country's entire protection PFE (350 000 hectares) is managed exclusively for the protection of soil and water.

Biological diversity. At least 674 tree species, 225 mammal species, 728 bird species, 340 butterfly species, 221 amphibian species, 157 fish species and four reptile species are found in forests.^a Twelve mammals, six birds, two reptiles, eleven amphibians, one arthropod and nine plants found in forests are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species (IUCN 2011). One plant species is listed in CITES Appendix I and 18 are listed in Appendix II (UNEP-WCMC 2011).

Protective measures in production forests.

About 100 000 hectares of the production PFE are considered environmentally sensitive (i.e. on steep slopes or erodible soils, or in streamside buffers).^a Measures exist to minimize damage in such areas: for example, no logging operation is permitted within buffer strips (25 m on either side of streams, and 50 m either side of rivers). No felling into buffer strips is permitted, and any tree or debris that falls within watercourses must be removed.

Extent of protected areas. The estimated area of protection PFE is 396 000 hectares. The Government of Ghana (2010) reported 31 protected areas in IUCN categories I and II covering a total area of 1.10 million hectares, most of which is (non-forest) grass savanna, as well as 7000 hectares in IUCN categories III and IV and 3.69 million hectares in IUCN category V. According to UNEP-WCMC (2010), 973 000 hectares of forest are in protected areas conforming to IUCN protected-area categories I–IV (including about 97 000 hectares of closed-canopy forest). The large difference between this and the estimated protection PFE may be caused partly by the inclusion, in the UNEP-WCMC estimate, of areas of savanna not included in the estimate of the protection PFE.

A national biodiversity strategy has been formulated that seeks to ensure the development and implementation of a well-coordinated biodiversity policy for the *in situ* and *ex situ* conservation of the nation's biological resources. The document contains a strategic framework for biodiversity conservation and management in Ghana. In addition, management plans for 30 'globally significant biodiversity areas' covering 230 000 hectares have been developed (including through flora and fauna surveys) and are being implemented.^a

Table 6 Forest carbon potential

Biomass forest carbon (MtC)	% intact forest/tree canopy cover > 60%	Deforestation/ degradation potential to 2030	Enhancement of carbon sink capacity to 2030	Forest area change monitoring capacity	Forest/ GHG inventory capacity	Importance of forest fire/ biomass burning	Engagement in international REDD+ processes
610–890	18	++	++	++	++	++	+++

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

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

Reporting year	Protection PFE	Attributed to IUCN categories I-IV	Allocated for soil and water	With management plans	Sustainably managed
2005*	353	174	-	-	108
2010	396	174**	353	230[‡]	230

* As reported in ITTO (2006).

** In the absence of reliable updated information, the 2005 estimate is repeated here.

‡ For globally significant biodiversity areas.

Estimate of the area of forest sustainably managed for protection. Table 7 shows the estimated area of protection PFE under SFM.

Socioeconomic aspects

Economic aspects. Forests accounted for 6% of GDP in 2004 (US\$520 million), and exports of timber products were worth an estimated US\$186 million in 2008.^a The formal forest sector employs about 120 000 people, including about 50 000 in the wood-products industry. About 70 companies are involved in timber harvesting, 70 are involved in primary processing, 127 are involved in secondary processing, and 1650 are involved in tertiary processing.^a According to Mayers et al. (2008) about 30 000 small-scale carpenter firms employ an estimated 200 000 people, and there are about 5000 woodcarvers and 1500 canoe carvers. Chainsaw milling, although illegal, provides jobs for about 130 000 Ghanaians and livelihood support for about 650 000 people (Marfo 2010); 5000–6000 people are estimated to be employed in the bush-meat industry.^a The extent of overlap in these various estimates is unclear.

The VPA between Ghana and the European Union, which was signed in November 2009, could have significant economic repercussions for Ghana. An assessment of its potential impact on forest governance and economics by Mayers et al. (2008) compared a business-as-usual scenario with a 'legitimate-timber' scenario (such as might occur under the VPA) and a 'sector-reform' scenario. The main components of the legitimate-timber scenario were a national legality standard; chain-of-custody system (timber-tracking); a verification-of-legality system (licensing by a new timber-validation entity); the piloting of the legal assurance system; and independent monitoring. The sector-reform scenario would involve a broader set of fiscal, regulatory, trade and tenure improvements. The assessment predicted that, under the legitimate-

timber scenario, the national timber harvest would drop by about 20% by 2012 and still further (more than 50% compared to the present level) by 2020, although this would still be above the sustainable level predicted under the sector-reform scenario. The first VPA-licensed products were anticipated in December 2010.

Livelihood values. An estimated 2 million people depend on forests for subsistence uses and traditional and customary lifestyles.^a Forest-adjacent communities undertake a wide range of forest-related activities, including fuelwood and charcoal production, wood-carving, canoe-carving, rattan production and chewstick-gathering.

Social relations. The Constitution provides for the sharing of royalties between government and traditional owners as follows: 40% to stools and 60% to the state in reserve forests; and 60% to stools and 40% to the state in off-reserve forests. Social-responsibility agreements are reached between TUC-holders and the communities where timber extraction takes place for the provision of agreed social services and amenities; a process of consultation is also undertaken.

The following benefit-sharing arrangement for the modified *taungya* system and commercial plantation developers is in place: farmers and the Forestry Commission should each receive 40% of benefits accruing based on their inputs; landowners should receive 15% (comprising traditional authorities 7% and tribal landowners 8%); and forest-adjacent communities should receive 5%.

Summary

A number of factors is driving the depletion of Ghana's forests, particularly off-reserve forests but also forest reserves. Forest-related laws are sometimes contradictory or overlapping. Nevertheless, steps are being taken to increase community participation in forest management. Ghana has a strong Forestry Commission, a long

history of forest management, and capacity for forest research. The forest industries are a large employer, much of it in the informal sector. The Forestry Commission has an established approach to forest management in forest reserves and has set an annual allowable cut of 500 000 m³, which has been criticized as unsustainable. Outside forest reserves there is little control of harvesting and the annual production is reportedly much higher than the allowable cut in forest reserves. A range of measures has been put in place to reduce the incidence of wildfire, and these appear to have been at least partially effective. Measures have been put in place to reduce illegal logging (which is reportedly high), including a timber-tracking system. A national forest plantation development program has been launched with the aim of developing a sustainable forest resource base. Ghana has been chosen as a pilot country for up-scaled REDD+ investment through the Forest Investment Program.

Key points

- The PFE is an estimated 1.33 million hectares (down from 1.6 million hectares in 2005), comprising 774 000 hectares of natural-forest production PFE (down from 1.15 million hectares in 2005), 396 000 hectares of protection PFE (up from 353 000 hectares in 2005) and 164 000 hectares of plantations (up from 97 000 hectares in 2005).
- At least 155 000 hectares of natural-forest production PFE are under SFM, down from about 270 000 hectares in 2005; an estimated 230 000 hectares of protection PFE are so managed, up from 108 000 hectares in 2005.
- There are manuals for production, management and planning, which set out the obligations of logging contractors.
- Ghana is strongly engaged in REDD+.
- As many as 800 000 people may be employed in forest industries, including an estimated 650 000 in the informal sector.

Endnotes

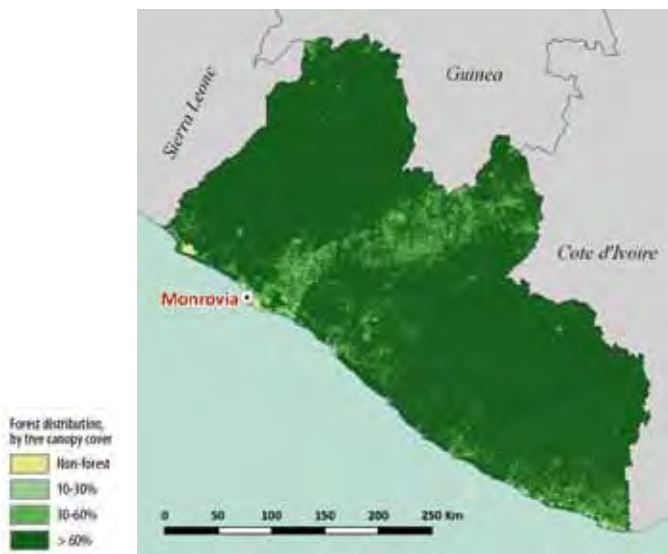
- a Government of Ghana (2010).
- b Personal communications with officials in the Government of Ghana, 2010.

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LIBERIA



Forest resources

Liberia has a land area of 11.1 million hectares and an estimated population in 2010 of 4.1 million people (United Nations Population Division 2010). The country is ranked 169th out of 182 countries in UNDP's Human Development Index (UNDP 2009). It is bounded by Sierra Leone to the west, Côte d'Ivoire to the east, Guinea to the north and the Atlantic Ocean to the south. FAO (2010) estimated Liberia's total forest area at 4.329 million hectares, which is 39% of the total land area. A 2004 analysis of GIS and satellite image data estimated that Liberia had 4.39 million hectares of forest.^a Liberia has large areas of secondary forests on abandoned agricultural land (J. Blaser, pers. comm., 2010).

Forest types. The three main categories of vegetation cover in Liberia are mangrove swamps and beaches along the coast; wooded hills and semi-deciduous shrublands in the middle belt; and dense tropical forests and plateaux in the interior. The bulk of the forest is concentrated in two large blocks: evergreen lowland forests in the southeast, and the semi-deciduous mountain forests in the northwest. There are ten national forests and two national parks. Counties that have significant forested land are Gbarpolu, Grand Gedeh, Rivercess Sinoe and River Gee.^a

Characteristic species of the moist evergreen forests are *Lophira alata*, *Heritiera utilis* and

Sacoglottis gabonensis, while Meliaceae (one of the most important timber families in West Africa) is represented by only two species: *Lovoa trichilioides* and *Guarea cedrata* (bossé). The semi-deciduous forests cover the northern half of the country and contain a higher representation of Meliaceae, the characteristic species being *Nesogordonia papaverifera* (danta) and *Aningeria robusta*. Common shade-intolerant species are *Albizia* spp, *Fagara* spp, *Terminalia* spp and *Pycnanthus angolensis*. Liberia has an estimated 10 900 hectares of mangroves, concentrated around coastal lagoons and along estuaries; *Rhizophora racemosa* is the dominant mangrove species, along with *Avicennia germinans* and *Acrostichum aureum* (Spalding et al. 2010).

Permanent forest estate. The natural PFE is estimated at 2.72 million hectares, comprising 1.7 million hectares of production forest (consisting of 1.36 million hectares in ten 'national' forests¹ and 340 000 million hectares in other forests, such as state forests and also forests that are under the control of traditional authorities) and 194 000 hectares of protection PFE, which comprises the 180 000-hectare Sapo National Park and the 13 600-hectare East Nimba Strict Nature Reserve (Table 1).

Forest ecosystem health

Deforestation and forest degradation. A study of remote sensing data indicates that deforestation increased from 0.2% in 1986–2000 to 0.35% in 2000–2006 (Government of Liberia 2008). Shearman (2009), however, suggested that this might be a substantial underestimate due to methodological problems and that recent deforestation could have been as high as 1%. Almost all clearing is in the form of numerous small (<10 hectare) clearings around towns and along roads near towns for shifting cultivation and conversion to single-crop plantations. The country's long-running civil conflicts, which forced

¹ Officially Liberia has eleven national forests. The 'Small Gbe' in Nimba County is partially degraded from encroachment by farmers and has been classified in land-use suitability studies as a salvage area, which effectively means that its merchantable timber can be removed without the need to fulfil the requirements of SFM. Therefore, this national forest has not been included in the PFE (W. Topor, pers. comm., 2010).

Table 1 Permanent forest estate

Reporting year	Estimated total forest area, range (million ha)	Total closed natural forest ('000 ha)	PFE ('000 hectares)			
			Production		Protection	Total
			Natural	Planted		
2005*	3.48–5.66	4124	1310	-	101	1411
2010	4.33–9.60	2420^a	1700	9.7	194^{**}	1904

* As reported in ITTO (2006).

** An expansion of the protected-area estate has been proposed, to a total of 1.02 million hectares.

Source: Blaser (2008), ITTO estimate, FAO (2010), UNEP-WCMC (2010).

many people to leave the countryside and move to the capital and elsewhere, was one reason why deforestation rates were low historically compared to elsewhere in the region. Now that peace has been restored, there is a general return of the population to rural areas, assisted by the repair of infrastructure such as road and bridges. These factors, coupled with expanding global markets for tropical agricultural products, biofuels and timber, are exerting pressure on forests and, without preventative measures, the deforestation rate is likely to increase (Government of Liberia 2008).

In addition to subsistence farming, a significant cause of forest degradation is chainsaw logging and associated pit-sawing, as well as other forms of uncontrolled logging. In the absence of sawmills, pit-sawing is a major source of timber supply for reconstruction. Blackett et al. (2009) identified two problems affecting the sustainability of remnant forests: over-harvesting per hectare, and the lack of post-logging management. Chainsaw logging occurs in all counties at distances of up to 5 km from roads – four-fifths of production forests are now within 3 km of a road (ITTO 2005). Other threats include conversion to small-scale agriculture (especially dry rice cultivation), and illegal alluvial mining for gold and diamonds, which can damage rivers, streams and soils. As with deforestation, these threats are increasing as internally displaced people return to the hinterland from urban centres.

In 2004 Liberia had an estimated 2.42 million hectares of closed dense forest.^a The open dense forest (forest logged in the ten years or so prior to 2004) was estimated at 1.02 million hectares, while there were 0.95 million hectares of forest that had been subject to extensive use by local people and were in varying states of degradation, from moderate to severe (Table 2). An additional 1.28 million hectares of forest was classified as mixed agriculture and forest.^a None of the forest in agricultural landscapes (i.e. 0.95 million hectares + 1.28 million hectares) is included in the estimate of total forest area given above, mainly because of its highly fragmented nature, although it may constitute an important resource at the local level. FAO (2010) estimated that Liberia had only 175 000 hectares of primary forest.

Vulnerability of forests to climate change.

The south of Liberia has an equatorial climate, with rainfall exceeding 5000 mm. The northern regions are strongly influenced by the West African monsoon, with a severe wet season between May and November. The rainy season is heavily influenced by the Inter-Tropical Convergence Zone. Mean annual temperature in Liberia increased by 0.8 °C between 1960 and 2006, an average of 0.18 °C per decade (McSweeney et al. undated). Mean annual rainfall has decreased since the early 1960s, but it is difficult to determine whether this is part of a long-term trend. Variations are associated

Table 2 Forest condition

	PFE	Non-PFE	Total ('000 ha)
	'000 ha		
Area of primary forest*	-	-	2420
Area of degraded primary forest**	-	-	1010
Area of secondary forest	-	-	-
Area of degraded forest land	-	-	950

* Closed dense forest, 2004.

** Open dense forest (forest logged in the ten years prior to 2004).

Source: Government of Liberia (2010).

with the El Niño–Southern Oscillation, which irregularly brings drier conditions to West Africa (ibid.). Mean annual temperature is projected to increase by 0.9–2.6 °C by 2060 and by 1.4–4.7 °C by 2090 (ibid.). In 2007 Liberia prepared a NAPA to respond to the country’s urgent and immediate needs to adapt to climate change. The NAPA states that agriculture, forestry, fisheries, wetlands and public health are of immediate concern. However, the potential impacts of climate change on Liberian agriculture and forestry are largely unknown. Liberia’s 2008 Food and Agricultural Policy establishes the monitoring of climate change and the provision of support for climate-change adaptation in agriculture and forestry as key action areas (Government of Liberia 2011).

SFM policy framework

Forest tenure. According to the National Forest Reform Law, 2006, “All forest resources in Liberia ... are held in trust by the Republic for the benefit of the people” (Table 3). Although the term land ownership is in common use in the country, it is not possible, in a strict sense, to own the land itself. Rather, it is the right to *use* land, or the resources on it, that can be owned by an individual or group.

Land ownership rights are held under three tenure systems: the customary land-tenure system; the Anglo-American system of land tenure, also known as the deed system; and the land registration system (Blaser 2008). Communal land is designated for the exclusive use of local communities for purposes other than logging. Customary rights over such land are not recognized automatically; they must have been documented previously. The only private forest resources are those that have been developed through artificial regeneration on privately owned

land. An ITTO diagnostic mission in 2005 (ITTO 2005) reported that the traditional land and resource rights of the majority rural population have been systematically ignored and undermined by a small elite throughout Liberia’s 150-year history. Nevertheless, the Liberian Constitution and specific laws, such as the National Environmental Protection Act (2002), note the rights of rural people.

The right to control the exploitation of natural resources such as timber and diamonds has been treated in the past as a prize of political office, especially under presidents Doe (1980–90) and Taylor (1997–2003). Armed factions also controlled territory to exploit natural resources, which helped to drive the conflicts of 1990–96 and 2000–03. Communities claim land that has been designated as national forest and there are also apparent conflicts over some large and long-term rights, such as those held by the Liberian Agricultural Company. The real extent of these conflicts, claims and challenges to ownership is unclear (Blaser 2008).

The most pressing issue affecting all land use in Liberia is the lack of legal clarity over property ownership and use rights. Security of land tenure in today’s Liberia is weak or non-existent and its restoration is essential to the development of Liberia’s economy and democracy. Rights of access to and use of natural resources, including land, minerals, forests and water, are shrouded in a state of tenure insecurity, vague and ambiguous legislation, conflicting and competing tenure arrangements, and constant and persistent clashes of customary and statutory rights (Government of Liberia 2008). There is scope under the National Forest Reform Law for community and private

Table 3 Forest area, by tenure

Ownership category	Total area	Of which PFE
	'000 ha	
State ownership (national, state or provincial government)	4330	2720
Other public entities (e.g. municipalities, villages)	0	0
Total public	4330	2720
Owned by local communities and/or Indigenous groups	0	0
Privately owned by individuals, firms, other corporate	0	0

Source: Government of Liberia (2010).

ownership, but all forests remain public pending the resolution of the land ownership issue (FAO 2010).

Criteria and indicators. With the support of the ATO/ITTO regional project, Liberia's ATO/ITTO PCI for SFM scheme was completed in January 2010. These PCI were formulated by a technical committee selected and mandated through a national working group and the draft document was vetted at a high-level national workshop attended by a range of stakeholders.^a A field test was conducted and its results were validated during a multi-stakeholder workshop. Training on the use of the Liberia ATO/ITTO PCI was also organized, although more is needed because of the low human-resource capacity of Liberia's forest sector. Liberia's submission to ITTO for this report was not in the ITTO C&I reporting format.

Forest policy and legislation. Before 2004, timber revenues and profits were controlled and manipulated by former president Charles Taylor to tighten his grip on the country. Existing logging concessions were taken from their previous owners and given to Taylor cronies (for example, Taylor's brother ran the Forest Development Authority – FDA). Revenues were diverted to buy arms and to acquire personal assets. Combatants were employed by logging companies and used to quell local opposition. Wildlife was hunted intensively (Blaser 2008).

In July 2003, the United Nations Security Council (2003) imposed sanctions on exports from Liberia – including timber exports – to restrict the flow of arms and to weaken the Taylor regime. Sawmills, plywood mills and all other forest products' industry infrastructure were destroyed by looters. Some companies lost millions of dollars in investment.

After eviction of the Taylor government and a move to a transitional government, free elections were held in November 2005 and a new government headed by Ellen Johnson Sirleaf was elected. Since then, rapid progress has been made in the forest sector, driven initially by the National Forest Monitoring Committee with assistance from the Liberia Forest Initiative, a multi-donor support mechanism. Based on this collaboration, the FDA is undertaking profound reforms. A new forest law, the National Forestry Reform Law, was approved by Parliament and enacted in October 2006. In the same month the United Nations Security Council

lifted its timber export sanctions, allowing the country to redevelop its commercial forest sector.

The National Forestry Reform Law provides for four principal commercial forest exploitation contracts and permits:

- Forest management contracts (FMCs): contracts for the management of forest areas between 50 000 and 400 000 hectares in size.
- Timber sales contracts (TSCs): contracts for the management of forest areas of 5000 hectares or less for a period of no longer than three years.
- Forest use permits: for non-timber forest uses (e.g. tourism and the harvesting of NTFPs).
- Private use permits: to regulate commercial activities on private land.

The Government of Liberia has adopted a new conceptual approach to the development of the forest sector, referred to in the Liberian forest policy (adopted in 2006) as the principles of the three Cs – commercial, conservation and community forestry. The policy aims to conserve and sustainably manage all forest areas so that they continue to produce a complete range of goods and services for the benefit of all Liberians and contribute to national poverty alleviation, while maintaining environmental agreements and conventions. Nevertheless, the policy has been criticized for lacking a clear strategy for reforestation and afforestation, NTFPs and value-added, and a failure to address the issue of illegal chain-saw operators (Blaser 2008).

The four strategies for implementing Liberia's forest policy – as spelt out in the National Forest Management Strategy of 2007 – are:

- *Strategy for commercial forestry:* this focuses on improving forest concession management, reforestation and forest plantation development and the modernization of the wood-processing industry.
- *Strategy for community forestry:* this strategy acknowledges the need for the greater involvement of local people in all aspects of the forest sector and pays special attention to the potential for forests to contribute more to local people and communities. It focuses on the production of bush meat, woodfuel and other NTFPs, as well as the management of forests by local communities to meet differing objectives. However, the dissociation of forest-use rights

from land ownership in the National Forest Reform Law makes the implementation of community forest management by local people a contentious issue.

- *Strategy for forest conservation:* this includes the management of specific sites of high conservation value and the integration of conservation objectives with all aspects of forest management. The strategy focuses on wildlife and protected-area management, the management of wetlands and mangroves, and the development of ecotourism and nature tourism.
- *Cross-cutting activities:* to support the above strategies, cross-cutting activities are to be implemented to strengthen the overall framework for the development of the forest sector. These include activities on issues related to land tenure, ownership and land-use planning; public administration (including financial management); research, information, education and training; and legislation and law enforcement.

The Community Reform Law was enacted in October 2009 and the National Wildlife Conservation and Protected Area Management Law is awaiting ratification (Government of Liberia 2011). The extended delay before enactment of the latter has fostered a perception that Liberia's 3Cs have differing priorities, with 'commercial' as the big C. This notion has been reinforced by maps that apparently confuse the relative areas of forest suitable for commercial, conservation and community uses (Government of Liberia 2011). A forest suitability study undertaken as part of the National Forest Management Strategy initially identified 3.41 million, 1.14 million and 0.05 million hectares of forest suitable as 'multiple sustainable use' areas, protected areas and pilot community forests, respectively. It also stated that multiple sustainable-use areas may be managed either by commercial firms or through community forest management, with at least 1.09 million hectares of forest suitable for community forest management (Government of Liberia 2011).

The Environmental Protection Act, which became law in 2003, is designed to enhance and manage Liberia's environment and natural resources. The Environmental Protection Agency, created under the Act, is to provide an inter-ministerial

mechanism for addressing and coordinating responses to Liberia's environmental problems. It should also establish a policy framework for environmental issues (including forest management, nature conservation and environmental impact), but this has not yet been done.

The Public Procurement and Concession Act (2005) establishes the rules for the acquisition and disposal of government assets, requires national and international competitive bidding for all timber concessions, and sets standards for pre-qualifying prospective timber concession-holders. Other laws that are being formulated include the Wildlife Law and the Community Rights Law.

Under the National Forest Reform Law the FDA has promulgated ten core regulations to ensure that the country's forests are managed in a way that is consistent with SFM and other requirements. They are 101: Public Participation; 102: Forest Land Use Planning; 103: Prequalification; 104: Tender, Award and Administration; 105: Pre-felling Operations; 106: Benefit Sharing; 107: Forest Fees; 108: Chain of Custody; 109: Penalties; and 110: Rights of Private Land Holder.

The Community Rights Law with Respect to Forest Lands, which was approved in October 2009, aims to empower communities to "fully engage in the sustainable management of the forests of Liberia, by creating a legal framework that defines and supports community rights in the management and use of forest resources". Among other things it defines the rights and responsibilities of communities to own, manage, use and benefit from forest resources. Forest lands ranging from 5001 and 49 999 hectares may be designated as community forest land. Communities have the right to enter into commercial agreements with logging companies to log community forest lands, subject to a range of conditions, and have the right to 55% of the revenues generated.

Draft Guidelines for Forest Management Planning have been developed to help forest managers and staff of companies that have been allocated FMCs, TSCs or other commercial permits, as well as staff at the FDA and other government agencies, to prepare and approve (respectively) forest-management and timber-harvesting plans. The planning requirements for harvesting forests under the various contractual arrangements differ in both the types of plans to be submitted and also the

level of detail. Notwithstanding these differences, however, the guidelines are designed to ensure that all logging companies conduct harvest activities in a way that meets SFM standards.

This is the first set of guidelines for forest management planning prepared in the country. It is designed to be read in conjunction with the Liberian Code of Forest Harvesting Practices, the objectives of which are to:

- Provide forest operators with guidelines and standards for improved forest harvesting practices that improve standards of logging/utilization and reduce environmental impacts, and so contribute to the conservation of forests through their wise use.
- Promote the health and safety of forest workers.
- Provide a framework for effective control of timber harvesting with predetermined guidelines and benchmarks.

In 2007 the Government of Liberia entered into an agreement with SGS to develop a chain-of-custody system for Liberia's forest sector for the tracking and verification of round logs. The tracking system, known as LiberFor, is claimed to be the world's most advanced nationwide verification system in place to monitor wood products and associated revenues (Pichet et al. 2009). Data are collected through physical inspections, documentary control and (eventually) legality audits and registered on a web-based information system. The implementation of the system faces several challenges, however, including a lack of capacity among forest stakeholders and a legacy of weak governance, which still impacts on forest management practices (ibid.).

The Government of Liberia signed a VPA with the European Union in April 2009, committing it to develop and implement a legality assurance system to ensure that all timber products specified in the VPA are produced legally.

Institutions involved in forests. An Act of Parliament in 1976 established the FDA as the body responsible for forestry in Liberia and also recognized the importance of forests as a key renewable natural resource. Amendments to this Act in 1988, 2000 and 2003 sought to strengthen the FDA's ability to manage and protect forests. The FDA is the agent through which policy is

implemented, including forest management plans. However, the FDA has limited human resources – in 2008 it had about 300 staff. More personnel will be required if the 3C approach is to be adopted and as more TSCs and FMCs are awarded. The FDA regional and district offices were destroyed during the civil conflicts. The FDA is struggling to renovate about one unit per region to accommodate regional offices, including supportive logistics (Blaser 2008). Integrating the 3C concept is challenging for the FDA, particularly at the FMU and regional levels.

Liberia has two professional forestry education institutions, both of which are inadequate and their curricula are outdated. The main facilities at the College of Agriculture and Forestry, University of Liberia, including dormitories and accommodation for teaching and support staff, are damaged and have not been renovated or refurbished. The college has been a pipeline of foresters to the FDA, offering a bachelor's degree, but the forestry program is understaffed, underfunded and there is a limited number of advanced degree-holders (Blaser 2008).

The Forestry Training Institute (recently renamed the Anthony Sayeh Forestry Training Institute) is the only institution for training middle-level forestry technicians in 60% practical and 40% theoretical forestry. During the civil conflicts the school facilities were looted and the structure de-roofed. The school resumed operations in 2008 and work is ongoing, including through an ITTO-funded project, to restore its training services.

Status of forest management

Forest for production

In the late 1990s more than 30 companies held logging concessions covering 40% of the national territory. The Oriental Timber Corporation alone was logging some 1.6 million hectares both within the PFE and outside it. During the reform process, however, all existing concession agreements were cancelled. With the cessation of formal logging, most of the forest industrial infrastructure was either destroyed or left idle to rust and decay. Skilled workers as well as professional foresters have been unable to exercise their skills for many years, and many either passed away or reached retirement age.

Nevertheless, FDA staff, private operators and newly developed civil-society organizations and their personnel have worked hard to develop a positive sense of entrepreneurship in the sector, which now has the potential to become an engine of development in Liberia (Blaser 2008). With the lifting of United Nations sanctions in 2006 the FDA set about developing new concessions and allocating them.

Under the National Forest Reform Law, FMCs must meet all of the following requirements:

- The land involved must be identified as a potential concession in the national forest management strategy in effect at the time the concession is offered.
- The land involved must not include private land.
- The contract must require the holder to perform actions necessary for sound, long-term forest management, including inventories, preparation of management plans, and annual operations plans.
- The contract must require the holder to prepare all environmental impact assessments required under the laws governing environmental protection.
- The contract must require the holder to submit a business plan to the FDA and to demonstrate to the FDA's satisfaction that the holder has the technical and financial capacity to manage the forest sustainably.
- The contract must require the holder to establish a social agreement with local forest-dependent communities, approved by the FDA, that defines those communities' benefits and access rights.
- The contract must require the holder to pay the government the fee that the holder bid in the concession process, in addition to any other applicable taxes and fees.
- The basic term of the contract must approximate the length of a forest rotation on the land based on a sustainable yield of timber products, although the contract may be terminated sooner.
- The land area subject to the contract must be at least 50 000 hectares and no more than 400 000 hectares.

- The size of annual coupes must allow the holder to harvest every suitable area once during the term of the contract.
- No holder can fell trees before the felling effective date.
- No holder can fell trees unless they possess a valid annual harvesting certificate.
- The FDA will issue an annual harvesting certificate to a holder only after all the following conditions have been met for the year:
 - The holder has an approved annual operations plan.
 - The holder has an approved forest management plan that covers the specific area to be harvested.
 - The holder has met the previous logging season annual audit requirements.

FMCs will comprise 90% of the areas allocated, with only 4% of the area subject to harvesting in any one year. Harvesting will be selective and designed to encourage the rapid growth of remaining stock. The design of FMCs includes set-aside areas (slopes, sacred areas, watercourses, etc) amounting to about 20% of the area, which will be excluded from logging. In aggregate, this area is about one-third of the total designated protected areas of Liberia (Government of Liberia 2008).

The requirements for TSCs (for areas of forest no larger than 5000 hectares) are less stringent than for FMCs, but an approved annual operations plan and a valid annual harvesting certificate are required.

It is difficult to assess the sustainable potential of Liberia's forests because there has been no forest inventory for 40 years and records of logged-over areas and volumes extracted in the last 20 years are incomplete and unreliable. Growth and yield dynamics are not well known and there are no permanent sampling plots or research on growth and replenishment rates (Blaser 2008). As of July 2009, seven forest management concessions had been formally designated over an area of about 1 million hectares, and three awarded under FMCs, but logging had yet to commence. Shearman (2009) recalculated harvestable volumes over the 1 million hectares designated for forest management concessions and concluded that the actual volume would be in the range of 25–50% of the volume

calculated by the FDA and, moreover, that the 25-year felling cycle was too short to be sustainable.

It has been suggested that up to 500 000 hectares of community forest land, designated and recognized under the Community Rights Law, might be managed as carbon concessions in which commercial forestry operations would take place according to raised logging standards (Government of Liberia 2011).

Silviculture and species selection. There is a lack of silvicultural knowledge about Liberia's forests, and much of the documentation of research programs in the 1970s and 80s has been lost (FDA 2006). Neither the National Forest Reform Law, the national forest policy, nor the guidelines for forest management planning specify a silvicultural approach; rather, the silvicultural system to be employed is to be specified in each forest management plan. FMCs are issued for a period of 25 years, implying a felling cycle of the same duration; the bid document issued by the FDA for Forest Management Contract Area 'K' (which has a gross forest area of 267 000 hectares), for example, specifies a felling cycle of 25 years. The Liberian Code of Forest Harvesting Practices specifies cutting limits for a number of species based on dbh, as well as a range of post-harvesting requirements.

No recent information was available on the most commonly harvested species; Table 4, therefore, shows the species listed in ITTO (2006).

Planted forest and trees outside the forest.

The area of planted forest is about 9700 hectares, comprising mainly *Gmelina arborea*, *Tectonia grandis*, *Eucalyptus* spp, *Pinus* spp and a number of hardwood species. There are also important rubber estates over several thousand hectares on agricultural land, which are generally in poor condition (Blaser 2008). There are large areas of oil-palm plantations, most of which are not currently managed. The

current condition and stocking of most existing plantations is unknown.

Forest certification. No Liberian forests are certified (e.g. FSC 2010) and there has been no move to develop policies in this direction.

Estimate of the area of forest sustainably managed for production. At present, no forest can be considered to be managed sustainably (Table 5).

Timber production and trade. Total industrial roundwood production in Liberia was estimated at 360 000 m³ in 2009, compared with 280 000 m³ in 2004 and 766 000 m³ in 2002, and sawnwood production was estimated at 80 000 m³ (ITTO 2011). In 2009 the estimated value of exports of logs and sawnwood was US\$1.18 million, up from US\$295 000 in 2008 and only about US\$11 000 in 2007 (ibid.).

Liberia has four sea ports, all of which were damaged during the civil conflicts. The National Port Authority has fully renovated the port at Monrovia, and Mittal Steel is about to renovate the Buchanan port. The other two ports (Harper and Greenville) both need considerable investment if they are to facilitate timber exports (Blaser 2008).

Non-timber forest products. Fruits, roots, mushrooms, leaves, honey, snails and bush meat are all harvested from forests and used as food by local communities. Bush meat – harvested both legally (but unsustainably) and illegally – accounts for up to 80% of meat consumption in Liberia (Blaser 2008). The most commonly hunted species are antelope, deer and monkey. Gums, resins, medicinal plants and cola nuts (*Cola* spp) are marketed locally and serve as sources of income. An estimated 98% of Liberia's energy needs are met by fuelwood and charcoal.

Forest carbon. Gibbs et al. (2007) estimated Liberia's national forest biomass carbon stock at 506–707 MtC; Eggleston et al. (2006) estimated

Table 4 Commonly harvested species for industrial hardwood

Species	Notes
<i>Lophira alata</i> (ekki)	Largest quantity harvested; regenerates well in forests.
<i>Ceiba pentandra</i> (ghe)	From open areas; for veneer and plywood.
<i>Hallea ciliata</i> (abura)	General-purpose timber; from swampy areas.
<i>Entandrophragma candollei</i> (kossipo)	Used for flooring and furniture-making; difficult to regenerate.
<i>Gilbertiodendron preussii</i> (limbali)	Used for heavy carpentry and shipbuilding, etc; difficult to regenerate.

Source: ITTO (2006).

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

Reporting year	Natural					Planted		
	Total	Available for harvesting	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
2005*	1310	1310	0	0	0	-	0	0
2010	1700	1000	265**	0	0	9.7	0	0

* As reported in ITTO (2006).

** FAO (2010).

it at 1302 MtC and FAO (2010) at 585 MtC. The large tracts of land that became overgrown by bush and secondary forests during the civil conflicts are not counted in these estimates. Liberia has created a climate-change and REDD working group within the FDA. The FDA submitted a project idea note to the Forest Carbon Partnership Facility in 2008 and a readiness preparation proposal in March 2011. It is collaborating with Conservation International and the World Bank to develop a REDD+ strategy for the country. This is hindered, however, by the country's limited human-resource capacity in policy and research institutions and in civil society. Table 6 summarizes Liberia's forest carbon potential. Liberia has significant intact forest and potential for conserving existing carbon stocks through avoided deforestation.

Forest for protection

Soil and water. No areas have been designated as primarily for soil and water conservation.

Biological diversity. Biologically, Liberia is exceptionally diverse, with high rates of endemism. The country's forests serve as a sanctuary for almost half of the remaining forest in the Upper Guinean Forest Hotspot (one of 34 hotspots worldwide that represent areas with 75% of the planet's most threatened species). Liberia's forests are home to at least 2900 flowering plants, 240 timber species, 150 mammals, 620 birds and 125 reptiles and amphibians. Some of the well-known species, whose conservation depends to some extent on

Liberian habitat, include *Pan troglodytes* (western chimpanzee), *Ptilocolobus badius* (red colobus monkey), *Cercopithecus diana diana* (diana monkey), *Hexaprotodron liberiensis* (pygmy hippopotamus) and *Loxodonta africana cyclotis* (forest elephant). Fifteen mammals, ten birds, one reptile, four amphibians, one fish, eight arthropods and three plants found in forests are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species (IUCN 2011). One plant species (*Cyathea camerooniana*, a tree fern) is listed in CITES Appendix II (UNEP-WCMC 2011).

Protective measures in production forests. The Liberian Code of Forest Harvesting Practices prescribes a number of exclusion areas: protected areas; protected animal species habitat; areas susceptible to degradation (such as steep slopes); watercourses; and cultural and customary tenure areas. No trees may be felled within such exclusion areas or their buffer zones, and no machines may access them (except at designated watercourse crossings). The Code prescribes a number of other protective measures in production forests, such as directional felling, wildlife management within concession areas, and waste management.

Extent of protected areas. There are two main protected areas in Liberia: Sapo National Park (180 000 hectares) in the southeast and the East Nimba Strict Nature Reserve (13 600 hectares), which is less than 2% of the country's land area. Fauna and Flora International, other NGOs and the Government of Liberia developed a five-year 'action

Table 6 Forest carbon potential

Biomass forest carbon (MtC)	% total forest with canopy cover >60%	Deforestation/ degradation potential to 2030	Enhancement of carbon sink capacity to 2030	Forest area change monitoring capacity	Forest/ GHG inventory capacity	Importance of forest fire/ biomass burning	Engagement in international REDD+ processes
506–707	88	++	+	+	+	++	++

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

plan' for Sapo National Park in 2005. Although not strictly a management plan, this constitutes the extent of protection PFE under management plans shown in Table 7.

The Government of Liberia through the FDA has identified the Gola National Forest (Gbarpolu County), Wonegizi National Forest (Lofa County) and Lake Piso Basin (Grand Cape Mount and Bomi counties) as areas to be upgraded and incorporated into the national protected forest areas network.^a Consultative meetings with the citizens of Grand Cape Mount and Bomi counties about the creation of Lake Piso Multiple Use Protected Area are under way. Lake Piso, as well as the Mesurado and Marshall wetlands, have been declared as Ramsar sites (Spalding et al. 2010). Initial meetings have been held on the creation of a transboundary peace park that will coordinate the management of the Gola forests on both sides of the border between Liberia and Sierra Leone (Blaser 2008), and the park was launched by the presidents of the two countries in May 2009 (Gasana 2010).

A four-year GEF project titled Consolidation of Liberia's Protected Area Network was launched in May 2008. Managed by the FDA, it will assist with the development of a comprehensive approach to an expanded protected-areas network.

Estimate of the area of forest sustainably managed for protection. No protection PFE is considered to be under SFM (Table 7).

Socioeconomic aspects

Economic aspects. Long in tatters, the Liberian economy has started to grow. GDP grew by 2.6% in 2004 to 5.3% in 2005, 7.8% in 2006 and 9.5% in 2007. Nevertheless, poverty remains widespread: for example, 58% of households headed by professionals fall below the United Nations-designated poverty line of US\$1 per day.^a



The Forestry Training Institute, now the Anthony Sayeh Forestry Training Institute, in Monrovia, Liberia.

The government's poverty reduction strategy (PRS) is predicated on, among other things, exploiting Liberia's rich natural resource base (Government of Liberia undated). It predicted that forestry would be one of the main components of rural economic growth in the PRS period (April 2008–June 2011), contributing 14–15% of real GDP. Forestry production was projected to grow substantially by 2011 to more than 1.3 million m³, but this seems overly optimistic given that by late in 2009 logging had not recommenced. The predicted growth was based on the progressive reintroduction of commercial logging in all regions, and secondary and higher processing of logs was expected to become a significant source of value-adding and jobs from 2009 onwards.

In addition to the formal sector, informal forest-based activities play a vital role in the livelihoods of many Liberian citizens. Fuelwood and charcoal production employ numerous people and remain, by far, the most important energy sources in the country. Similarly, the harvesting and sale of bush meat and NTFPs make a significant contribution to local income and employment while providing a major share of protein in the average diet.

Livelihood values. About one-third of the population lives in forested areas and depends

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

Reporting year	Protection PFE	Attributed to IUCN categories I-IV	Allocated for soil and water	Protected areas with management plans	Sustainably managed
2005*	101	101	0	0	0
2010	194	97**	0	180	0

* As reported in ITTO (2006).

** UNEP-WCMC (2010).

on forests for housing and furniture materials, a variety of foods and traditional medicines, healthy watersheds for fish, clean water and soil, micro-climate stabilization and some cash income. Rural communities were particularly dependent on forests for subsistence during the recent civil strife. Thousands of people make their living from the provision of charcoal and fuelwood to urban centres (ITTO 2005). The traditional ‘Sande’ (females) and ‘Poro’ (male) (secret) societies that are of significant importance to rural communities conduct their rituals in certain groves and rivers within isolated forest areas.^a

Social relations. Until recently, local and traditional forest use and ownership rights had not been recognized in Liberia. Under the Johnson Sirleaf government, however, community involvement in forestry has become a major goal. The National Forestry Reform Law specifies the rights and responsibilities of communities with respect to the ownership and use of forest resources, and the Community Rights Law with Respect to Forest Lands further sets out those rights and responsibilities and specifies that forest lands 5001–49 999 hectares in size may be designated as community forest land that communities can use to generate revenue, including by logging. Although its stated objective is to empower local communities to fully engage in the sustainable management of Liberia’s forests, it has been criticized for weakening controls on the allocation and management of logging concessions (Global Witness 2009).

The government conducted intensive forest management outreach over several months prior to the final drafting of the National Forest Reform Law in 2006. The various regulations based on that law require public communication through radio and newsprint media, as well as consultation in affected communities. In practical terms, this means that communities in or around proposed timber concessions or protected areas must be fully consulted in an environmental and social impact assessment (Government of Liberia 2008). A similar process has been used recently to validate draft proposals for an expanded network of protected areas.

Summary

Deforestation appears to have increased in Liberia since the end of the civil conflicts as people return to rural areas. In addition to subsistence farming, a significant cause of forest degradation is chainsaw logging and associated pit-sawing, as well as other forms of uncontrolled logging. The Government of Liberia has adopted a new conceptual approach to the development of the forest sector, referred to as the principles of the three Cs – commercial, conservation and community forestry, and there is a new Community Rights Law with Respect to Forest Lands. Draft guidelines for forest management planning, and a log-tracking system, have been developed. As of July 2009, seven forest management concessions had been formally designated over an area of about 1 million hectares, but logging had yet to commence. Nevertheless, forest production is projected to grow substantially in the next few years as commercial logging is reintroduced.

Key points

- Liberia’s PFE covers an estimated 1.90 million hectares (compared with 1.41 million hectares in 2005), comprising 1.70 million hectares of natural-forest production PFE (compared with 1.31 million hectares in 2005) and 194 000 hectares of protection PFE (compared with 101 000 hectares in 2005).
- None of the PFE is currently considered to be under SFM. The existing protection PFE comprises about 4.5% of the lower estimate of total forest area.
- An embargo on the export of timber imposed by the United Nations Security Council in 2003 was lifted in October 2006.
- Liberia has a new forest policy and a new forest law (the National Forestry Reform Law) and is in the process of developing national-level PCI for SFM.
- Little is known about the potential impacts of climate change on Liberian forests. Liberia has significant intact forest and therefore potential for conserving existing carbon stocks through avoided deforestation.

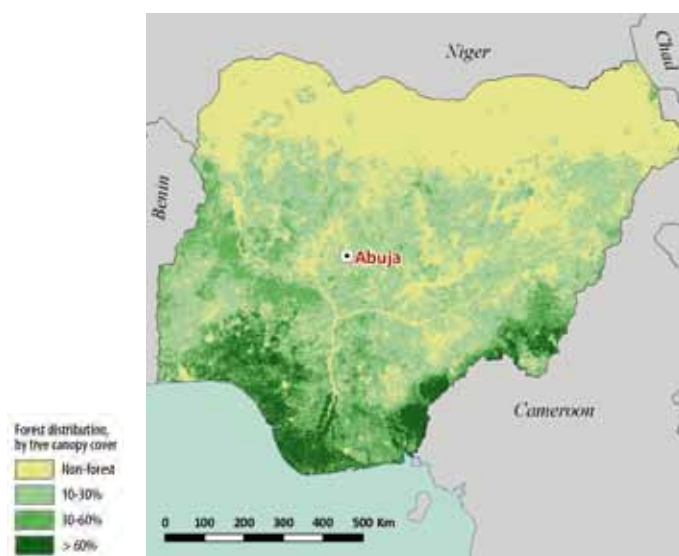
Endnote

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NIGERIA



Forest resources

Nigeria has a land area of 92.4 million hectares. It is Africa's most populous country, with an estimated population in 2010 of 158 million people, up from 141 million in 2005 (United Nations Population Division 2010). Nigeria is ranked 158th out of 182 countries in UNDP's Human Development Index (UNDP 2009). The climate is humid in the south and drier to the north. A large proportion of the country sits on a plateau, which is divided into three parts by the Niger River and its main tributary, the Benue. Mountain ranges, including some peaks above 2000 m, occur along the central and northern borders with Cameroon. There are two major vegetation zones: the forest zone, which occurs in a belt 50–250 km wide adjacent to the Atlantic coast; and a savanna zone to the north, which can be subdivided into the Guinea, Sudan and Sahel zones.

Based on a linear extrapolation of surveys from 1977 and 1994, FAO (2010) estimated forest cover in 2010 at 9.04 million hectares. Only a small part of this forest is lowland rainforest: even in the late 1990s it was estimated that only 1.19 million hectares of lowland rainforest remained in the country, only about 288 000 hectares of which was in official forest reserves.^b

Forest types. Nigeria's forest types comprise open tree savanna, mangrove and coastal forest, fresh water swamp and lowland wet forest. The

latter type (also called 'high forest') is divided into lowland rainforest in the south and mixed deciduous forest to the north. These forest types, although heavily degraded, are the main remaining sources of hardwood timber; there is an estimated 3.94 million hectares of lowland rainforest.^a Meliaceae and Leguminosae species such as *Khaya ivorensis* (Lagos mahogany), *Entandrophragma* spp, *Lovoa trichilioides* (cedar) and *Gosweilerodendron balsamiferum* (agba) are characteristic of the rainforest area, whereas Sterculiaceae, Ulmaceae and Moraceae species such as *Nesogordonia papaverifera* (otutu), *Triplochiton scleroxylon* (obeche), *Celtis* spp and *Chlorophora excelsa* (iroko) characterize semi-deciduous forests. The transitional area on the northern fringes of the forest zone has been heavily degraded by human activity and is now characterized by fire-tolerant savanna species such as *Parkia* spp, *Daniellia oliveri*, *Azzeria africana*, *Ceiba pentrandra* and *Butyrospermum paradoxum* (shea butter tree), some of which yield valuable products. Riparian (gallery) forests are the only closed forest in the savanna zone, characterized by species such as *Mitragyna ciliate*, *Lophira lancolata*, *Terminalia glaucescens* and *Uapaca* spp.

Nigeria has the largest extent of mangroves in Africa, with more than 730 000 hectares (Spalding et al. 2010). The largest areas are around the Niger delta, where they are found up to 40 km inland. The Niger delta constitutes one of the world's largest contiguous blocks of mangrove forest (ibid.).

Some of Nigeria's forests are so heavily degraded that secondary forest succession is impeded. *Elaeis guineensis* (oil palm) regenerates naturally in many degraded areas of the high-forest zone. Important secondary forest species in degraded forest and in unmanaged rubber and *Gmelina* plantations are *Trema guineensis*, *Pentaclethra macrophylla*, *Musanga cecropioides* and *Anthocleista* spp (ITTO 2006).

Permanent forest estate. In the 1960s the government set aside an area of 9.7 million hectares, about 10% of the country, as forest reserves. These were distributed over 445 sites, 75% of which were in the savanna and 25% of which were in the high forest. The total area available for harvesting in forest reserves in the seven 'productive' states (Cross River, Edo, Ekiti, Ogun, Ondo, Osun

Table 1 Permanent forest estate

Reporting year	Estimated total forest area, range (million ha)	Total closed natural forest ('000 ha)	PFE ('000 hectares)			
			Production		Protection	Total
			Natural	Planted		
2005*	9.7–13.5	4456	2720	375	1010	4105
2010	9.04	958**	2720‡	382†	2540§	5622

* As reported in ITTO (2006).

** Calculated using the ratio of forest with greater than 60% forest cover estimated by UNEP-WCMC (2010) (10.6%) and the total natural forest area as estimated by FAO (2010).

‡ Updated information was unavailable. Therefore, the estimate of ITTO (2006) is used here.

† FAO (2010).

§ UNEP-WCMC (2010).

and Oyo) is 3.92 million hectares^a; it is unclear, however, how much forest remains in these areas. More than 60% of the initial forest reserve area had been lost by 2000 due to agricultural encroachment, illegal logging, planned agricultural development and urbanization. No new data on the production PFE was available for this report. The estimate of protection PFE in Table 1 is taken from UNEP-WCMC (2010), which is similar to the estimate by FAO (2010). It indicates an increase since 2005 (which was based on an estimate by UNEP-WCMC in 2004), but this is most likely due to differences in assessment method rather than a real increase.

Forest ecosystem health

Deforestation and forest degradation. While it is apparent that Nigeria's forests have been declining in both extent and condition, no reliable data are available on the extent of forest loss or degradation. The change in forest area reported by FAO (2010) was calculated using a linear extrapolation of data from 1977 and 1994. By this method it was determined that the forest area declined from 13.1 million hectares in 2000 to 11.1 million hectares in 2005 and to 9.04 million hectares in 2010. On the basis of the data presented in FAO (2010), Nigeria lost 21% of its forest cover between 1990 and

2005, compared with the world average for that period of 3.3%.

FAO (2010) also reported that the area of primary forest declined from 326 000 hectares in 2005 to zero in 2010 (Table 2). There are likely to be small areas of intact forest, however. For example, owing to its rugged terrain, most of the Afi forest reserve (about 8500 hectares) in Cross River State is still primary forest.^a The main direct causes of deforestation and forest degradation are oil and gas exploitation in the coastal forests and shifting cultivation, fuelwood-gathering, charcoal-making, illegal logging and urbanization.

Vulnerability of forests to climate change.

The mean annual temperature in Nigeria has increased by about 0.2 °C over the past three decades (McSweeney et al. undated). Mean annual rainfall has decreased since the early 1960s, but it is difficult to determine whether this is part of a long-term trend. It is projected that the annual temperature will increase by 0.9–2.5 °C by the 2060s (ibid.), with warming most rapid in the northern, drier part of the country (Federal Ministry of Environment 2003). Since the forest area has been reduced dramatically in the past 50 years and most of the remaining forests are degraded, the ecosystem services performed by forests are greatly diminished.

Table 2 Forest condition

	PFE	Non-PFE	Total
	'000 ha		
Area of primary forest	0	0	0
Area of degraded primary forest	-	-	-
Area of secondary forest	-	-	8660*
Area of degraded forest land	-	-	-

* 'Naturally regenerated forest'.

Source: FAO (2010).

Nigeria's climate-change strategy includes a focus on forests and trees as an effective adaptation measure (Government of Nigeria 2010a). Forest-related actions include avoiding unregulated forest exploitation; the implementation of a national afforestation program using appropriate tree species to protect watersheds; and the development of agroforestry and organic farming as a means to help people to adapt to changing climatic conditions. The Ministry of Environment identified the biggest obstacles to climate-change adaptation as a lack of awareness and knowledge about the impacts of climate change.

SFM policy framework

Forest tenure. Forests are state-owned (Table 3). Forest reserves, which cover around three-quarters of the forest area, are held in trust for the people. Their management and control is vested in state governments, although dual ownership of natural forests by local and state governments still exists in the northern states. Thus, local governments are responsible for communal forest areas, state governments are in control of forest reserves, game reserves and sanctuaries, and national parks are under the control of the federal government.^a

Table 3 Forest area, by tenure

Ownership category	Total area	Of which PFE
	'000 ha	
State ownership (national, state or provincial government)	9040	5622
Other public entities (e.g. municipalities, villages)	0	0
Total public	9040	5622
Owned by local communities and/or Indigenous groups	0	0
Privately owned by individuals, firms, other corporate	0	0

Source: Based on the estimate of total forest cover and total PFE shown in Table 1.

Individuals or private organizations may occupy land on leases (usually 99 years), but only that which the occupier puts on the land belongs to the occupier. The government may withdraw authority to occupy land at any time, with appropriate compensation paid (FAO 2010). Tree tenure rights in communal areas are ascribed to the person who planted the tree or the person who uses the land on which the tree lies.^b

A total of 16 states (Abia, Akwa Ibom, Anambra, Cross River, Delta, Edo, Enugu, Ebonyi, Imo, Lagos, Ogun, Ondo, Ekiti, Osun, River and Bayelsa) contain high forests and have special forest laws to administer their tenure (ITTO 2006).

Criteria and indicators. Nigeria is a member of the ATO and, since 2001, of ITTO. The C&I frameworks of these two organizations are therefore available for uptake in Nigeria. With the support of the ATO/ITTO regional project, the Government of Nigeria finalized, in May 2010, the development of a national version of the ATO/ITTO PCI for the sustainable management of the country's natural forests, and conducted training in their use. The Government of Nigeria used the ITTO C&I in its submission to ITTO for this report.^a

Forest policy and legislation. Nigeria has had forestry and natural-resource conservation laws since the first half of the 20th century. The first Forestry Act was enacted in 1937, which established a forest reserve system under the state governments. A more comprehensive forest law was enacted in 1956 – the Law for the Preservation and Control of Forests in Eastern Nigeria. This gives the designated minister responsibility for the protection, control and management of forest reserves and protected areas and the power to de-reserve forests (i.e. re-classify them for other uses). Some states have enacted specific regulations to monitor and control the reserves, but the apparent high rate of deforestation suggests that overall control has not been effective.

Nigeria's national agricultural policy, adopted in 1988, set forth a national policy on forest management and the sustainable use of forest resources. The goal was to achieve self-sufficiency in all aspects of forest production. Major goals included the expansion of the forest estate and its management for sustained yield, the promotion of forest regeneration at rates higher than harvesting, the protection of forest resources from fire and grazing, and the development of forest industry. To achieve these objectives, it aimed to expand the forest estate from 10% to 20%. Nevertheless, de-reservation and deforestation expanded over the life of the policy (ITTO 2006).

A 2002 participatory review of the 1988 policy led to the approval (in 2006) of a new national forest policy, the first to stand alone and not be subsumed within the policy of another sector. A forest law that

has been in preparation for several years to provide legal backing to the new policy is yet to be passed, however (in August 2010 it was before the Federal Ministry of Justice before going to the National Assembly for approval).^a The policy review took into account changes in the present state of the forest sector in Nigeria and also addressed emergent global issues. The overall objective of the new policy is “to achieve sustainable forest management that would ensure sustainable increase in economic, social and environmental benefits from forests and trees for the present and future generation including the poor and vulnerable groups”.^a

An analysis of the new policy^b showed that it has some major points of departure from the old policy that could strengthen sustainable forest use and environmental protection. Unlike the old policy, the new policy focuses on creating the necessary environment to ensure the longer-term sustainability of forest resources. For example, it mandates the preparation and implementation of scientific forest management plans; stresses the importance of developing community-based forest protection and management; and urges the federal and state governments to increase revenue by valuing forest products at their true market value and tightening the control of harvest operations. It recommends special funding arrangements to support research and development and the expansion of the forest estate.

A comprehensive national land-use policy is under development. Among other things it contains an action plan for forestry and wildlife habitat development.

The four-year (2000–03) National Forestry Development Programme, which aimed to establish forest plantations through community participation, was approved for implementation by the National Executive Council. Due to the unavailability of funds, however, implementation was stalled and the program was extended to the next four years (2003–07). The extent to which it was implemented in that period is unclear.

Programs dealing with environmental management have been in constant flux, with negative consequences. For example, the federal Ministry of Environment (2001) stated that efforts to combat desertification “have been adversely affected by frequent shifts in policy by government. Such

policy shifts have been observed to be dictated by the country’s economic fortune or misfortune”.

Institutions involved in forests. The forest sector is administered at the federal, state and local government levels. Responsibilities, authority and resources are shared among these levels according to the 1999 Constitution, which gives control over the development of natural resources to local governments and the states. However, there is a lack of clarity in the respective mandates of the responsible bodies (there are 36 state forest departments and 774 local councils), which leads to inefficiencies.

The Federal Department of Forestry (FDF), created in 1970, is currently under the Ministry of Environment; it has no authority over forest management and is mainly responsible for international treaties and for providing policy guidelines to state forest authorities. The National Forestry Development Committee is responsible for formulating national forest policy and technical forest management guidelines. In order to facilitate field operations the FDF fosters forest and environmental development through six divisions: Forestry Management; Forest Resource Survey; Forest Resources Utilization; Agroforestry; Support Services and Extension; and Environmental Conservation. The Forestry Research Institute of Nigeria has a mandate for research and education on forestry and the use of forest products.

The University of Ibadan, the University of Agriculture and the Federal University of Technology, Akure provide training for forestry professionals.^a In 2008, 180 students (12% of them women) graduated with forest-related masters degrees, 400 students (12% women) graduated with forest-related bachelor degrees, and 560 students (12% women) graduated with forest technician certificates or diplomas (FAO 2010).

Forest-sector development has been hindered by a lack of funds and frequent policy changes, despite (or perhaps partly because of) the extensive bureaucracy involved in overseeing the sector (ITTO 2006).

Direct investment and reinvestment in forest management, administration, research and human resource development in 2009 by the federal government, sub-national governments, private sources and international governmental

sources were estimated at US\$19.2 million, US\$9.24 million, US\$800 000 and US\$650 000, respectively.^a In 2008 an estimated 13 100 people were employed in public forest institutions, including at the state level, 5320 of whom had university degrees or equivalent and 9% of whom were women (FAO 2010). An estimated 180 professional staff and 250 technical staff are employed in forestry in the federal government.^a

Several NGOs provide inputs to the management of forest resources. Notable among these are the Nigerian Conservation Foundation, the Nigerian Environmental Study and Action Team, Savannah Conservation Nigeria, the Forestry Association of Nigeria and local initiatives such as the Ekuri Initiative in Cross River state.

Status of forest management

Forest for production

According to FAO (2010), the available information on Nigeria's forests "is either obsolete or based on extrapolation from very old data. Nigeria falls short of the basic standard of acquiring regular and up to date data on the forest resources".

While many forest reserves were intensively managed in the past for timber production, a significant number has also been almost completely deforested while retaining the designation, leading to the apparent contradiction of non-forested forest reserves (ITTO 2006).

There are generally three types of logging operation in Nigeria:

- Small-scale operations that use chainsaw mills (accounting for more than half of the log volume taken from forests). Fees for this type of logging are usually assessed on a stumpage basis.
- Medium-sized operations that are usually an integral part of a medium-to-large industrial organization. This type of logging is usually organized by concessionaires and annual production generally amounts to 10 000–20 000 m³ per operation.
- Larger operations, also conducted by concessionaires, generally producing about 60 000 m³ per year.^b

According to Sanwo (2005), 70% of the total timber extracted in high-forest states in Nigeria

is stolen, with no records kept. The state forest departments have been unable to adequately protect the forest estate from encroachment.

The state allocation of timber resources has, since the 1970s, systematically moved away from long-term tenures to short-term (1–3 year) concessions. This prompted an exodus of large and sometimes foreign-owned concessionaires and now concessions are largely in the hands of small concessionaires. In off-reserve areas, communities have rights to trees and negotiate freely with timber operators for the sale of trees. Forest planning is minimal. Timber resources are generally allocated by discretion. In some states (e.g. Ondo and Edo), a committee screens applicants and forwards a list of registered concessionaires who meet statutory requirements to the commissioner for his final decision. In Ogun State, the allocation is administered directly by the commissioner. These allocations are not based on sound technical considerations but rather on political patronage.^b

An exception to how the state forest services are organized is in Cross River state, which is the only state to have established a forestry commission instead of a department within the ministries of agriculture or environment. The Cross River Forestry Commission is headed by a board comprising representatives of various stakeholders. Its most important difference compared to forest departments is its (semi-) financial autonomy. Due to a revision of state laws, the Forestry Commission is able to directly access part of the revenue generated from forests with which to manage its programs.^b

Silviculture and species selection. Initially, the forest resources in the high-forest zone were managed for timber production on a felling cycle of 100 years, with a specified minimum diameter limit for various species of 60–90 cm (FDF 1996). Forests in the southern and south-central regions were sub-divided into numbered mile-square compartments managed on the basis of working plans prepared by the FDF. In response to harvesting pressures, the felling cycle for natural forests was reduced to 50 years and has since been further lowered. Natural regeneration of the harvested forests was stimulated by the Tropical Shelterwood System (TSS). By the mid 1960s, 200 000 hectares in the western region of Nigeria was managed under the TSS. Owing to the low

Table 4 Commonly harvested species for industrial roundwood

Species	Notes
<i>Mansonia altissima</i> (ofun)	From southern deciduous forests.
<i>Tectona grandis</i> (teak)	Plantation timber.
<i>Terminalia superba</i> (afara)	Rare as large trees but regenerating in secondary forests.
<i>Entandrophragma candollei</i> (omu)	From natural forests, increasingly rare.
<i>Triplochiton scleroxylon</i> (obeche)	Timber from natural forests and agroforestry plantations.

Source: ITTO (2006).

growth rates of the natural forest, the TSS was abandoned in the early 1970s in favour of artificial regeneration under the *taungya* system. The early *taungya* plantations led to subsequent major plantation schemes in the high-forest zone (ITTO 2006).

More than 300 tree species have been identified as possible timber species; about 40 were reportedly being harvested on a significant scale in 2005 (ITTO 2006). In addition to the five species listed in Table 4 and *Gmelina arborea* from planted forests, *Entandrophragma cylindricum* (sapele), *Gossweilerodendron balsamiferum* (agba), *Chlorophora excelsa* (iroko), *Terminalia ivorensis* (edo), *Brachystegia* spp and *Lophira alata* (ekki) are common species harvested for timber (ITTO 2006), although recent information was unavailable for this report.

Planted forest and trees outside the forest. The estimated planted forest area of 382 000 hectares in 2010 (FAO 2010) was thought to comprise at least 168 000 hectares of *Gmelina arborea* and teak. Other planted hardwood species include *Terminalia ivorensis*, *Nauclea diderrichii*, *Triplochiton scleroxylon*, acacias and eucalypts, and about 10 000 hectares of various pines (Okonofua 2005). However, the estimate by FAO (2010) is based on a linear extrapolation of past establishment rates.

Many of the planted forest areas are being harvested today, but few of them are adequately managed for long-term production (ITTO 2006).

The Presidential Initiative on Afforestation for Economic and Environmental Sustainability was launched in 2008 with a focus on promoting indigenous forest species and an overall target of expanding national forest cover by 25% in ten years. To finance afforestation the government recently directed that 60% of the Ecological Fund¹

should be used for the massive afforestation of the country as a sign of a firm commitment to the attainment of sustainable forest development in Nigeria. Towards this end, the first tranche of 5 billion naira has been released to the Ecological Fund Office for the first phase of the program for upgrading forest nurseries and raising 1 million tree seedlings in each of Nigeria's 37 states for planting in the 2011 planting season.³ In addition, about 400 hectares of new plantations have been established in degraded forest reserves in ten states in the last two years.^a

Forest certification. No Nigerian forest has so far been certified (e.g. FSC 2010), and no certification initiative in the country has been reported.

Estimate of the area of forest sustainably managed for production. The Government of Nigeria (2010) reported that 3.45 million hectares of production forest were under management plans (an area significantly greater than the total production PFE), on the basis of reports from state forestry departments, but the status of these management plans is unclear, and no data for this parameter are shown in Table 5. A lack of detailed information makes it difficult to estimate the area of forest under active management and to assess the quality of that management. The only area of forest for which available information suggests a sustainable regime is the Ekuri community forest in Cross River state.

Timber production and trade. The total fuelwood production in 2005 was estimated at 70.4 million m³ (FAO 2010). Nigeria's total production of industrial roundwood was estimated at 7.10 million m³ in 2009, although this figure is repeated from previous years and its accuracy is unclear (ITTO 2011). On the other hand, the Government of Nigeria (2010) reported an average annual sawnwood harvest of 7.52 million m³ in the PFE and 1.98 million m³ in other forest. An estimated 2.0 million m³ of sawnwood, 56 000 m³ of

¹ The Ecological Fund was established in 1981 by the Government of Nigeria to address the serious ecological problems facing the nation.

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

Reporting year	Natural					Planted		
	Total	Available for harvesting	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
2005*	2720	1060	650	0	-	375	175	0
2010	2720	1060**	- †	0	33†	382	-	0

* As reported in ITTO (2006).

** As reported in ITTO (2006). No new data were available for the present report.

† Government of Nigeria (2010) reported that 3.45 million hectares were under management plans, but the extent to which these are operational is unclear.

‡ The Ekuri community forest in Cross River state.

plywood and 1000 m³ of veneer were produced, and about 64 000 m³ of logs and 163 000 m³ of sawnwood were exported (ibid.).

The Nigerian industrial forest sector comprises about 2000 sawmills of various sizes, ten plywood mills, two functional paper mills, eight safety-match factories and four particleboard mills. The sector is producing at 30–40% of installed capacity. The rate of recovery in the sawmilling sector is lower than 40%, partly because of the use of obsolete machines designed for the conversion of large-diameter logs. Most sawmill owners are unable to replace their machines with more modern equipment suited to the changing nature of the resource. The forest fees and tariffs levied on standing timber or cut logs are very low. Combined with a protectionist policy (i.e. a log export ban), this reduces timber prices and so contributes to inefficiency and waste in the logging and industrial processes – they may be profitable while being totally inefficient.^b

In 2009 the total value of exports of primary industrial wood products was US\$28.2 million (up from US\$22.8 million in 2004 but down from US\$53.9 million in 2002) and the total value of imports was US\$11.4 million (up from US\$800 000 in 2004 and US\$1.76 million in 2002) (ITTO 2011).

Non-timber forest products. Marketed NTFPs include *Acacia senegal* (gum arabic), rattan and fibres such as *Raphia* spp, *Garcinia afzelii* (chewsticks), and sheabutter from nuts of *Vitellaria paradoxa* (syn. *Butyrospermum parkii*). Many NTFPs are locally traded and consumed by rural communities, including leaves (eg *Abura* spp), fruit, bark, nuts, honey, mushrooms, resins, canes and medicinal plants such as *Garcinia* spp. Bush meat is perhaps the most important NTFP, providing a source of protein for rural people in isolated

high-forest areas and in the savanna zone. Plants that provide edible products are *Irvingia gabonensis*; *Spondias mombin* and *Dacryodes edulis*; *Gnetum africanum* leaves as vegetables; the seeds of *Parkia biglobosa* (dawa-dawa); and the nuts of *Cola* spp. Fruits of oil palm and *Raphia* spp are used widely for palm wine. No national data are available on the volume or value of the harvest of any of these products.

As forests become increasingly degraded, competition for NTFPs becomes fiercer and market failures and the absence of clear property rights result in the non-management of those resources (FAO 2001). Ecological services provided by the forest include protection from erosion, floods and desertification, the regulation of stream flow, wildlife habitat, the protection of biodiversity, carbon sequestration, and microclimatic benefits, among others. These ecological services have not been evaluated and are rarely considered in policy decisions.^b

Forest carbon. Gibbs et al (2007) estimated the national-level forest biomass carbon stock at 1278–1805 MtC, Eggleston et al. (2006) estimated it at 3952 MtC and FAO (2010) estimated it at 1085 MtC. Due to past deforestation, Nigeria has relatively limited potential for avoiding deforestation. On the other hand it has considerable potential to sequester carbon through forest restoration (Table 6). In 2010 Nigeria established the Nigerian Climate Change Commission within the federal Ministry for the Environment. The Commission will address issues related to environmental pollution, erosion, deforestation, desertification and climate change and has prepared a national climate-change policy and legislation. REDD+ is a key concern in Nigeria's climate-change negotiation strategy at the UNFCCC. In mid 2010 Nigeria was granted observer status

Table 6 Forest carbon potential

Biomass forest carbon (MtC)	% forest with canopy cover >60%	Deforestation/ degradation potential to 2030	Enhancement of carbon sink capacity to 2030	Forest area change monitoring capacity	Forest/ GHG inventory capacity	Importance of forest fire/ biomass burning	Engagement in international REDD+ processes
1278–1805	11	++	+++	+	+	++	++

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

at UN-REDD. The Nigeria REDD+ readiness program was submitted to the UN-REDD Policy Board in March 2011. It focuses on Cross River State, which contains about 50% of the remaining rainforests in Nigeria and is rich in biodiversity.

Forest for protection

Soil and water. An estimated 57 300 hectares of forest are managed primarily for the protection of soil and water.^a No further information on measures to conserve soil and water was available for this report.

Biological diversity. Twenty mammals, seven birds, twelve amphibians, one reptile, ten arthropods and 68 plants found in forests are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species (IUCN 2011). Two plant species are listed in CITES Appendix I and 25 in Appendix II (UNEP-WCMC 2011).

Protective measures in production forests.

The principal constraints on conservation in the production PFE are poaching, over-harvesting, illegal burning, grazing and deforestation. Few protective measures are undertaken in forest reserves (ITTO 2006).

Extent of protected areas. The federal government controls Nigeria's eight national parks through the National Parks Service. Nature conservation laws include the Wild Animals Preservation Act (1916) consequently modified and adopted by the states), the Endangered Species Decree (1985) and the Land Use Act (1976). According to UNEP-WCMC (2010), 2.54 million hectares of forest are in IUCN protected area categories I–IV; while this is likely an over-estimate, in the absence of other data it is used in this report to represent the area of the protection PFE.

The first national park, Kainji Lake, was established in 1973; the Chad Basin, Cross River, Gashaka-Gumti, Old Oyo and Yankari national parks in

1993; and the Kamuku and Okomu national parks in 1999. Five of these national parks are located close to borders with neighbouring countries, suggesting potential for transboundary conservation. The Cross River National Park, for example, borders Cameroon's Korup National Park. A transboundary conservation initiative in the region could help to address illegal logging, and unsustainable hunting and NTFP extraction, all of which are prevalent in the area (Eniang et al. 2010). A successful challenge by the Government of Cameroon in the International Court over the location of the border has also led to the unauthorized shifting of boundary markers by local people (ibid.).

Some national parks have been degraded by logging, grazing, burning and the hunting and smuggling of primates, all of which are illegal within park boundaries.

The NGO Pro-Natura International (Nigeria) recently announced a project in collaboration with the Nigerian Conservation Foundation and several donors in the Omo-Oluwa-Shasha Forest in southwestern Nigeria with the aim of protecting the forest from further degradation. Project activities include capacity-building, an investigation into alternative livelihood approaches, and the development of a REDD+ initiative (Pro-Natura International 2011).

Estimate of the area of forest sustainably managed for protection. Given the lack of clear information on what is happening in the field, the generally widespread problems of degradation, illegal logging, poaching and encroachment, and the lack of data on management plans and their implementation, no area of protection PFE is considered to be under SFM (Table 7).



A forest-dependent family near Abeokuta, Nigeria.

Socioeconomic aspects

Economic aspects. Although forests are important for domestic energy, food and medical supplies, these are not fully reflected in formal national accounts. Officially, the forest sector contributed 2.5% to Nigeria's GDP in 2008 and 3% (US\$692 million) in 2009.^a

A major problem facing Nigerian forestry is inadequate funding. In 1993 the federal government urged state governments to pay 10% of forestry revenues into a trust fund for forest management, but only a few state governments have implemented this proposal. The setting and collection of forest revenues is at the discretion of state governments and sometimes local communities, so there are large variations, by region, in the fees charged (ITTO 2006).

Livelihood values. Forest products, particularly NTFPs, support the subsistence of local communities: an estimated 48 million people depend significantly on forest resources for their livelihoods. Sustainable rural-based programs to stabilize ecosystems and diversify products in order to meet the continuing needs and livelihoods of forest-dependent communities are being carried out in some states as pilot projects, although no information on these is available.^a

Social relations. The sharing of benefits from forest activities between state governments and local communities varies from state to state. State governments are supposed to share a percentage of any revenues collected from forest activities outside forest reserves (on average 25–40% of revenues in the savanna and 30–35% in the closed forest) with local communities, but this is often

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

Reporting year	Protection PFE	Attributed to IUCN categories I-IV	Allocated for soil and water	With management plans	Sustainably managed
2005*	1010	1010	-	-	-
2010	2540	2536**	-	-	-

* As reported in ITTO (2006).

** UNEP-WCMC (2010).

not done in practice (ITTO 2006). Nevertheless, in many FMUs communities have used royalty payments to develop, renovate and upgrade basic local infrastructure such as schools, health centres, roads and markets, and also to provide training on alternative livelihood options such as bee-keeping, snail-rearing, livestock, tree-crop nursery raising, and improved crop husbandry for cash crops such as cocoa and oil palm.^a

The continuing decline and degradation of forest resources in Nigeria suggest that the relationship between local communities and forest administrations is not conducive to forest conservation and SFM in most of the high-forest states of Nigeria (ITTO 2006). Community-based forest management is pursued in only one state, Cross River.^a

Summary

One of the obstacles to SFM identified in 2005 was the lack of reliable forest data. There appears to have been little improvement in this regard since then; even estimates of forest cover are derived using deforestation rates that are up to two decades old. It is unclear how much forest remains in what was set aside in the 1960s by government as forest reserves. A new forest policy with several positive features was approved in 2006, but the law to implement the policy is yet to be passed. Despite the apparently poor and worsening state of Nigeria's forests, an estimated 48 million people depend significantly on them for their livelihoods. Chainsaw milling accounts for more than half the log volume harvested. Illegal logging is reportedly high. State forest administrations are generally severely under-resourced, although the Cross River Forestry Commission has direct access to part of the revenue generated from forests with which to finance its programs. Since 2008 a national afforestation program has been under way with an ambitious target for expanding national forest cover. Nigeria has a relatively limited potential for avoiding deforestation. On the other hand it has considerable potential to sequester carbon through afforestation and forest restoration.

Key points

- Nigeria has an estimated PFE of 5.62 million hectares (compared with 4.10 million hectares in 2005), comprising 2.72 million hectares of natural production forest (the same as estimated for 2005), 2.54 million hectares of protection forest (compared with 1.01 million hectares in 2005), and 382 000 hectares of planted forest (compared with 375 000 hectares in 2005).
- Data are generally weak. Increases in estimates of the PFE are most likely due to differences in assessment method rather than real increases. A forest reserve system to be managed by state governments was created in 1937, but the extent to which forest reserves are still forested is unclear.
- An estimated 33 000 hectares of the production PFE is under SFM. No forest is certified, and no part of the protection PFE is under SFM.
- A new national forest policy was approved in 2006. The Presidential Initiative on Afforestation was launched in 2008, and funds were made available to encourage afforestation.
- The wood-processing industry is characterized by outdated technology, poor recovery and inefficiency.
- There is a lack of awareness in Nigeria about the potential impacts of climate change, including with respect to forests. Nigeria has considerable potential for carbon capture and storage through forest restoration and afforestation, if forest governance can be improved.

Endnotes

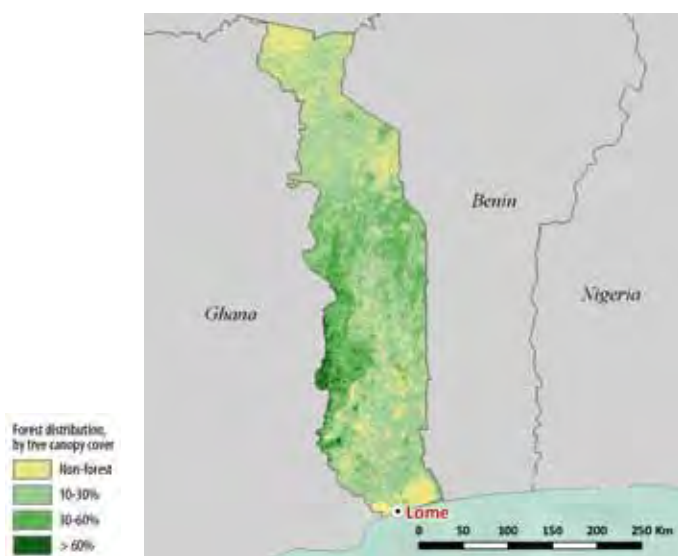
- a Government of Nigeria (2010b).
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TOGO



Forest resources

Togo lies north of the Gulf of Guinea in West Africa. It has a land area of 5.68 million hectares and an estimated population in 2010 of 6.8 million people (United Nations Population Division 2010). Togo is ranked 159rd out of 182 countries in UNDP's Human Development Index (UNDP 2009). The country is characterized by a narrow east–west extension of between 50 and 150 km and a longer length from north to south of about 600 km. There is an extensive inland plateau, rising from 60 m to 450 m in altitude towards the north and the Atakorian Mountains in the west. The highest peak (Mount Agou) reaches an altitude of 986 m. There is little forest in Togo. FAO (2010a) estimated the forest area at 486 000 hectares in 2000 and 386 000 hectares in 2005 and extrapolated the forest area to 287 000 hectares in 2010. The Government of Togo estimated the extent of open forests and planted forests at 511 000 hectares in 2009^a; in addition there are about 1.18 million hectares classified as bush and tree savanna.^a Togo also has an estimated 11 000 hectares of mangroves.

Forest types. Originally only about 17% of Togo was forested.^a The country has lost nearly 50% of its forests since 1990, mainly to subsistence agriculture. Apart from fragments of closed semi-deciduous forests and degraded semi-deciduous forests in the southwest (which

cover less than 120 000 hectares), there are only a few small islands of dry forests (*forêts denses sèches*) in southern and central Togo (less than 30 000 hectares) and gallery forests along watercourses.^a The majority of the forest is in a forest–savanna mosaic (about 320 000 hectares), which extends from the Guinean vegetation zone into the Sudanian vegetation zone. On the plateau, dense savanna forests are characterized by *Ceiba pentandra*, *Daniellia oliveri* and *Butyrospermum paradoxum*. Further north, *Khaya senegalensis* and *Prosopis africana* predominate, along with the palm *Borassus aethiopum*. There are stands of semi-deciduous closed forest in the mountains (about 40 000 hectares), with *Antiaris africana* and *Chlorophora excelsa* among the most typical species. Togo has only about 50 km of coastline, which is mostly sandy with some lagoonal waters where mangroves are rare. In total, Togo has less than 1000 hectares of mangroves, which occur in small patches near the border with Benin (Spalding et al. 2010).

Permanent forest estate. No distinction is made in Togo between production PFE and protection PFE; harvesting is undertaken in all areas, even in officially protected areas (ITTO 2008). Togo's PFE consists of 83 forest areas, including 71 classified forests (*forêts classées*, estimated at 217 000 hectares), two national parks (357 000 hectares) and ten wildlife reserves (218 000 hectares). Of the total theoretical PFE of 792 000 hectares, large areas are either very open forests or deforested. About one-third of the PFE is estimated to be completely without forest cover and the remaining area consists of heavily degraded and secondary forests and human-induced savanna dominated by *Ceiba pentandra*.^a UNEP-WCMC (2010) estimated the forested protected area (with 30% and more crown cover) at 368 000 hectares; this estimate is used in Table 1.

Forest ecosystem health

Deforestation and forest degradation. Because of its small forest area and the continuing pressures on it, Togo has one of the world's highest rates of deforestation, losing an estimated 5.75% (20 000 hectares) of its forest estate per year (FAO 2010b).

Table 1 Permanent forest estate

Reporting year	Estimated total forest area, range (million ha)	Total closed natural forest ('000 ha)	PFE ('000 hectares)			
			Production		Protection	Total
			Natural	Planted		
2005*	0.5-1.09	368	41	14	313	368
2010	0.5-1.68**	287	0	15†	368	383

* As reported in ITTO (2006).

** The higher figure includes an estimated area of 1.179 million hectares of bush and tree savanna.

† FAO (2010a). In addition to state-owned plantations there are an estimated 21 000 hectares of privately owned plantations, which are not considered to be part of the PFE (ITTO 2008).

Most of the deforestation appears to be occurring in wetter areas, where forests are important for watershed protection. The major threats to the scarce remaining dense forests include uncontrolled fire (the main cause of deforestation in non-PFE forest), excessive fuelwood harvesting, shifting cultivation, and illegal cutting of the few remaining commercial tree species. In addition, in the past 35 years the frontier of cotton plantations (in particular in the southern zone around the forest of Abdoulaye and in the western Tchilla-Monota forest area) has advanced at the expense of forest. There is no primary forest left in Togo (Table 2). More than one-third of the forest in forest reserves has been converted to agricultural uses.

Vulnerability of forests to climate change.

Togo's climate varies from humid tropical to tropical savanna. Togo finalized its NAPA in September 2009, according to which climate change is projected to increase average monthly temperatures by 1–1.25 °C on a south–north gradient. These warmer temperatures are projected to be accompanied by a drying trend, which would have a major impact on various economic sectors. The main climate-related risks identified in Togo are flooding, drought, altered distribution of rain, late rains, violent winds and coastal erosion. Across the country, climate change could increase the incidence of drought, wildfire and flooding. The most vulnerable ecosystems are coastal ecosystems, agricultural ecosystems and some of the remaining

natural forest areas (Government of Togo 2009a). Uncontrolled forest fires already occur regularly in the latter stages of the dry seasons and cause additional damage to degraded forest areas.

SFM policy framework

Forest tenure. According to the 2008 Forest Code, there are three types of forest tenure: the public forest domain (*domaine forestier de l'Etat*), which includes forest reserves; the collective forest domain (*domaine forestier des collectivités territoriales*) and private forest (*domaine forestier des particuliers*) (Table 3). Closed forests and dense tree savanna are generally part of the public forest domain. In all forest reserves, user rights exist for local communities (as per the colonial forest code of 1938, articles 12–18, and reconfirmed by the 2008 Forest Code).

The new collective forest domain comprises those forest lands that have been legally classified as such. Communes, prefectures and regions have territorial authorities (*collectivités territoriales*), which have legal status and financial independence under Law 98/006 (amended in 2001). They have responsibilities in the management of state lands and on environmental issues. Communes and prefectures generally have a keen interest in the management of forest reserves.

Villages adjacent to forest reserves generally have a village development committee (*comité villageois*

Table 2 Forest condition

	PFE	Non-PFE	Total
	'000 ha		
Area of primary forest	0	0	0
Area of secondary forest and degraded primary forest	287	-	287
Area of degraded forest land*	- *	407**	407

* Most of the former forest land has been converted to agriculture and is now considered as such.^a

** Degraded since 1990 (derived from FAO 2010a); most of this land is now productive agricultural land.

Source: Government of Togo (2010).

de développement – CVD), which attempts to ensure that local interests are accommodated in the use of forest reserves and is responsible for the management of committed forests. Outside the reserves, all trees and plantations belong to local communities and private citizens, with little control from the state (ITTO 2006). Such off-reserve forests provide most of the forest products sold locally.^a

Criteria and indicators. Togo participated in the C&I processes of ITTO, Dry-zone Africa and ATO/ITTO, but no adequate C&I framework for SFM has yet been developed for local conditions. No strategic plan or actions are foreseen beyond securing forest reserves from further conversion and encroachment. The Government of Togo used the ITTO C&I in its submission to ITTO for this report^a, and a national validation meeting of the C&I report was convened in March 2010.

Forest policy and legislation. Until 2008, forest use was regulated by the 1938 forest code and the 1988 environmental code. A new forest code was approved by parliament in June 2008 (Law 2008/009), as was a new law on the environment (Law 2008/005). The 2008 Forest Code addresses issues of participation, SFM, ecological security and the role of the forest industry in the framework of sustainable development. It specifies the definition of the national forest domain; rules for classifying and declassifying forests and for forest management planning; and the institutionalization of local management through the creation of CVDs.^a Although CVDs have been assigned management authority over forests, overall responsibility for natural resource management has mostly remained with the central Ministry for Environment and Natural Resources (*Ministère de l'Environnement et des Ressources Forestières* – MERF).

The national environmental policy of 1998, completed in 2001 as the National Environmental Action Plan (*Plan National d'Action pour l'Environnement* – PNAE), is the most important policy framework for forests. A project to develop a specific forest policy, initiated in 2000, was never concluded. In December 2009, the Declaration of a National Forest Policy was submitted to the government for approval. This declaration canvasses a participatory approach to forest management and greater decentralized responsibility in managing forests; the division of tasks between local stakeholders and the state; the principles of sustainably managing forest resources; the valorisation of biodiversity; the recognition of the role of forests in climate change; and the organization of the forest sector. The new forest policy was to be prepared through a consultative approach in 2010. In December 2009 the Government of Togo approved a declaration on a national policy for land-use management (*Politique Nationale d'Aménagement du Territoire*) that encompasses environmental management, rural economic development and social integration. The forest policy will need to be consistent with this recently initiated policy process.

Institutions involved in forests. MERF was reorganized in 2008 (under Decree 2008/090PR) to create a central service and decentralized units, coordinated by a Secretary General.^a The central service comprises three general directorates: Environment; Forest Resources; and Common Programmes. The Office for Forest Development and Harvesting (*Office de Développement et d'Exploitation des Forêts* – ODEF), which was attached to MERF, was also reorganized and is due to be changed from an 'office' to a

Table 3 Forest area, by tenure

Ownership category	Total area	Of which PFE	Notes
	'000 ha		
State ownership (national, state or provincial government)	-	-	<i>Domaine forestier de l'Etat</i> (not clear in extent).
Other public entities (e.g. municipalities, villages)	-	-	<i>Domaine forestier des collectivités territoriales</i> (not clear in extent).
Total public	-	369	The distribution of forest between the two categories <i>domaine forestier de l'Etat</i> and <i>domaine forestier des collectivités territoriales</i> needs to be clarified.
Owned by local communities and/or Indigenous groups	281		
Privately owned by individuals, firms, other corporate		27	<i>domaine forestier des particuliers</i> ; includes privately owned forest plantations (mainly teak) and other areas.

Source: Government of Togo (2010).

semi-governmental organization supervised by a board. Nevertheless, by mid 2010, none of the legally decided changes had been installed and the former organization (as described in ITTO 2006) was still functional.^a ODEF is responsible for the management of forest reserves, forestry extension, harvesting and reforestation.^a Following the 2008 institutional reform, four new organizations have been created with a mandate attached to MERF: the National Forest Development Fund (*Fonds National de Développement Forestier*); the National Agency for the Management of the Environment (*Agence Nationale de Gestion de l'Environnement*); the National Fund for the Environment (*Fonds National de l'Environnement*); and the National Commission for Sustainable Development (*Commission Nationale du Développement Durable*). In 2010 MERF employed 1213 staff, substantially more than in 2005 (937 people); 550 have specialized functions in the management of forest resources, 20 have university degrees and 73 are high-level technicians.^a

The University of Lomé and the Togo Agricultural Research Institute (*Institut Togolais de Recherche Agronomique*) have mandates in forest-based research. The country's only forestry training institute, *Institut National de Formation Agricole*, in Tové, was closed between 1990 and 2004 but restarted in 2006 to train agricultural technicians with specialization in forestry. A post-graduate course in natural resource management is planned to start in 2011 at the Agricultural University (*Ecole Supérieure d'Agronomie*).

No major international NGO works in forest-related areas in Togo, but a considerable number of civil-society and national NGOs are engaged in local forest development, generally organized in regional federations. Three groupings have some influence on forest development: the *Consortium des ONG en matière d'Environnement au Togo* (COMET), a consortium of NGOs dealing with the environment; ROSCTOCC, a Togolese network of civil-society organizations concerned with climate change; and REBIOTOG, a network concerned with biodiversity (ITTO 2008). There has been a general trend towards wider public participation in the management of forests. Communities and NGOs are often involved in protecting forests, such as from fire (through *brigades de feux de brousse*).

Status of forest management

Forest for production

The rural population traditionally depends on forests and trees for fuelwood, fodder, timber and other forest products. This heavy dependence generates great pressure on forests. Most of the 71 remaining forest reserves are heavily degraded and are deforested to a great extent.

For more than 20 years, no long-term concession contract (*permis de coupe conventionnée*) has been allocated because there are no commercially exploitable forests left in Togo. Today, timber-harvesting rights are assigned (through cutting permits – *permis de coupe spéciale*) to individuals and collectives for small-scale timber harvesting or the cutting of single trees. There are no forest management prescriptions (e.g. pre-inventory of diameter limits) for this type of timber harvesting (*cahier de charges*); harvesting is based simply on the availability of sizeable trees in a given area. Thus, even official timber operations are done with complete informality (ITTO 2008). The only obligation of a timber operator is to pay a forest tax (which for the time being is not centralized) and to submit to passive control by the forest service. Such a procedure is convenient to the operator, who does not need to follow rules and is thus able to maximize profits. It is also open to misuse and risks the development of a petty corruption system among officials. Conflicts arise where local communities exercise their traditional land rights. Should this system continue, the scarce remaining timber resources are likely to be completely depleted within a short time.

Silviculture and species selection. Timber harvesting takes place in some forest reserves, in savanna and in planted forests; trees outside forests are also harvested. Silvicultural rules do not exist to manage natural production forest. A large array of species is used for timber, but no data are available about the volume harvested. Besides those listed in Table 4, the most commonly harvested timber and fuelwood species from degraded and secondary forests are *Azelia africana*, *Albizia* spp., *A. zygia*, *Alstonia congensis*, *Anogeissus leiocarpus*, *Ceiba pentandra*, *Cola cordifolia*, *Daniellia oliveri*, *Dichostachys glomerata*, *Dialium guineense*, *Harungana paniculata*, *Isobertia doka*, *Lophira alata*, *Macaranga spinosa*, *Malacantha alnifolia*, *Parkia biglobosa*, *Prosopis Africana*, *Pterocarpus*

Table 4 Commonly harvested species for industrial roundwood

Species	Notes
<i>Tectona grandis</i> (teak)*	From planted forests; annual production about 40 000 m ³ , including state forests and private plantations.
<i>Khaya grandifolia</i> (acajou)*, <i>Pterocarpus</i> spp, <i>Pterocarpus erinaceus</i> (véne), <i>Chlorophora excelsa</i> (iroko)*, <i>Antiaris africana</i> (ako)*, <i>Triplochiton scleroxylon</i> (ayous)*	20–30 additional species are also harvested in natural forests and savanna. The harvest volume is unknown. One species (<i>Pterocarpus erinaceus</i>) is currently exported by a Chinese trader with an indicative volume of about 3500 m ³ per year. ^a

* Also listed in ITTO (2006).

Source: Government of Togo (2010).

erinaceus, *Pycnanthus angolensis*, *Terminalia superba*, *Trichilia africana* and *Uapaca heudelotii*.

The most important commercial tree species is *Tectona grandis* (teak) from planted forests and roadside plantings. Teak was introduced in 1910 and has become well adapted to the country; it is known commercially as ‘Togo teak’. The species regenerates naturally in Togo and is used widely in agroforestry plantations, as street trees and in commercial planted forests. ODEF has developed a silvicultural system to induce natural regeneration and this is practised in some of the older teak stands.

Planted forest and trees outside the forest.

Planting new forests and trees is possibly the only way for Togo to address some of its biggest environmental problems, such as deteriorating watersheds and freshwater supply, climate change, and increasing shortages of fuelwood, timber and NTFPs. Nonetheless, the development of new plantations is hampered by a lack of knowledge, a shortage of funds and a high level of insecurity with respect to land tenure and the use and frequency of forest fire. Between 1970 and 2009, about 38 000 hectares of forest plantations were created, including 24 000 hectares outside the PFE by individuals and private firms (ITTO 2008). The main planted species is teak (estimated at more than 18 000 hectares). The planned planting rate of teak is 300 hectares per year, mainly on agricultural land using the *taungya* system (ITTO 2006). This

planting rate is generally considered inadequate to meet the timber needs of the country; a rate of 2000 hectares per year of industrial plantations would be needed to meet domestic requirements for construction timber alone (ITTO 2006).

Forest certification. There is no certified forest in Togo (e.g. FSC 2010). Both state and private teak plantations have potential for certification, but most of the harvested timber is exported to markets where there is little demand for certified timber.

Estimate of the area of forest sustainably managed for production. About 7000 hectares of teak and eucalypt plantations (state and privately owned) have some sort of management and harvesting plan (Government of Togo 2010, ITTO 2008). As there is no production PFE and harvesting occurs in all kinds of forests, including protected areas, no forest can be considered to be under SFM (Table 5).

Timber production and trade. Total roundwood production was estimated at 6 million m³ in 2008 (FAO 2010a). In 2009 Togo produced about 123 000 m³ of industrial roundwood (ITTO 2010), predominantly teak – the public sector alone produced about 27 000 m³ of teak per year between 2006 and 2008.^a Log production has fluctuated in the last decade, declining from 314 000 m³ in 1999 to 65 000 m³ in 2004 before recovering slightly (ITTO 2010). No data are available on the volume of timber harvested by the informal sector (ITTO 2008).

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

Reporting year	Natural					Planted		
	Total	Available for harvesting	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
2005*	41	41	5.5	0	5.5	14	1.2	0
2010	0	0	0	0	0	15	7	0

* As reported in ITTO (2006).



Five-year-old private teak plantations in Togo in a *taungya* system.

Nearly all of Togo's wood exports are in the form of logs. An estimated 95 000 m³ were exported in 2009, up from only about 12 000 m³ in 2004. The major export species was teak, but 3500 m³ of *Pterocarpus* were also recorded.^a The main export destinations are in Asia, including India, Pakistan and China.^a Timber products from neighbouring countries (mainly Ghana) are traded in the Togo market but are also exported from the free port of Lomé. Trees harvested in the savanna, including teak, limba, ayous, ceiba and cola, are providing an increasing share of the raw materials for local sawmills (ITTO 2006). There are more than 200 depots for construction wood, many of them of an informal nature.^a Commercial fuelwood and charcoal production is estimated about 2 million m³ per year (ITTO 2006).

Non-timber forest products. Forest fragments harbour a variety of plants that are used in daily living or as a supplemental source of income.

Fruits, roots and medicinal plants are collected but are no longer available in the required quantities or qualities. The three spices mostly used in Togo are the seeds of *Monodora myristica* (false nutmeg) and the fruits of *Piper guineense* (African pepper) and *Xylopia aethiopica* (Guinean pepper); each has commercial value in Togo (Kokou et al. 2005). Bush meat is the most important NTFP in forest reserves. Another considerable source of income, although illegal, is the collection of wild reptiles for export. At least 18 reptile species are produced in animal farms for export, in particular *Python regius* (royal python) but also chameleons (*Chamaeleo gracilis*, and *C. senegalensis*), big lizards (*Varanus niloticus* and *V. exanthematicus*) and turtles (e.g. *Kinixys belliana*, *K. erosa* and *K. homeana*).

Forest carbon. Togo has one of the lowest national forest carbon stocks in sub-Saharan Africa. Gibbs et al. (2007) estimated the total forest biomass carbon stock at 145–252 MtC and Eggleston et al. (2006) estimated it at 510 MtC. Togo has not participated in any of the forest carbon initiatives in REDD+ or in afforestation and reforestation projects through the CDM. In March 2011, however, the country began preparing a REDD+ strategy with the support of the ITTO Thematic Programme on Reducing Deforestation and Forest Degradation and Enhancing Environmental Services (REDDES). Togo has considerable potential for the enhancement of carbon sinks through reforestation and agroforestry activities and increased efficiency in the use of forest biofuels. Togo participates actively in the UNFCCC climate-change adaptation program. The Government of Togo (2009a) listed forests as an important adaptation measure in its national reporting to the UNFCCC. Table 6 summarizes Togo's current forest carbon potential.

Forest for protection

Soil and water. While soil and water protection is a major objective of forest management in Togo,

Table 6 Forest carbon potential

Biomass forest carbon (MtC)	% forest with canopy cover >60%	Deforestation/ degradation potential to 2030	Enhancement of carbon sink capacity to 2030	Forest area change monitoring capacity	Forest/ GHG inventory capacity	Importance of forest fire/ biomass burning	Engagement in international REDD+ processes
145–252	2	+	++	+	+	+++	+

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

no forest is set aside primarily for the protection of soil and water.^a An estimated 5700 hectares of protection plantations was established between 2000 and 2007 in forest reserves (e.g. Kara – 362 hectares; Namon – 413 hectares; Asrama – 338 hectares; and Avétnou – 1100 hectares), the objectives of which expressly include the protection of soil and water resources.^a

Biological diversity. Togo contains considerable biological diversity due largely to its ecological diversity (ranging from savannas in the north to humid tropical forests in the southwest). There are at least 3085 plant species, 228 mammal species, 708 bird species, 156 reptile species and 42 amphibian species (Government of Togo 2009b). Mammals that once occurred in Togo but have largely or entirely disappeared include the chimpanzee, the red-bellied monkey, the Diana monkey, the African lion and the wild dog (ibid.). Six mammals, two amphibians and one arthropod found in forests are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species (IUCN 2011). One plant species is listed in CITES Appendix I and three are listed in Appendix II (UNEP-WCMC 2011).

Protective measures in production forests.

Provisions are made in the 2008 Forest Code to prohibit logging on slopes susceptible to erosion as well as for the protection of streams, springs and watersheds. None of these measures is implemented effectively, however.

Extent of protected areas. Estimates of Togo's protection PFE are highly uncertain because none of the protected areas is effectively delineated or the demarcation is no longer recognizable^a; moreover, it is unclear how much of these areas are still forested. According to UNEP-WCMC (2010), 368 000 hectares of forest are in protected areas conforming to IUCN protected-area categories I–IV, and this figure is used as a proxy for the protection PFE. The main problems of protected-area management

Box 1 Bird-watching in Togo

In Togo, small forest areas, such as the classified forest of Missahoe and the adjacent classified forest of Damétui, may have surprising assets. The Missahoe–Damétui forest, for example, is a heavily degraded semi-deciduous forest dominated by *Antiaris africana* and *Chlorophora excelsa*. It only covers an area of about 5000 hectares, yet it is catalogued by Bird Watch International as an excellent spot for bird-watching.

Source: www.birdlife.org/index.html.

in Togo is the encroachment of parks by the local population, in particular for subsistence agriculture; fuelwood cutting and poaching; and the lack of means for participatory management planning with local stakeholders. Togo's fourth assessment report to the CBD on its biodiversity (Government of Togo 2009b) estimated that at least 125 000 hectares of officially protected areas are encroached.

Estimate of the area of forest sustainably managed for protection.

In general, insufficient data were available for an estimate to be made on the area of protection PFE under SFM. Missahoe, the site of a former ITTO project area, is also supported by Birdwatch International and IUCN Netherlands. It constitutes the only forest area known to be under management consistent with sustainability, as shown in Table 7. Nevertheless, the community in this area needs further support in its efforts to maintain the integrity of their forest.

Socioeconomic aspects

Economic aspects. The contribution of the forest sector to GDP was about 3.5% annually in the period 2006–08^a, although this estimate does not account for informal activities (especially related to wood energy). Since 2000 there has been modest

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

Reporting year	Protection PFE	Attributed to IUCN categories I–IV	Allocated for soil and water	With management plans	Sustainably managed
2005*	313	61	200	-	-
2010	368	368	200	5	5**

* As reported in ITTO (2006).

** Missahoe and the adjacent Damétui classified forest (see Box 1). But there is a need to further support the community in its efforts to maintain the integrity of the heavily degraded forest.

Box 2 Sacred forests

A special role for biodiversity conservation can be attributed to sacred forests, in particular in the human-populated region of southeast of Togo (see also Kokou et al. 2005). Sacred forests are scattered throughout the semi-deciduous forest fragments and range in size from less of one hectare to tens of hectares. Inventories have shown that these forests are a last refuge of many tree and fauna species. They are considered an important part of the heritage in the riparian villages, as they are sometimes useful catchment areas for rivers and provide NTFPs. With the decreasing social and economic cohesion, however, sacred forests are increasingly under threat.

private investment in teak plantations on private land. The formal private enterprise employs about 1000 salaried full-time and part-time workers. It is estimated that forestry provides about 90 000 jobs in the informal sector, 77% of them for women and children, many in commercial fuelwood collection and charcoal-making (ITTO 2006).

Livelihood values. The few existing forests are often considered by rural people as the only available reserves of land. Therefore they are heavily encroached upon and claimed for subsistence production. Forest reserves provide an important source of protein for people living in rural areas. Forests are also a place of ritual and spiritual significance for many ethnic groups.

Social relations. The participation of local stakeholders in forest decision-making and management is not well-developed. Where a functional working relationship exists (e.g. in Missahoe through a number of projects), effective partnerships between local population and the forest authorities can be established.

Summary

Togo faces numerous environmental challenges, including a growing population, poverty, and an imbalance between the consumption of resources and the rate of restoration. Forest-sector plans and programs give little consideration to the environmental and social dimensions of management. The most visible signs of

environmental deterioration are deforestation and degradation; desertification; soil erosion in all forms and all ecological zones; the sedimentation of lakes and waterways; the salinization of the coastal sedimentary basin; a generalized drop in water quality; a loss of soil fertility; and biofuel shortages. The main difficulty in protecting and managing forests in Togo is the heavy pressure on them from an impoverished rural population. The Ministry for Environment and Natural Resources is in charge of forests but capacity is low. This affects many forestry operations through, for example, the failure to secure the integrity of classified forests and forest protected areas and the inability to enforce forest laws and regulations. Progress is slow in forest restoration and reforestation.

Key points

- Togo has an estimated PFE of 383 000 hectares (compared with 368 000 hectares in 2005), comprising 15 000 hectares of state-owned forest plantations (compared with 14 000 in 2005) and 368 000 hectares of protection forest (compared with 313 000 hectares in 2005).
- There is no natural-forest production PFE and therefore no natural-forest production PFE under SFM. An estimated 5000 hectares of protection PFE (an area also used for production) is sustainably managed.
- There is no regulated forest industry in Togo. Timber and fuelwood harvesting is occurring in all forests, irrespective of their legal status.
- Togo has the highest relative forest loss in Africa. The main direct threats to forest resources are uncontrolled fire; excessive harvesting for fuelwood; agricultural encroachment; illegal cutting; and poaching and hunting.
- A process is ongoing to reclassify forest reserves and protected areas and to develop collaborative forms of management.
- The Government of Togo adopted a new forest policy in 2008 and is developing a wider forest and environmental policy that aims to increase the participation of local people in forest and natural resource management. Support by the international community would greatly assist in the implementation of this forest-reform process.

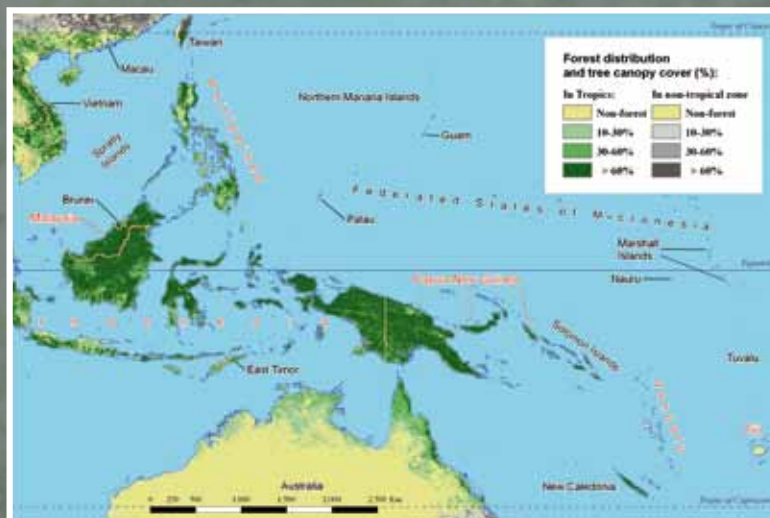
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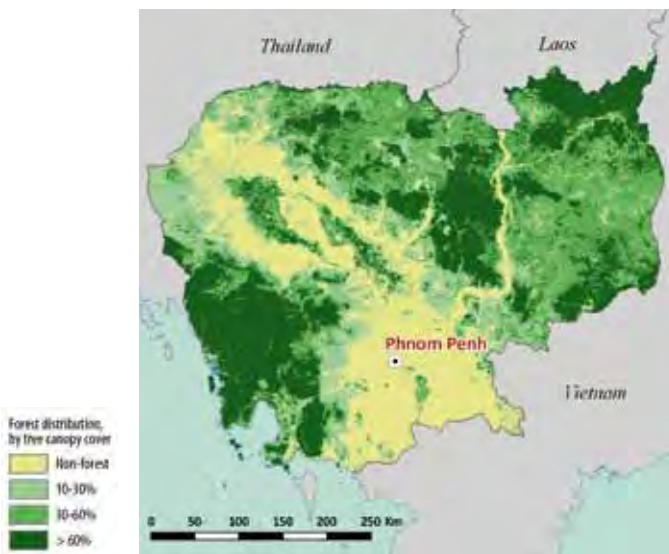
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CAMBODIA



Forest resources

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

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

- Evergreen forest – 3.67 million hectares, with the main characteristic species *Dipterocarpus dyeri*, *D. corbatus*, *D. alatus*, *Anisoptera cochinchinensis*, *Hopea* spp, *Roherea vulgaris* and *Syzygium* spp.

- Semi-evergreen forest – 1.36 million hectares, composed of deciduous dipterocarps such as *Dipterocarpus intricatus*, *D. obtusifolius* and *Shorea obtusa*.
- Deciduous forest – 4.69 million hectares, composed of deciduous dipterocarps such as *Dipterocarpus intricatus*, *D. obtusifolius* and *Shorea obtusa*.
- Wood shrubland (dry) – 37 000 hectares, wood shrubland evergreen – 96 000 hectares, and bamboo – 36 000 hectares.
- Other forest – 971 000 hectares, including 73 000 hectares of mangroves (Spalding et al. 2010).

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

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

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

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

Table 1 Permanent forest estate

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

* As reported in ITTO (2006).

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

‡ FAO (2010).

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

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

Forest ecosystem health

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

An estimated 322 000 hectares of primary forest remain in Cambodia, but no data were available on the area of degraded primary forest, secondary forest or degraded forest land (Table 2). Slash-and-burn agriculture, forest land encroachment and land-grabbing are the main causes of forest fire.^a Issues related to forest fire are generally considered

to be a low priority in the country (Fuels and Fire Behaviour Research Capacity Building Project 2008).

Vulnerability of forests to climate change.

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

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

Table 2 Forest condition

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

SFM policy framework

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

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

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

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

Table 3 Forest area, by tenure

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

Source: Government of Cambodia (2009b).

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

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

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

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

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

Box 1 Forests in national planning

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

Source: *Gurung et al. (2011)*.

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

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

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

In mid 2007 a partnership between Cambodia and the National Forest Programme Facility was established to strengthen the implementation

capacity of the national community forestry program; promote the development of technologies that support community livelihoods and the responsible governance of forest resources management; and seek opportunities to integrate tree seed genetic conservation into community forestry.¹

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

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

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

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

Status of forest management

Forest for production

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

¹ www.nfp-facility.org.

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

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

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

The hasty introduction of the concession system in 1994 caused widespread damage to the forest. Field inspections and observations indicated that “the state of the current concession forest management is alarmingly at odds with the goal of sustainability” (World Bank 2000). There was no reliable assessment of resources and the processing facilities set up had significant over-capacity. The period 1994–1998 was also one of uncontrolled illegal logging, and wood extraction soon reached unsustainable levels (ITTO 2006). Attempts to get the concessionaires to manage their forests sustainably and pay more taxes did not meet with success. Most companies continued to log high-value species as quickly as possible, without following the prescribed 25-year harvesting cycle (the nominal duration of the concession). The recommended level of harvest was an average of 10 m³ per hectare, but this would scarcely have been economically viable and concessionaires typically harvested four to five times that amount (ibid.).

Between 1994 and 1997 the government granted 36 commercial forest concessions covering about seven million hectares or around 70% of Cambodia’s forests. In this way, the government sought to raise much-needed revenue for national

development. Foreign timber companies started investing from late 1994, peaked in 1996, and the last concession was granted in 1997. In 1998 the government began to restructure the sector through the Forestry Reform Program supported by the World Bank. In 2000 the Forest Administration stipulated that no cutting permits would be issued until 100% inventories of current annual coupes had been completed, 5% inventories had been carried out for the next four annual coupes, and the companies had made the required minimum royalty payments (ITTO 2006).

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

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

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

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



Shifting cultivation in Cambodian evergreen forests.

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

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

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

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

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

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

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

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

in major towns and prices were stable, an indication that the effect of the logging ban had been to stimulate a significant illegal timber industry (ITTO 2004).

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

Planted forest and trees outside the forest.

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

Table 4 Commonly harvested species for industrial roundwood

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

* Also listed in ITTO (2006).

Source: Government of Cambodia (2009b).

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

Reporting year	Natural					Planted		
	Total	Available for harvesting	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
2005*	3460	3370 (suspended)	150	0	0	17	7	0
2010	3710	5**	150†	0	0	69	-	0

* As reported in ITTO (2006).

** Annual bidding coupes issued by the Forest Administration. In addition, MAFF has issued small-scale harvesting permits, but the area covered by these is unreported.

† Although the Government of Cambodia (2009b) reported that 6.24 million hectares of forest were under management plans, the nature and status of those management plans is unclear. Therefore, the estimate reported in ITTO (2006) is repeated here.

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

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

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

Timber production and trade. Recorded wood production in Cambodia fell when forest concessions were cancelled or suspended; industrial log production was estimated to have been constant at 118 000 m³ per year in the period 2005–09, compared to 130 000 m³ in 2004 and 291 000 m³ in 1999 (ITTO 2011). The recorded timber is obtained from government-approved land conversion activities and from annual bidding coupes. As indicated above, however, illegal logging was reportedly significant, at least in the mid 2000s. The reported volume of timber exports was small in 2009, comprising 3450 m³ of logs and 17 000 m³ of sawnwood (ibid.).

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

In 2005 an estimated 559 tonnes of bamboo, 185 tonnes of liquid resin and 4.5 tonnes of rattan were harvested in forests (FAO 2010).

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

Forest for protection

Soil and water. There are laws, rules and regulations (eg the 2003 Law on Forestry, Royal decrees 1993 and 1999, and sub-decrees 75, 76 and

Table 6 Forest carbon potential

Biomass forest carbon (MtC)	% forest with canopy cover >60%	Deforestation/degradation potential to 2030	Enhancement of carbon sink capacity to 2030	Forest area change monitoring capacity	Forest/GHG inventory capacity	Importance of forest fire/biomass burning	Engagement in the international REDD+ processes
957–1914	39	++	+++	+	+	++	+++

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

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

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

Source: Government of Cambodia (2009b).

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

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

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

Protective measures in production forests.

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

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

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

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

Reporting year	Protection PFE	Attributed to IUCN categories I-IV	Allocated for soil and water	With management plans	Sustainably managed
2005*	4620	3360	4200	-	-
2010	4530	4050^a	551^{**}	1490^a	-

* As reported in ITTO (2006).

** FAO (2010).

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

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

Socioeconomic aspects

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

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

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

The country's community forestry program has increased in scope and size since 1992. A sub-decree on community forestry management (Sub-decree 79, 2 December 2003) provides for an increase

in the number (and area) of community forests and encourages local communities to participate in SFM. The Forest Administration is committed to increasing the area of community forests to a total of 2 million hectares (Government of Cambodia 2009a), up from the 145 000 hectares that are currently covered by community forestry agreements involving 124 communities (although the Forest Administration 2010 reported that there were 377 community forestry areas covering 348 000 hectares). In 2004 the government established a community forestry office within the Forest Administration; this office supports the establishment of community forests and is in charge of developing the national community forestry program (Government of Cambodia 2009a).

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

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

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

Summary

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

Key points

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

Endnotes

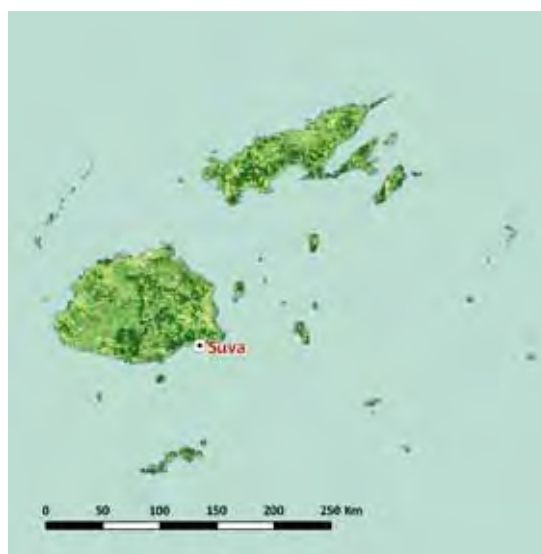
- a Government of Cambodia (2009b).
- b ITTO estimate.

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FIJI



Forest distribution,
by tree canopy cover

- Non-forest
- 10-30%
- 30-60%
- > 60%

Forest resources

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

Forest types. The predominant forest type is tropical rainforest, which occurs mainly on the eastern sides of Viti Levu and Vanua Levu. Small

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

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

Forest ecosystem health

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

Table 1 Permanent forest estate

Reporting year	Estimated total forest area, range (million ha)	Total closed natural forest ('000 ha)	PFE ('000 hectares)			
			Production		Protection	Total
			Natural	Planted		
2005*	0.82–0.93	747	0	113	241	354
2010	1.014	566	0	176	43a	219

* As reported in ITTO (2006).

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

Table 2 Forest condition

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

* Other naturally regenerated forest.

Source: FAO (2010a).

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

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

SFM policy framework

Forest tenure. There are three types of land tenure in Fiji: freehold, stateland and native land. The freeholder exclusively and privately owns the freehold title and may dispose of it as he or she pleases. Stateland comprises Schedule A, Schedule B, State Freehold, State Foreshore and Stateland without Title. Schedule A and Schedule

B land is held by the state in trust for Indigenous landowners. Fijian communal units, commonly referred to as ‘landowning units’, own native land. These may be in the form of a *yavusa* (tribe), *mataqali* (clan), *tokatoka* (family unit), the chief in his titular position or descendants of a chief or lady (Native Land Trust Board – NLTB – 2010). Such units own 89% of unexploited forests and 84% of all Fijian forests, including planted forests (ITTO 2006). For the latter, companies (mostly government-owned) lease the land from its Indigenous owners but own the trees.

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

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

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

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

Table 3 Forest area, by tenure

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

Source: FAO (2010a).

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

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

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

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

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

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

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

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

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

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

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

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

A number of NGOs are active in Fiji, including Nature Fiji, IUCN, Conservation International and Wetlands International. The University of the South Pacific and the Fiji National University

provide training and other capacity-building. The Secretariat of the Pacific Community/GTZ provides some technical support.^a

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

Status of forest management

Forest for production

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

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

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

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

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

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

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

More species than the obligatory 22 are used in production and trade. The most readily available

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

Planted forest and trees outside the forest.

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

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

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

Table 4 Commonly harvested species for industrial roundwood

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

Source: ITTO (2006).

The main planted hardwood species, *Swietenia macrophylla* (mahogany), is managed by FHCL. Mahogany plantations also began in the early 1950s and the expansion of establishment had grown to around 1000 hectares a year by the mid 1960s. The program virtually stopped in 1971 because of widespread attack by the ambrosia stem borer but resumed after a few years with the development of successful containment measures (ITTO 2006). The annual sustainable production of mahogany is estimated at about 100 000 m³. FHCL has had recurring financial difficulties, with the Fiji government needing to provide guarantees to enable the company to source capital from the domestic financial market. Stringent monitoring of the financial performance by government is necessary to raise the level of returns on the government's equity in FHCL and to ensure the financial viability of the company (Government of Fiji 2006).

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

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



Mangrove forest, Fiji. © S. Baba

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

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

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

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

Reporting year	Natural					Planted		
	Total	Available for harvesting	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
2005*	0	-	-	-	-	113	90	0
2010	0	-	6.3**	0	6.3**	176	68†	0

* As reported in ITTO (2006).

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

† Mahogany plantation.

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

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

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

The estimated industrial roundwood production in 2009 was 466 000 m³, of which 300 000 m³ was softwood from pine plantations (ITTO 2011); this was similar to the estimated 470 000 m³ of total industrial roundwood production in 1999 (ibid.). In 2009 Fiji produced 90 000 m³ of sawnwood (down from 96 000 m³ in 2004 but up from 64 000 m³ in 1999), 9000 m³ of veneer and 11 000 m³ of plywood, and it exported 10 000 m³ of sawnwood and 2200 m³ of plywood (ibid.).

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

Non-timber forest products. NTFPs are of great importance, especially to rural communities. Many

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

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

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

Forest for protection

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

Table 6 Forest carbon potential

Biomass forest carbon (MtC)	% forest with canopy cover >60%	Deforestation/ degradation potential to 2030	Enhancement of carbon sink capacity to 2030	Forest area change monitoring capacity	Forest/ GHG inventory capacity	Importance of forest fire/ biomass burning	Engagement in international REDD+ processes
80–100	No data	+	+	-	+	+	-

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

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

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

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

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

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

Socioeconomic aspects

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

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

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

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

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

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

Reporting year	Protection PFE	Attributed to IUCN categories I–IV	Allocated for soil and water	With management plans	Sustainably managed
2005*	241	3	18	37	55
2010	43	43	304	-	-

* As reported in ITTO (2006).

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

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

Summary

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

Key points

- Although Fiji has no formal PFE, some forests have equivalent status. The PFE, therefore, is estimated at 219 000 hectares (compared with 354 000 hectares in 2005), comprising 176 000

hectares of planted production PFE (compared with 113 000 hectares in 2005) and 43 000 hectares of protection PFE (compared with 241 000 hectares in 2005).

- About 6300 hectares of the natural production forest (although not part of the PFE) is considered to be sustainably managed. No estimate was possible of the area of protection PFE so managed.
- Fiji has about 176 000 hectares of planted forests, mostly comprising the high-value species *Swietenia macrophylla* (mahogany) and *Pinus caribaea*; an estimated 100 000 m³ of mahogany is harvested annually.
- The timber industry is inefficient, but the government is working to improve wood-processing skills. Portable sawmills have been introduced to communities to enable them to saw small logs. The timber sector employs about 8% of the Fijian workforce.

Endnote

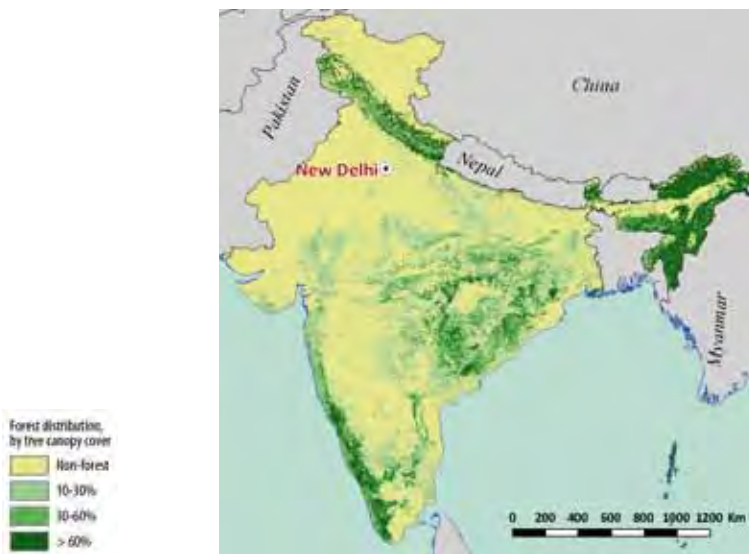
- a Government of Fiji (2010).

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INDIA



Forest resources

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

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

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

FSI (2009) also contains information on forest area by state and territory; the total tropical forest

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

Legally proclaimed and gazetted forest is classified as:

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

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

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

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

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

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

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

2005 (46.1 million hectares), but the protection PFE was nearly 6 million hectares smaller (19.8 million hectares).

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

Forest ecosystem health

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

Table 1 Permanent forest estate

Reporting year	Estimated total forest area, range (million ha)	Total closed natural forest ('000 ha)	PFE ('000 hectares)			
			Production		Protection	Total
			Natural	Planted		
2005* (all India)	64.1–76.8	22 500	13 500	32 600	25 600	71 700
2010** (tropical)	37.8	23 100[‡]	26 160	5600[†]	4540[§]	36 300

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

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

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

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

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

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

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

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

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

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

magur) and also the big-head carp are known to have had an adverse impact on native fish diversity.^b

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

Vulnerability of forests to climate change.

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

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

SFM policy framework

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

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

Table 2 Forest condition

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

Note: Data are for all India.

* 'Other naturally regenerated forest'.

Source: FAO (2010).

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

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

This lack of coordination in land-use planning is compounded by complexities in land tenure. The lack of systems to avoid or resolve land-use conflicts is evident in the frequent reporting of corruption in land dealings, especially in peri-urban areas as cities expand and formerly arable and forest lands are converted to housing lots and industrial plots. The regulation of de-reservation and the excision of notified forests under the Forest (Conservation) Act, 1980 makes ad hoc diversion into other

land uses almost inevitable in areas where there is strong competition for land. These diversions in land use are covered by state forest department *pattas* (land-use leases of defined periods such as five or ten years), similar to the agricultural leases granted by the Revenue Department. The state forest departments are hampered in defending the boundaries of notified forests by outdated ways of valuing forest resources (according to out-of-date royalty values, not by total economic value) which prevail at both the state and central levels (ibid.).

Table 3 Forest area, by tenure

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

Note: Data are for all India.

Source: RRI (2009). FAO (2010) reported 58.0 million hectares of forest in public ownership and 9.70 million hectares in private ownership.

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

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

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

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

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

State governments generally have the freedom to manage forest resources on the basis of forest management plans. Under the Forest Conservation

Act, 2003, however, state governments must obtain prior approval from the national government for any forest clearance for non-forestry purposes (ITTO 2006a).

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

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

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

implemented through a three-tiered institutional structure:

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

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

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

Certain provisions in the Recognition of Forest Rights Act are unclear and appear to be in conflict with existing legislation related to forest and wildlife.^b In November 2009, the Campaign for Survival and Dignity³ (2010a) made the following statement regarding the Act: “Passed in December 2006, the ... Act was hailed as a historic step towards recognising the rights of forest dwellers and correcting a gross injustice. Almost three years later, it is clear that the government has no intention of allowing it to be implemented.” Overall, it seems that the Act is proving difficult to implement (Dash 2010).

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

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

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

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

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

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

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

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

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

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

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

Status of forest management

Forest for production

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

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

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

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

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

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

Silviculture and species selection. Several silvicultural systems are prescribed in the working plans for Indian natural forests, varying according to the ecological potential of the dominant timber species. They include a selection system in the wet evergreen and semi-evergreen forests; a shelterwood system in coniferous forests and certain types of

moist deciduous forests; and gap felling and coppice management in dry deciduous forests. Table 4 lists some commonly harvested species of natural-forest tropical hardwoods. Others include *Adina cordifolia*, *Albizia lebbek* (kokko), *Cedrela toona*, *Gmelina arborea* (gamari, yemane), *Grewia* spp, *Pterocarpus* spp and *Xylia xylocarpa*.

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

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

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

Table 4 Commonly harvested species for industrial roundwood

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

* Also listed in ITTO (2006a).

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



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

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

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

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

ITTO (2006a) estimated that 9.72 million hectares of the production PFE (all India) were being managed under regular working plans, of which at least 4.8 million hectares were considered to be sustainably managed. This area comprises forest reserves that have been managed according to working plans for more than 30 years. No

information has been received for the current report to indicate a change in this situation; therefore, the 2005 estimate is assumed to apply in 2010 (Table 5).

Timber production and trade. About 50% of India's wood supply is provided by non-forest sources and the rest is accounted for by imports and the supply from public forests, mainly planted forests. India's official total roundwood production in 2005 was 307 million m³, of which 261 million m³ (85%) was fuelwood (FAO 2010), although only about 55.1 million m³ was from forests. India produced 20.3 million m³ of non-coniferous tropical hardwood logs in 2009, unchanged from 2004 but considerably more than the 14.0 million m³ produced in 1999 (ITTO 2011). Non-coniferous tropical sawnwood production was estimated at 4.89 million m³ in 2009, non-coniferous tropical veneer production was estimated at 270 000 m³ and tropical plywood production was estimated at 2.13 million m³ (ibid.).

In 2009 India imported about 3.0 million m³ of non-coniferous tropical logs (ibid.), mainly from Malaysia, Myanmar and, increasingly, Africa. The total value of imports of primary timber products (industrial roundwood, sawnwood, plywood and veneer) in 2009 was US\$1.47 billion (ibid.). According to ITTO (2004), the Indian timber market is not well organized, reducing timber's competitiveness against substitute products.

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

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

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

Reporting year	Natural					Planted		
	Total	Available for harvesting	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
2005* (all India)	13 500	13 500	9720	0	4800	32 600	8150	0
2010	26 160** (tropical)	16 800 (tropical)	16 800† (tropical)	0	4800†	5600‡	-	0.68

* As reported in ITTO (2006a).

** Natural and planted forest.

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

‡ All India.

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

Table 6 Forest carbon potential

Biomass forest carbon (MtC)	% tropical forest with canopy cover >60%	Deforestation/ degradation potential to 2030	Enhancement of carbon sink capacity to 2030	Forest area change monitoring capacity	Forest/ GHG inventory capacity	Importance of forest fire/ biomass burning	Engagement in international REDD+ processes
5085–8560	13	+	+++	+++	+++	++	+

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

around 1.7 billion tonnes of CO₂e (Government of India 2010a). On the other hand, India's forests sequestered 67.8 million tonnes of CO₂ in 2007 (ibid.). Gibbs et al. (2007) estimated the national-level forest biomass carbon stock at 5085–8560 MtC, but FAO (2010) estimated it at only 2800 MtC.

India's National Action Plan on Climate Change contains a 'National Green India Mission', which aims to double the area of afforestation and forest restoration in the next ten years to 20 million hectares, which would result in an increased sequestration rate of 43 million tCO₂e annually (Government of India 2010b).

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

Forest for protection

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

Biological diversity. India is one of the twelve megadiverse countries, hosting 7% of the world's biodiversity and supporting 16% of its major forest types. Twenty-three mammals, four reptiles, two amphibians, 20 fish, 16 arthropods and 209 plants found in India's tropical forests⁴ are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species (IUCN 2010). Twelve plants are listed

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

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

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

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

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

Socioeconomic aspects

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

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

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

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

Reporting year	Protection PFE	Attributed to IUCN categories I–IV	Allocated for soil and water	With management plans	Sustainably managed
2005*	25 600 (all India)	3060 (tropical)	-	-	-
2010 (tropical)	4540	4540	4540^b	722	722

* As reported in ITTO (2006a).

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

Summary

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

Key points

- The estimated 36.3 million hectares of India's tropical PFE comprises 31.8 million hectares of production forest and 4.54 million hectares of protection forest.
- While India appears to be adding forest cover, natural forest continues to be lost or degraded.
- An estimated 4.8 million hectares of India's production PFE and an estimated 722 000 hectares of India's tropical protection PFE is under SFM.
- In many states, forest departments lack the capacity to deal effectively with the problems facing the sector, and forest law enforcement is often inadequate.
- Information on the extent and management of forests is fragmentary and often unreliable.
- Forest management is becoming increasingly decentralized and community-based approaches are becoming more common.

- A national afforestation program was initiated in 2000 and operates at the level of forest divisions within states through forest development agencies and village forest committees.
- India's wood-based industries face a serious scarcity of raw materials and are increasingly dependent on non-forest and external sources. The country has become a major importer of tropical timber, particularly logs.
- A very large number of people (up to 7.5 million people) are in forest-related employment, and over 200 million people are considered to be forest-dependent.
- Tenure reforms pose a serious challenge. The Recognition of Forests Rights Act, which was enacted in 2006, is designed to recognize and vest forest rights to forest-dwelling tribes and other traditional owners; however, the implementation of this law has been slow.
- India is highly exposed to the negative effects of climate change. The forest sector has been identified as a priority sector for climate-change adaptation. A national REDD+ program is being developed with the aim of greatly increasing forest carbon stocks.

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- a Government of India (2010c).
- b Personal communications with P.C. Kotwal, consultant, 2010.

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INDONESIA



Forest resources

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

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

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

forests inland to wide seagrass beds and coral reef communities offshore (Spalding et al. 2010).

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

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

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

Forest ecosystem health

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

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

Table 1 Permanent forest estate

Reporting year	Estimated total forest area, range (million ha)	Total closed natural forest ('000 ha)	PFE ('000 ha)			
			Production		Protection	Total
			Natural	Planted		
2005*	105–120	100 382	46 000	2 500	22 500	71 000
2010	94.4–98.5	69 230**	38 600^{a,‡}	2 500^a	27 300	68 400[†]

* As reported in ITTO (2006).

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

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

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

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

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

Vulnerability of forests to climate change.

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

Indonesia is highly vulnerable to the impacts of climate change, such as an increased frequency of extreme weather events, heavy rainfall leading to

flooding, and prolonged droughts, all of which could have harmful effects on agriculture, fisheries and forestry and threaten food security and livelihoods. Ten of the biggest natural disasters in Indonesia in the period 1907–2007 occurred after the 1990s – they were largely climate-related disasters, especially floods, droughts and forest fire (Government of Indonesia 2007).

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

SFM policy framework

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

Table 2 Forest condition

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

* 'Other naturally regenerated forest'.

Source: FAO (2010a).

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

Table 3 Forest area, by tenure

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

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

Source: FAO (2010a).

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

Forest policy and legislation. For many years the legal and policy framework for forests was provided by the Basic Forestry Law of 1967 (5/1967). This was replaced by Forestry Law 41 (1999), which is now the primary source of authority and guidance on forest stewardship, forest ownership and forest management. Other relevant policy and

legal instruments include Law 5 (1990) on the conservation of natural living resources and their ecosystems; Law 24 (1992) on spatial planning; Law 23 (1997) on environmental management; Law 25 (2002) on anti-money laundering; and Law 7 (2004) on water resources.

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

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

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

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

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

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

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

- Provincial governments will perform forest inventories of production forest, protection forest, conservation forest and watershed areas across the regency areas. The central government will create the norms, standards, procedures and criteria of forest inventories.
- Provincial governments will devise forestry plans at the provincial level, set up information systems, issues permits for timber and non-timber harvesting from the production forest, issues permits for the use of forests and the production of ecosystem services, issue permits for forest industry with a production capacity of less than 6000 m³ per year, and publish technical advice for the establishment of forest industries with a production capacity greater than 6000 m³ per year.

- Provincial governments will design, form and propose management areas for protection and production forests.
- Provincial governments will approve short-term management plans for production areas.
- Provincial governments will manage forest parks.
- Provincial governments will undertake and maintain forest rehabilitation in production forest, protected forest and forest parks.

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

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

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

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

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

Status of forest management

Forest for production

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

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

HPHs ceased to be issued after July 1989 but were revived after decentralization in the form of log exploitation permits (*izin pemanfaatan kayu* – IPKs), which are awarded to companies by the provincial forest service for the conversion of forests to enable the harvesting of logs. Conversion forests are defined as those with a standing volume of less than 20 m³ per hectare which are proposed to be cleared for agriculture, plantation, transmigration or industrial forest plantations.

By the early 1990s the number of HPHs had reached 584, with a total area of about 68 million hectares. The recorded production of industrial wood increased from 5 million m³ in 1965 to about 47 million m³ in 1990, a trend which led to the development of forest industries on the basis of 'supply-push'. In 2001, there were 354 HPHs and 102 HTIs covering 39.3 million hectares (ITTO 2006).

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

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

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

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

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

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

At a policy level, the national AAC was reduced from 22 million m³ in the 1990s to 4.8 million m³ in 2006. Given that aspects of forest management have been decentralized, however, the extent to which a national AAC can be enforced is unclear; in any case, much timber is still harvested illegally, reducing the significance of an AAC (ITTO 2006, Human Rights Watch 2009). In general, Indonesian forest management needs urgent improvement. Many of the concessions do not have clearly demarcated boundaries, and forest fires, illegal land clearance and shifting cultivation are widespread.

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

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

- Presidential Instruction *Inpres* 4/2005: Eradication of Illegal Logging and Its Distribution at the Entire Indonesian Territory.

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

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

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

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

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

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

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

Planted forest and trees outside the forest.

According to FAO (2010a), 404 000 hectares of plantation were established, on average, each year in the period 2003–2007 through afforestation and reforestation, compared to an annual average of about 119 000 hectares in 1998–2002.

Afforestation comprised community forests (*Hutan Rakyat*), *terras* rehabilitation, city forests, mangrove rehabilitation, the development of community forest outside forestland and Ministry of Forestry rehabilitation plantings along rivers and roads, but excluded oil-palm plantations. Reforestation included activities such as re-greening, social forestry and community forest on forestland.

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

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

Table 4 Commonly harvested species for industrial roundwood

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

Source: ITTO (2006).

Box 1 Target of planting plan, 2010–2020

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

Source: Government of Indonesia (2010).

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

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

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

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

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

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

Box 2 Mandatory certification of IUPHHK-HAs

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

Source: Government of Indonesia (2010).

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

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

Timber production and trade. Average annual wood production in the period 2003–2007 was estimated at about 101 million m³, consisting of 14.4 million m³ of industrial wood and 86.4 million m³ of fuelwood. Overall this was a reduction of about 17 million m³ per year on the average total wood production in the period 1998–2002 (FAO 2010a). ITTO (2011) estimated total industrial log production in 2009 at 36.0 million m³, up from 24.8 million m³ in 2004; however, the volume of illegal logging has been estimated to be about equal to the official harvest (Human Rights Watch 2009). The Government of Indonesia (2010) estimated that total log production in 2008 was 32 million m³, more than double official production in 2004. Most of the reported increase was from plantation forests, where wood production increased from 8.25 million m³ in 2004 to 22.4 million m³ in 2008. These data have been criticized as unreliable (Human Rights Watch 2009).

The production of tropical hardwood plywood in 2009 was estimated at 3.20 million m³, down from 4.51 million m³ in 2004 and 7.50 million m³ in 1999 (ITTO 2010). The recent decline has been attributed to reductions in logging quotas and crackdowns on illegal log flows that have

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

Reporting year	Natural					Planted		
	Total	Available for harvesting	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
2005*	46 000	43 200	18 400	275	2940	2500	2500	0.152
2010	38 600	26 200	13 700	1125	3160**	2500	2500	195

* As reported in ITTO (2006).

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

restricted log availability for plywood production (ITTO 2009). The estimated volume of tropical hardwood sawnwood produced in 2009 was 4.17 million m³, compared with 4.33 million m³ in 2004 and 6.5 million m³ in 1999 (ITTO 2011). In 1999 Indonesia produced 50 000 m³ of tropical hardwood veneer; this grew to 220 000 m³ in 2009 (ibid.).

In 2009 Indonesia exported an estimated 2.15 million m³ of tropical hardwood plywood, 698 000 m³ of tropical hardwood sawnwood, 11 000 m³ of tropical hardwood veneer and 67 000 m³ of tropical hardwood logs. The total export value of primary wood products (including coniferous wood) was about US\$2.15 billion, down from US\$2.89 billion in 1999 (ITTO 2011).

In 2008 there were 227 production units with an installed capacity of more than 6000 m³ per year. Total processing capacity was 23.4 million m³ per year^a, but in 2005 the installed capacity utilization rate was less than 50% in both the plywood/veneer and sawmilling sectors. On the other hand, the pulp industry has been expanding, based mainly on the plantation resource, and in 2005 was operating at over 80% capacity (Forest Industry Revitalization In-house Experts Working Group 2007).

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

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

Forestry Minister Regulation P35/Menhut-II/2007 identified nine potential and prospective groups of

NTFPs, consisting, in total, of 557 species plant and animals. Five species groups – rattan, bamboo, bees, silk and sandalwood – have been afforded development priority.

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

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

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

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

Forest carbon. Gibbs et al. (2007) estimated national-level forest biomass carbon stock in the range 13 143–25 547 MtC and FAO (2010b) estimated it at 13 017 MtC. Deforestation, peatland degradation and forest fires have put Indonesia among the world’s top three emitters of GHGs; emissions resulting from deforestation and forest fires are five times those of non-forestry emissions. Carbon emissions from Indonesia’s deforestation and forest degradation are estimated at 55 MtCO₂e per year.

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



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

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

REDD+ is being carried out in three steps. The first step (2007–2010) is preparation by identifying the state of science and related policy. The second step (2009–2012) is ‘readiness’, which is to set

the method and policy used. The third step is full implementation (Ministry of Forestry 2010). Indonesia participates in all major international REDD+ initiatives, including the REDD+ Partnership, the Forest Carbon Partnership Facility, UN-REDD and the Forest Investment Program. A considerable number of regionally based foreign-supported REDD+ pilots are being implemented throughout the country. As part of the climate-change partnership established between the Government of Indonesia and the Government of Norway, the latter has stated its intention to contribute funds to Indonesia’s REDD+ efforts in the order of US\$1 billion. In December 2010 the Government of Australia also announced it would join the partnership and pledged to contribute US\$45 million to it.

Table 6 Forest carbon potential

Biomass forest carbon (MtC)	% forest canopy cover >60%	Deforestation/ degradation potential to 2030	Enhancement of carbon sink capacity to 2030	Forest area change monitoring capacity	Forest/ GHG inventory capacity	Importance of forest fire/ biomass burning	Engagement in international REDD+ processes
13 143–25 547	69	+++	+++	++	++	+++	+++

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

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

Forest for protection

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

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

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

of streams/rivers and roads, the alignment of skid trails, directional felling, and enrichment and protective planting.

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

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

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

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

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

Reporting year	Protection PFE	Attributed to IUCN categories I–IV	Allocated for soil and water	With management plans	Sustainably managed
2005*	22 500	14 400	16 000	5000	1360
2010	27 300	14 100**	26 400^b	2180	1360

* As reported in ITTO (2006).

** UNEP-WCMC (2010).

Socioeconomic aspects

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

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

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

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

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

Bina Desa) has involved 19 810 families in forest communities. The social forestry program covers 8614 hectares and involves 540 families.

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

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

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

Summary

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

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

Key points

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

Endnotes

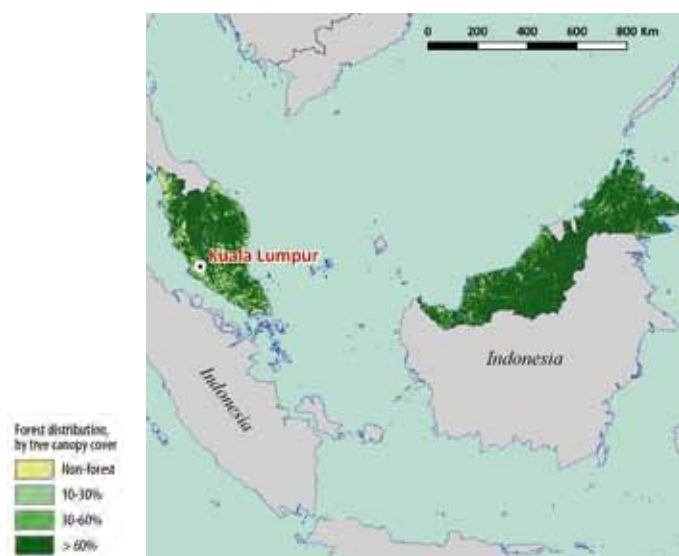
- a Government of Indonesia (2010).
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MALAYSIA



Forest resources

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

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

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

Table 1 Permanent forest estate

Reporting year	Estimated total forest area, range (million ha)	Total closed natural forest ('000 ha)	PFE ('000 hectares)			
			Production		Protection	Total
			Natural	Planted		
2005*	19.3–19.5	19 148	11 200	183	3 210	14 593
2010	18.4–18.6	14 700**	10 298	539	3 579	14 416‡
			Of which: 2 738 in Peninsular Malaysia 2 790 in Sabah 4 770 in Sarawak	Of which: 109 in Peninsular Malaysia 200 in Sabah 230 in Sarawak	Of which: 1 969 in Peninsular Malaysia 610 in Sabah 1 000 in Sarawak	

* As reported in ITTO (2006).

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

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

Source: Government of Malaysia (2009).

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

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

Forest ecosystem health

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

area of primary forest of 3.82 million hectares and Peninsular Malaysia reported 191 000 hectares of degraded primary forest in the PFE (Table 2). There were an estimated 2.70 million hectares of secondary forest in Sabah's PFE, the only region for which data on that parameter were available.^a

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

SFM policy framework

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

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

Table 2 Forest condition

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

* FAO (2010a).

** Data available for Peninsular Malaysia only.

‡ Data available for Sabah only.

Table 3 Forest area, by tenure

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

* Includes only natural forest.

Source: Government of Malaysia (2009).

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

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

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

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

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



Log landing at Ravenscott in Sarawak.

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

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

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

research and development expenditure and exemption from import duty and sales tax on machinery and equipment used in research and development.

- *Incentives for training:* forest concessionaires can claim deductions for the training of staff.

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

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

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

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

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

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

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

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

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

Status of forest management

Forest for production

Malaysian forest policy emphasizes the sustainable management of forests and the balance between protection and production. Regulations are set out in codes of forest practice, forest harvesting guidelines and standard road specifications for the country's three broad forest types (dry inland forest, peat swamp forest, and mangrove forest). These specify, in detail, the silvicultural and harvesting

steps to be followed. Reduced impact logging and helicopter logging are being carried out with an emphasis on reducing environmental impact and (for the latter) on timber harvesting in terrain and conditions that preclude ground-based systems. The Logfisher winch system, a Malaysian-developed technology for extracting logs on level terrain with the minimal use of tractors, has been deployed in one FMU.^a

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

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

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

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

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

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

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

In Peninsular Malaysia, the dry inland forests are managed under two management systems: the Modified Malayan Uniform System and the SMS. Under the Modified Malayan Uniform System, the mature crop may be removed in a single felling of all trees down to 45 cm dbh for all species. Under the SMS, the current cutting limit prescribed for dipterocarp species is 65 cm dbh, that prescribed for non-dipterocarps is 55 cm dbh, and the maximum permitted harvested volume is 85 m³/hectare.

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

In Sarawak, the cutting cycle prescribed for dry inland forest is 25 years and the prescribed cutting limits for dipterocarp and non-dipterocarp species is 60 cm dbh and 45 cm dbh, respectively. An average of 7–9 trees are harvested per hectare, and the average volume removed per hectare is 54 m³.

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

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

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

Table 4 Commonly harvested species for industrial roundwood, Peninsular Malaysia

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

^{**} Red and dark red meranti are distinguished by their specific gravities: 0.38–0.58 for red meranti and >0.58 for dark red meranti.

[‡] Also listed in ITTO (2006).

[†] Comprising red and yellow balau.

Source: Government of Malaysia (2009).

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

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

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

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

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

As of April 2010, ten Certificates for Forest Management (Natural Forest) had been issued by either the PEFC or the MTCS to FMUs covering 4.953 million hectares, which was 48%

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

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

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

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

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

Timber production and trade. Total Malaysian industrial log production was 18.0 million m³ (mostly from natural forests) in 2009, down from 24.7 million m³ in 2004 (ITTO 2011); in 1990 the estimated total industrial log production was 39.1 million m³ (ITTO 1995). In the period 2011–15, total annual log production is projected to be 29.2 million m³. Production from natural forests will decline to 15.5 million m³ but the harvest from forest plantations will grow to 11.8 million m³, with most of the expansion occurring in Sarawak (and 1.90 million m³ will also be harvested in rubber plantations). In the period 2016–2020, annual natural forest production will decline to 11.5 million m³, while production from plantations will increase to 16.1 million m³. Thus, annual log production from natural forests is expected to decline from 19.3 million m³ per year in 2006 to 11.5 million m³ in 2020, but total log production (i.e. from natural and planted forests combined) will increase. Over the period, the decline in annual log production in the PFE in Peninsular Malaysia, Sabah and Sarawak will be due mainly to the introduction of more conservative forest-harvesting practices and stringent enforcement.^a Most of the projected decline in natural-forest production in Sarawak (from 11.5 million m³ per year in 2006–10 to 8.0 million m³ per year in 2016–2020) is due to a reduction in log production from non-PFE natural forests. There will be a slight reduction in the harvest in the PFE, from 8.5 million m³ to 8.0 million m³.^b

Log exports fell from 6.73 million m³ in 1999 to 4.37 million m³ in 2009 (ITTO 2011), continuing a downward trend since 1990, when exports were estimated at 20.3 million m³ (ITTO 1995). Sawnwood production fell from 5.24 million m³ in 1999 to 4.49 million m³ in 2009 (ITTO 2011).

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

Non-timber forest products. The fourth national forest inventory, completed in 2007, contained data on some NTFPs in Peninsular Malaysia. However, the Government of Malaysia's submission for this report included little information on NTFPs.^a In Peninsular Malaysia, about 35 000 m³ of rattan and 300 000 m³ of bamboo are harvested each year. The combined value of rattan furniture exports from Peninsular Malaysia and Sabah was just over US\$10 million in 2008.^a In 2005 the harvest of agarwood was valued at 92 million ringgit and the harvest of birds' nests was worth 22 million ringgit (FAO 2010a).

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

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

Reporting year	Natural					Planted		
	Total	Available for harvesting	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
2005*	11 200	6790	11 200	4620	4790	183	183	183
2010	10 298	9910	9910	5228**	5950	539	539	35

* As reported in ITTO (2006).

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

Table 6 Forest carbon potential

Biomass forest carbon (MtC)	% forest with canopy cover >60%	Deforestation/ degradation potential to 2030	Enhancement of carbon sink capacity to 2030	Forest area change monitoring capacity	Forest/ GHG inventory capacity	Importance of forest fire/ biomass burning	Engagement in international REDD+ processes
2405–4625	79	+	++	+++	+	+	

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

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

Forest for protection

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

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

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

ramin (UNEP-WCMC 2011).

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

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

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

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

Reporting year	Protection PFE	Attributed to IUCN categories I–IV	Allocated for soil and water	With management plans	Sustainably managed
2005*	3210	1400	3210	3210	3210
2010	3579	1980	3579	3579	3579

* As reported in ITTO (2006).

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

Socioeconomic aspects

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

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

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

In Peninsular Malaysia and Sabah, about 76 600 hectares of forest are designated as community

forests, in which local people may pursue traditional and subsistence uses. Peninsular Malaysia also has just over 17 000 hectares of forested 'Indigenous peoples reserves'.^a

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

Summary

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

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

Key points

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

Endnotes

- a Government of Malaysia (2009).
- b Personal communications with officials in the Ministry of Plantation Industries and Commodities, Government of Malaysia, 2010.

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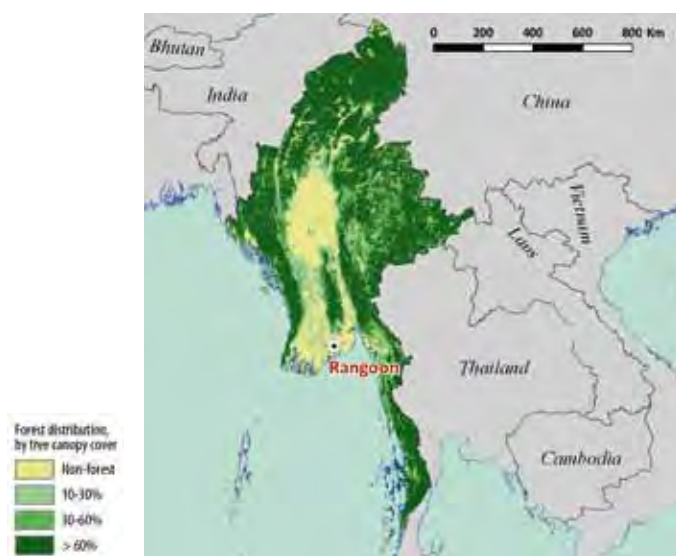
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MYANMAR



Forest resources

Myanmar lies between India and Bangladesh to the west and Thailand, Laos and China to the east and stretches from a latitude of 9° north in the Kra Isthmus to about 27° north in the Himalayas. In 2010 it had an estimated population of 50.5 million people (United Nations Population Division 2010) and it is ranked 138th out of 182 countries in UNDP's Human Development Index (UNDP 2009). Rainfall varies from 500 to 5000 mm and there is a marked dry season. Topographically, the country varies from flat lands at sea level to snow-capped peaks of nearly 6000 m. The total natural forest area in Myanmar is estimated at 30.8 million hectares, which is 45% of the total land area (FAO 2010). The Government of Myanmar reported total natural forest areas of 35.4 million

hectares (in 2006, including beach and tidal forests)^a and 33.0 million hectares.^b Not all Myanmar's forests are tropical, but tropical and non-tropical forests are not disaggregated in this report.

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

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

Table 1 Permanent forest estate

Reporting year	Estimated total forest area, range (million ha)	Total closed natural forest ('000 ha)	PFE ('000 hectares)			
			Production		Protection	Total
			Natural	Planted		
2005*	34.4	32 700	9700	710	3300	13 710
2010	30.8–35.4	17 500^{a,**}	15 800^{b,‡}	882^{b,†}	5330^{b,**}	22 012

* As reported in ITTO (2006).

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

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

† As of 2006.

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

Forest ecosystem health

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

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

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

Vulnerability of forests to climate change.

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

UNFCCC focal point and the Department of Meteorology and Hydrology under the Ministry of Transport is overseeing the preparation of the NAPA.

SFM policy framework

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

Table 3 Forest area, by tenure

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

Source: FAO (2010).

Table 2 Forest condition

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

* 'Other naturally regenerated forest'.

Source: FAO (2010).

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

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

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

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

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

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

Institutions involved in forests. The Ministry of Forestry has primary responsibility for implementing the forest policy, for the administration and management of the forest sector and, since January 2005, for environmental protection (Global Witness 2005). The Ministry of Forestry oversees forest management and provides guidance to the Forest Department, the

Myanmar Timber Enterprise (MTE), the Dry Zone Greening Department, the Planning and Statistics Department, the Institute of Forestry and the National Commission for Environmental Affairs.

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

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

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

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

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

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

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

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

Status of forest management

Forest for production

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

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

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

Timber extraction is concentrated on only a few economically important species. This 'creaming' of the forest, if unabated, will lead to the devaluation of the forests in the long run through a decrease of valuable species. Other problems are the illegal logging of trees for commercial use; the extension of pasture land and swidden agriculture; and over-harvesting for fuelwood and charcoal.^b

The political situation in remote areas creates an environment that allows wasteful and unplanned logging and possible illegal cross-border trade.

Since 2003/04 the annual allowable cut for teak has been 334 000 m³, but the actual harvest in the period 2003/04–2006/07 averaged 588 000 m³ per year. The allowable cut for other hardwoods in that period was 1.602 million m³ but the actual cut averaged 2.113 million m³ per year. Production exceeded the annual allowable cut because of an increase in production in areas where insurgency made production impossible in the past and where land-use change occurred for development programs (Zaw Win Myint 2009).

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

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

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

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

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

Global Witness (2009) reported that “log imports, across the Burma-China land border, have fallen from 1 million cubic metres in 2005 to 270 000 m³ in 2008 according to Chinese import data”, due mainly to measures put in place by the Chinese authorities. Nevertheless, it was “probable” that 90% of that trade was still illegal (ibid.).

Silviculture and species selection. Forest management during the colonial period was based solely on teak. British foresters formulated and

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

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

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

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

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

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

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

Planted forest and trees outside the forest. The area of planted forests in 2006 was estimated at 882 000 hectares, about 373 000 hectares of which were teak, 62 000 hectares of which were *Xylia kerri*

Table 4 Annual harvested volume of teak and other hardwoods, 1996–97 to 2005–06 (‘000 m³)

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

Note: Totals might not tally due to rounding.

Source: Personal communications – see endnote b.

(pyinkado), and about 79 000 hectares of which were eucalypt species.^b

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

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

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



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

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

forests will be conserved and restored by natural means, and 323 750 hectares will be planted by 2030. In addition, about 500 000 hectares of natural and planted forests will be converted to community forests.^a

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

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

Reporting year	Natural					Planted		
	Total	Available for harvesting	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
2005*	9700	-	9700	0	291	710	0	0
2010	15 800	-	15 800	0	291**	882[‡]	882	0

* As reported in ITTO (2006).

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

[‡] As estimated in 2006.^b

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

Timber production and trade. Roundwood production in 2005 was estimated at 43.1 million m³, of which 39.2 million m³ (91%) was fuelwood (FAO 2010). The estimated production of industrial roundwood in 2009 was 4.24 million m³, as it was in 2004 (although it was only about 3.35 million m³ in 1999; ITTO 2011). Myanmar's estimated production of tropical hardwood sawnwood in 2009 was 897 000 m³, down from 979 000 m³ in 2004 and up from 298 000 m³ in 1999. An estimated 1.38 million m³ of tropical hardwood logs were exported in 2009, similar to the 1.37 million m³ exported in 2004 (*ibid.*). Major export destinations are India (reported by the Government of India at 741 000 m³ in 2008), China (reported by the Government of China at 462 000 m³ in 2008) and Thailand (96 600 m³ in 2008). The estimated value of Myanmar's exports of primary timber products amounted to US\$859 million in 2008, of which logs contributed US\$716 million (83%) (ITTO 2010).

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

important: eleven areas are set apart as recreation forest (ITTO 2006).

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

Forest for protection

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

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

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

Table 6 Forest carbon potential

Biomass forest carbon (MtC)	% forest with canopy cover >60%	Deforestation/ degradation potential to 2030	Enhancement of carbon sink capacity to 2030	Forest area change monitoring capacity	Forest/ GHG inventory capacity	Importance of forest fire/ biomass burning	Engagement in international REDD+ processes
2377–5182	58	+++	++	+	+	+	

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

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

Reporting year	Protection PFE	Attributed to IUCN categories I-IV	Allocated for soil and water	With management plans	Sustainably managed
2005*	3300	195	6560	-	-
2010	5330	1370	21 100	5330	-

* As reported in ITTO (2006).

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

Protective measures in production forests.

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

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

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

Socioeconomic aspects

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

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

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

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

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

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

Summary

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

(an estimated US\$859 million in 2008), but the Forest Department operates at a substantial loss. Community forestry faces a number of challenges, such as a lack of security of agreements reached with government agencies.

Key points

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

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PAPUA NEW GUINEA



Forest resources

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

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

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

Forest types. The forests are varied, stretching from sea level to an altitude of over 4000 m. Shearman et al. (2008) classified them as lowland rainforest

(20.3 million hectares), lower montane forest (8.91 million hectares), upper montane forest (702 000 hectares), swamp forest (3.4 million hectares), dry evergreen forest (750 000 hectares) and mangrove forest (575 000 hectares). According to Spalding et al. (2010), PNG has 426 000 hectares of mangroves, which is 75% of all mangroves in the Pacific.

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

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

Forest ecosystem health

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

Table 1 Permanent forest estate

Reporting year	Estimated total forest area, range (million ha)	Total closed natural forest ('000 ha)	PFE ('000 hectares)			
			Production		Protection	Total
			Natural	Planted		
2005*	30.6	30 150	8700	80	1700	10 480
2010	28.6–33.0	22 800**	8700*	58‡	1700*	10 458

* As reported in ITTO (2006).

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

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

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

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

Vulnerability of forests to climate change. Recent studies have shown that the annual and seasonal ocean surface and island air temperatures in the southern Pacific, including PNG, have increased by 0.6–1 °C since 1910 (Government of PNG 2010a). Over the period 1961–2003 there was a significant

increase in the annual number of hot days and warm nights in the region. Climate-change projections indicate a warming trend for all small island states involving an annual mean increase of 1.98 °C by 2050 and 2.81 °C by 2080 (ibid.).

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

SFM policy framework

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

Table 2 Forest condition

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

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

Source: Shearman et al. (2008).

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

Table 3 Forest area, by tenure

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

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

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

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

the National Eco Forestry Policy; the National Reforestation Policy; and the National Policy on Downstream Processing of Forest Products.

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

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

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

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

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

The main function of provincial forest management committees (PFMCs), as stipulated in the Forestry Act, is to facilitate consultation with, and ensure the proper involvement of, provincial governments and customary landowners. In addition, PFMCs are entrusted with assisting provincial governments in the preparation of forest plans and development programs and in recommending to the NFB the terms of forest management agreements (FMAs – see below), the selection of operators, the preparation of timber permits and the enforcement of timber-permit conditions. There are indications,

however, that PFMCs are not functioning anywhere near an optimal level, due in part to a lack of capacity to enforce their mandates.^b

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

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

Box 1 Strengths and weaknesses of the PNG Forest Authority

Strengths	Weaknesses
<ul style="list-style-type: none"> • It is the government’s priority economic sector agency. 	<ul style="list-style-type: none"> • Few funds invested in SFM by government. Much of the annual allocation is for administrative overheads and staff salaries.
<ul style="list-style-type: none"> • Good policy and legal framework for achieving SFM. 	<ul style="list-style-type: none"> • Weak implementation/enforcement of policies and laws. • Inadequate staffing levels in monitoring projects.
<ul style="list-style-type: none"> • Positive foreign-donor support for forest sector. • Reforestation levy collected and held in trust. 	<ul style="list-style-type: none"> • Lack of capacity to receive and implement aid projects. • High landowner demands and disruptions.
<ul style="list-style-type: none"> • Has developed key standards for logging natural forests (Planning, Monitoring and Control Procedures Manual). 	<ul style="list-style-type: none"> • Poor industry–government cooperation. • Lack of support for field staff, transport and communication facilities for improved monitoring.
<ul style="list-style-type: none"> • PNG Logging Code of Practice. • Project supervisors in the field. 	<ul style="list-style-type: none"> • NGO-government cooperation lacking (but improving). • Investment in forest plantation is almost negligent. • Implementation of ITTO C&I at FMA level unduly delayed. • Poor coordination and interface between the PNG Forest Research Institute and NFS management. • Reforestation levy not enough to establish new plantations or improve management of existing plantations. • Inadequate cooperation between the Department of Environment and Conservation and the Forest Authority.

Source: Government of PNG (2010b).

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

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

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

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

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

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

Status of forest management

Forest for production

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

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

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

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

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

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

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

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

For some years the AAC from natural forests has been set at about 3 million m³ based on the allowable harvest levels specified under timber permits and FMAs. If this AAC was to be met it would involve the harvest of about 120 000 hectares of natural forest per year.^a

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

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

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

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

The AAC does not take into account the timber harvested under forest-clearance authorities for agriculture, estimated at about 1.8 million m³ per year.^a

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

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

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

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

Silviculture and species selection. The silvicultural system prescribed for natural forests is selective logging, involving the removal of mature and overmature trees to allow the remaining crop to grow naturally to maturity. Even though the pre-FMA system was also described as selective logging, all trees above the prescribed limit in a management unit were cut over within 10–20

years (i.e. less than the planned felling cycle), thus consuming the resource faster than could be sustained. Since 1991–92, all new forestry operations have had an assigned cutting cycle of 35 years.

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

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

Table 4 Commonly harvested species for industrial roundwood

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

Source: ITTO (2006).

Planted forest and trees outside the forest.

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

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

Forest certification. PNG has a national FSC working group and has developed national certification standards. In 2008 SGS developed a timber legality and traceability standard for PNG. Two forest areas have been FSC-certified: a natural forest covering 2705 hectares managed by the Foundation for People and Community Development near Madang, and an area of 19 920 hectares of planted forest (mostly *Eucalyptus deglupta*) managed by Open Bay Timber² (FSC 2010).

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

In addition to the forests that have been certified, two forest operations have demonstrated high-quality forest management: Cloudy Bay Sustainable Forestry Limited, and Vanimo Forest Products.^c The Cloudy Bay operation commenced in 2003 under an FMA covering 148 900 hectares. The annual allowable cut is 60 000 m³: the company's first sawmill, at Bonoabo, is processing 15 000 m³ per annum and a second sawmill is under construction at Bam that will process 45 000



NTFPs play many cultural roles in PNG.

m³ per annum. The concession has been allocated for a 35-year period.

Vanimo Forest Products is one of the major operators in the West Sepik (Sandaun) Province as well as in PNG as a whole. The combined harvest of the company's licensed areas, which cover 545 000 hectares, is 444 000 m³ per year. The company has a sawmill with an annual log output of 50 000 m³ and the balance is exported as round logs. The following observations can be made:

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

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

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

Timber production and trade. Total industrial log production in PNG was estimated at 2.91 million m³ in 2009, up from 2.25 million m³ in 2004 and 2.12 million m³ in 1999 (ITTO 2011). The forest industry is based predominantly on log exports. An estimated 1.93 million m³ of logs were exported in 2009 (ITTO 2011), making PNG the world's second-largest exporter of tropical logs after Malaysia. PNG earned US\$172 million in 2009 from timber exports, US\$141 million of which was from logs (ITTO 2011).

Non-timber forest products. The people of PNG make use of many NTFPs for their livelihoods and consume bush meat, wild tubers, medicinal plants and other produce on a daily basis. Butterflies, live birds, *Gyrinops ledermannii* (eagle wood), *Santalum* (sandalwood) and rattan products are important sources of local income. Despite the significant

value of and community dependence on NTFPs, there appear to be no firm government policies for their management and exploitation. Within the Forest Authority there is a general lack of capacity to assess the market for timber, valued-added forest products, and NTFPs.^b

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

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

Reporting year	Natural					Planted		
	Total	Available for harvesting	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
2005*	8700	5600	4980	19	1500	80	-	0
2010	8700	4900	738	2.7	193	58	31.2**	19.2

* As reported in ITTO (2006).

** The Bulolo forest plantation in Morobe Province, and the certified area of Open Bay Timber.

Table 6 Forest carbon potential

Biomass forest carbon (MtC)	% forest with canopy cover >60%	Deforestation/ degradation potential to 2030	Enhancement of carbon sink capacity to 2030	Forest area change monitoring capacity	Forest/ GHG inventory capacity	Importance of forest fire/ biomass burning	Engagement in international REDD+ processes
4154–8037	79	+++	+	+	+	++	++

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

Forest for protection

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

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

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

Extent of protected areas. At present there is no agreed legal national definition of protected areas in PNG.^b Data on protected areas and protection forests as identified by the Forest Authority and the Department of Environment and Conservation are vague and vary widely, which is perhaps a reflection of poor communication between the two organizations. According to the Department of Environment and Conservation there are 1.64 million hectares of protected areas in PNG, comprising national parks, memorial parks,

protected areas, provincial parks, reserves, wildlife management areas and sanctuaries, although the extent to which these areas are forested is unclear. According to the Forest Authority there are 1.2 million hectares of protection forests^a, and a third estimate puts the area of protection forest at 547 000 hectares.^b UNEP-WCMC (2010) was unable to provide an estimate of the area of forest in protected areas in PNG. The delineation of protected areas on the ground, the institution with management authority over them, and the extent of monitoring and enforcement are all uncertain.^b

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

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

Socioeconomic aspects

Economic aspects. Forestry is the third-largest foreign-exchange earner after mineral and agricultural exports (Overseas Development Institute 2007). The forest industry employs an estimated 10 000 people.^a The government collects revenues from a log export tax and a reforestation levy, while resource owners receive a royalty on timber harvested (10 kina per m³) and other levies and premiums. It has been observed, however, that many of the benefits of forestry operations have generally not filtered through to landowners, and income has not been saved or invested to ensure long-term development (PNG Forest Authority 2002). In 2005 the forest sector generated revenue worth about 130 million kina and total public expenditure in the sector was about 23.4 million kina.

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

Reporting year	Protection PFE	Attributed to IUCN categories I–IV	Allocated for soil and water	With management plans	Sustainably managed
2005*	1700	362	-	-	-
2010	1700	-	0	-	-

* As reported in ITTO (2006).

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

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

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

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

Summary

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

Key points

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

- PNG is a major exporter of tropical logs, shipping out an estimated 1.93 million m³ in 2009.
- PNG's forests are thought to be vulnerable to climate change, but the country also has potential for forest-based carbon capture and storage.

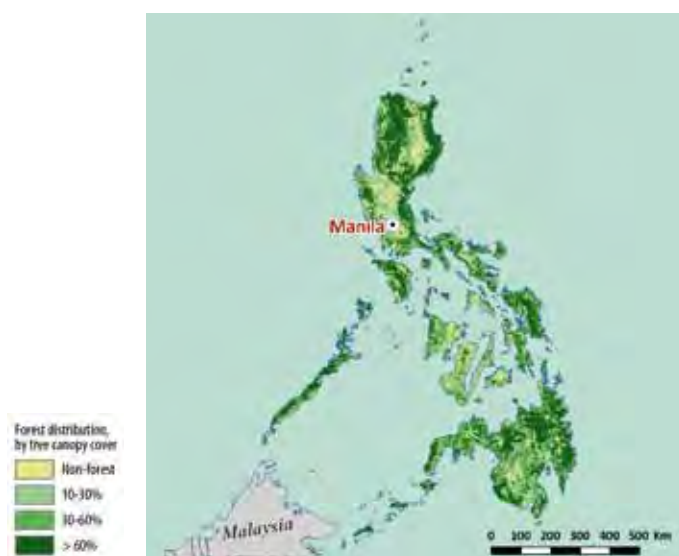
Endnotes

- a Government of Papua New Guinea (2010b).
- b ITTO (2007).
- c Personal communications with D. Kare, who was commissioned to prepare PNG's submission for this report. As part of the submission he reviewed the operations of Cloudy Bay Sustainable Forestry Limited and Vanimo Forest Products.

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PHILIPPINES



Forest resources

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

FAO (2010) estimated the forest area in the Philippines at 7.66 million hectares, which is 26% of the total land area. The Government of the Philippines estimated the total forest area at 7.17 million hectares (including 737 000 hectares that are outside the 'forestlands' category).^a

Forest types. The Philippines has two broad biogeographical regions: the east, which remains wet throughout the year, and the west, which has a dry season. The forests have been classified by climate and altitude into evergreen rainforest (81%), semi-evergreen forest (10%) and mountain forest (9%). They have also been classified as closed forest (i.e. with greater than 40% cover), open forest (10–40% canopy cover), mangrove forests, and plantations.^a Philippine forests may also be

classified into five broad forest types on the basis of species composition:

- Dipterocarp forests, in which timber species of the dipterocarp family, such as *Pentacme contorta* (white lauan), *Shorea negrosensis* (red lauan) and *Dipterocarpus grandiflorus* (apitong), dominate stands. In the past, this forest type was the main source of raw material for the timber industry.
- *Molave* forest, which is more open than dipterocarp forest, with a timber volume averaging 30 m³ per hectare. This forest type occurs in regions where there are distinct wet and dry seasons. Major species include *Vitex parviflora* (molave), *Pterocarpus* spp (narra) and *Intisa bijuga* (ipil).
- Pine forests, which are found in the high mountainous regions of northern Luzon and Mindoro. The principal species are *Pinus insularis* and *P. merkusii*.
- Mangrove forests, which occur on tidal flats in estuaries and on the shores of protected bays. In the 1950s mangrove forests covered an area of more than 375 000 hectares, but today degraded mangrove forests cover about 250 000 hectares (Spalding et al. 2010).
- Beach forests, which occur along streams and on tidal flats. They usually comprise pure stands of nipa palm (*Nipa fruticans*), but may also contain species such as *Terminalia catappa* (talisai), *Barringtonia asiatica* (botong) and *Calophyllum inophyllum* (palomaria).

Permanent forest estate. The country's land resources are classified into forestlands and alienable and disposable (A&D) lands. All lands in the public domain with slopes of 18% or greater are classified as forestlands and are owned by the state. A&D lands are subject to the granting of private rights and allocation to various (principally agricultural) uses. The entire extent of forestlands (15.9 million hectares) has been demarcated with 'monuments'^a; within this area there is no differentiation in the field between production and protection forest.

Information on the extent and condition of forestland and A&D land is often confusing. Most forests are found on forestland, and most

cropland on A&D land, but these land uses are not always consistent with the legal classes. Of the area presently classified as A&D land, 30–35% has slopes greater than 18%. Conversely, as much as 28% of forestlands have slopes of less than 18%. About 40% of classified forestlands are not used for forestry purposes (e.g. in urban areas such as Quezon City, General Santos City and Metropolitan Cebu).^a On the other hand, certain A&D lands or even private lands cannot be used in community-based forest production due to policy constraints.

The actual extent of forest in the PFE is also unclear. For example, in its submission to ITTO for this report, the Government of the Philippines (2009) variously reported a PFE of 15.9 million hectares (when reporting the extent of designated forestlands), 6.82 million hectares (when reporting on forest condition classes), 6.43 million hectares (when reporting on forest area by forest type), and 5.4 million hectares (when reporting on changes in forest area). Moreover, it reported identical areas for protection forests in both the PFE and non-PFE (1.339 million hectares in each). The estimate of production PFE given in Table 1 is based on the estimate given in ITTO (2006). It is assumed that no forests on A&D lands are in the PFE. The total extent of planted forest is also unclear, with estimates of 314 000 hectares^c, 330 000 hectares (FMB 2010) and 352 000 hectares (FAO 2010).

Forest ecosystem health

Deforestation and forest degradation.

Deforestation occurred at an annual rate of about 316 000 hectares in the 1980s, caused by land conversion, shifting cultivation, forest fire and over-logging.^a According to FAO (2010), total forest area increased by 274 000 hectares between

2005 and 2010 and by 1.10 million hectares between 1990 and 2010, mainly due to natural regeneration on degraded lands.

In 2006 about 28 000 hectares of forest were formally cleared for agriculture, settlements, infrastructure or other purposes, unplanned fire destroyed an estimated 9000 hectares, and drought, storms and pests and diseases reportedly affected about 7700 hectares of forest.^a Based on arrests, illegal exploitation was reported to have occurred on about 1500 hectares of forestland, although this is perhaps more a reflection of the efficacy of forest law enforcement than of the absolute extent of illegal forest activities.^a Table 2 presents an estimate of the area of natural forests by condition.

Vulnerability of forests to climate change. Mean annual temperature has increased in the Philippines in the last 20 years. Those regions that have warmed the most (northern Luzon and Mindanao) have also dried the most. There has also been an increase in the frequency of typhoons and other wind damage. Floods have caused widespread damage and large numbers of casualties in recent years.

About 1.02 million hectares of natural forests are considered highly vulnerable to climate variability (Cruz & de Luna 2009), mostly located in Davao del Sur, Leyte, Sarangani, Sultan Kudarat and Zamboanga del Norte. Natural forests in Leyte are at risk of increased damage from strong winds and excessive rain associated with typhoons. In Mindanao, which is not frequently affected by typhoons, the natural forests are more likely to be affected by drought, although the risk is unknown. Among other things, higher drought frequency and severity can increase the risk of grass, brush and forest fires (ibid.).

Table 1 Permanent forest estate

Reporting year	Estimated total forest area, range (million ha)	Total closed natural forest ('000 ha)	PFE ('000 hectares)			
			Production		Protection	Total
			Natural	Planted		
2005*	5.4–7.2	5288	4700	274	1540	6514
2010	7.17–7.66	3248**	4700[‡]	314^{b,†}	1340^a	6354

* As reported in ITTO (2006).

** Calculated using the ratio of forest with greater than 60% forest cover estimated by UNEP-WCMC (2010) (42.4%) and the total natural forest area as estimated by FAO (2010). DENR (undated) estimated the area of closed natural forest at 2.48 million hectares.

[‡] Based on ITTO (2006) and personal communications – see endnote b.

[†] Based on projected planting rate. FAO (2010) reported a planted-forest area of 352 000 hectares but noted that data on reforestation are weak because of the possibility of double-counting.

Table 2 Forest condition

	PFE	Non-PFE	Total
	'000 ha		
Area of primary forest	-	-	822 ^{c,*}
Area of degraded primary forest	-	0	0
Area of secondary forest	-	-	2560 ^c
Area of degraded forest land	-	-	4031 ^c

* FAO (2010) reported a primary forest area of 861 000 hectares, which was unchanged since 1990 on the basis that a 1990 DENR regulation provided for a shift in logging from old-growth forest to residual forest.

The Presidential Task Force on Climate Change was created in 2007 with the aim of providing mitigation and adaptation measures to reduce the impacts of climate change on identified sectors, including the forest sector. The Government of the Philippines has also established the Inter-Agency Committee on Climate Change, which is responsible for ensuring that the Philippines meets its obligations to the UNFCCC. The Philippine Climate Change Act (RA 9729), enacted in October 2009, created the Climate Change Commission, the sole policymaking body on climate-change issues, and initiated the formulation of the National Framework Strategy on Climate Change (which was approved by the President of the Philippines in April 2010).

SFM policy framework

Forest tenure. The entire land area formally designated as forestland is owned by the state. Since the PFE falls within that estate, the entire PFE is also owned by the state (Table 3). Considerable portions of forest are held by the private sector, communities, people's organizations and Indigenous people under various kinds of tenure arrangement that do not include outright ownership. These include:

- Community-based forest management agreements (CBFMAs) – 25-year leases for communities, renewable for another 25 years over forest areas of a maximum of 5000 hectares each.
- Industrial forest management agreements – 25-year production-sharing agreements for private companies, renewable for another 25 years, mainly comprising industrial plantations.
- Socialized industrial forest management agreements (SIFMAs) – 25-year leases for communities, renewable for another 25 years, mainly comprising community-based plantations.

- Timber licence agreements (TLAs) – 25-year leases renewable for another 25 years. These are no longer allowed under the Constitution and will cease once the last TLA expires in 2011 (land currently assigned under TLAs will have to shift to other production-sharing or joint-venture agreements).
- Certificates of ancestral domain title, which are titles or certificates to ancestral land domains on both forestland and A&D lands.

An estimated 7.1 million hectares of land (both within and outside the PFE) has been allocated to Indigenous communities under certificates of ancestral domain title or are under ancestral domain claim.³ It is unclear, however, what effect the granting of rights to ancestral lands and domains has on ownership; it appears that, while recognizing rights, the state retains ownership of the resources on those lands (Fey 2007). The rights of Indigenous peoples over ancestral domains are clear. While the government retains legal ownership over natural resources (although this is being contested), Indigenous peoples are given the preferential option to use those resources and thus other bodies/entities intending to extract resources or conduct any development options in the area must obtain the free, prior informed consent of the relevant Indigenous community (C. Guerrero, pers. comm., 2010).

In recent years a new forests and forestlands management strategy has started to emerge that recognizes, through a co-management approach, the crucial role that local government units and upland dwellers play in forest and land management. The issuing of individual property rights (IPR) agreements is a means by which the Department of Environment and Natural Resources (DENR) and the local government units share stewardship of forests and forestlands with claimants/occupants. An IPR agreement gives each occupant in a

co-managed area the right to use, develop and manage a maximum of five hectares of land for 25 years, renewable for another 25 years at the option of both parties. Claimants can use the land to farm and harvest the crops they have planted. As stewards and managers of the resource they are bound to help protect and conserve the forest and its resources, and to reforest open and denuded areas. IPR agreements allow community members to benefit commercially from their upland farms, thus motivating them to develop bare forestlands and adopt sustainable and environment-friendly farming methods, such as agroforestry, that minimize forest conversion, slash-and-burn activities and wanton timber-cutting. With the support of local government units, DENR, civil society and the private sector, IPR agreement-holders are encouraged to use their own labour, know-how and available capital to develop their claims, consistent with the co-management agreement and in support of the land-use plans of local government units.

The role of IPR agreements is still in its infancy. In January 2007, in a milestone for forest management in the country, IPR agreements covering about 20 hectares were issued by the municipal government of Quezon and the Provincial Environment and Natural Resources Office to eight upland farmers. Another 43 farmers were party to IPR agreements in February 2008.

Table 3 Forest area, by tenure

Ownership category	Total area	Of which PFE
	'000 ha	
State ownership (national, state or provincial government)	-	6354
Other public entities (e.g. municipalities, villages)	-	0
Total public	-	6354
Owned by local communities and/or Indigenous groups	-	0
Privately owned by individuals, firms, other corporate	-	0

Source: *Government of the Philippines (2009)*.

Criteria and indicators. The Philippine system of C&I for the sustainable management of forests is an adaptation of the ITTO model (ITTO 2005) refined to suit the local context. Specifically, the purpose of the Philippine C&I is to provide the government, through DENR, and other forest

managers with an improved tool for assessing changes and trends in forest conditions and forest management systems. The Philippine C&I provide a means of assessing progress towards the attainment of the objective set under Executive Order 318, otherwise known as Promoting Sustainable Forest Management in the Philippines. The approved set of Philippine C&I is used formally by the government in the performance evaluation of various types of FMUs through a memorandum order issued by DENR in July 2007. The Government of the Philippines used the ITTO C&I in its submission to ITTO for this report.^a

Forest policy and legislation. The foundation of forest policy is Presidential Decree 705 (1975), as amended; it is known as the Revised Forestry Code of the Philippines. According to this Code (Section 2), the components of forest policy are the multiple-use of forests, the systemization of land classification, the establishment of wood-processing plants and the protection, development and rehabilitation of forestlands. The Code was drawn up when the major emphasis was on the large-scale commercial harvesting of state-owned natural forests by large corporations.

The 1987 Constitution, which reflects a general reorientation of natural resource management policies in favour of co-production, installed community-based forest management (CBFM) as the main framework for forest resource management. Today, communities are the main implementers of SFM strategies and programs in both planted and natural forests. Nevertheless, a systematic approach to SFM is not yet apparent on the ground. A major law on a National Integrated Protected Area System (NIPAS), the NIPAS Act, was enacted in 1992 and the Indigenous Peoples' Rights Act was enacted in 1997; both provide overarching directions for forest management. Other relevant laws include the Local Government Code, enacted in 1991, and the Wildlife Conservation and Protection Act, enacted in 2001.

The Forestry Code and subsequent laws and regulations have not been fully harmonized and updated to reflect this reorientation. A Sustainable Forest Management Bill has been under consideration by the national legislature since 1989 but, to date, has not been passed into law. The bill has seven guiding principles: watershed as the basic forestland management unit; multi-sectoral participation; CBFM; the protection of

forestlands and natural resources as a priority concern; reforestation as a priority measure; security of tenure of stakeholders; and professionalism in the forest service (Fourteenth Congress of the Republic of the Philippines undated).

The optimal use of the country's land and its sustainable management, as set out in a national land-use plan, is the key feature of the much-awaited Act on National Land-use Policy. Should the Act pass into law, it would, among other things, identify mechanisms for the allocation of unused and under-used private and A&D lands for tree plantations to augment the limited wood supply from natural secondary forests.

Institutions involved in forests. DENR is the government agency responsible for the management of forests and protected areas. Other institutions with responsibilities related to forests include the Forest Management Bureau (FMB, part of DENR), which has responsibility for the management of the country's forest resources; the Environmental Management Bureau, which is responsible for the management of the overall environment; the Protected Areas and Wildlife Bureau, which is responsible for the management of an integrated protected areas system and the conservation of biological diversity; and the Ecosystem Research and Development Bureau, which is responsible for forest ecosystem research and technology development. The Philippine Wood Producers' Association is responsible for carrying out timber production and processing on government forestlands. The total 2009 budget of DENR for forest management and administration and forest-related projects was US\$84.8 million.^a

Under Executive Order 606 (27 February 2007) on sustainable upland development, DENR has embarked on a comprehensive upland development program. The organization's 2009 resources for forest development and management were substantially reconfigured to focus on the restoration of the ecosystem services provided by vital watersheds and protected areas while simultaneously catalysing improvements in upland productivity, creating incomes for upland poor, mitigating hunger among highly vulnerable populations, engaging with organized upland communities, and providing a climate for gainful economic production among poor upland dwellers.^a

The Philippines Local Government Code (1991) confers certain central government powers relating to forest taxation, budgeting, planning and project management on local government units. Some officers, mostly involved in social forestry, were also devolved to local governments, which created their own environment and natural resources offices. The process of devolution in the government forest sector is ongoing, with closer coordination between DENR and the Department of Interior and Local Government. Local government units are assuming a greater role in forest management and strengthening co-management mechanisms with DENR in agroforestry and watershed management. Several foreign-funded forestry projects are being implemented with local governments as executing agencies.

With support from ITTO, DENR is developing a forest information system to promote SFM and aid policy formulation and decision-making through improved data collection and information processing. Also through an ITTO-funded project, the FMB has been developing an integrated chain-of-custody and timber-tracking system, particularly to assist in identifying and quantifying illegal timber and other forest products. The project assessed the impacts of the existing Log Control Monitoring System and the Forest Stock Management System, as pilot-tested in selected regions in the Philippines, to determine gaps in the system and to expand it to include a chain-of-custody module. The resultant Philippine Timber Tracking System includes improved field procedures in data-gathering at the seven nodes identified for chain of custody and timber-tracking, software for data entry and report generation, and a database for timber-tracking. The system has been piloted in one Integrated Forest Management Agreement (IFMA) operation and DENR plans to implement the system nationwide. It is hoped that this management tool will facilitate forest law enforcement, chain-of-custody procedures and forest certification.^a

In 2008 the FMB computerized its forms for certificates of timber origin and certificates of lumber origin. These are management tools for monitoring and tracking the movement and legality of origin of locally produced forest products that are transported and traded within the country.

Status of forest management

Forest for production

No other Asia-Pacific country was deforested as extensively as the Philippines in the period after World War II. Even though TLAs, until recently the system for allocating logging rights, stipulated that logging operations should be conducted according to a system of selective logging, the detailed guidelines for forest management were hardly ever applied. Many of the problems associated with the large-scale destruction of the forest resource can be linked to a combination of land-tenure and concession-tenure issues and the lack of ability or will to enforce the conditions of the concessions. In order to prevent the loss of old-growth forests, Decree 24/1991 imposed a ban on old-growth (or primary-forest) logging from January 1992 and shifted logging to second-growth (residual) forests. Silvicultural prescriptions were not followed. Today, the control of illegal activities remains a major challenge and is considered one of the main obstacles to SFM (ITTO 2006).

The legal basis of the TLA system changed under the 1987 Constitution, resulting in a dramatic reduction in the awarding of concessions. However, TLA-holders were allowed to continue to operate until the expiry date indicated in the original agreements, subject to certain requirements. Areas under TLAs started to be phased out in favour of awarding forest harvesting rights embodied in timber production sharing agreements (TPSAs). The TPSA system increased government revenues, but these revenues did not generally go back into forest management as originally intended.

TPSAs evolved into IFMAs, SIFMAs and CBFMAs, all of which aim to encourage investment in maintaining the forest growing stock through a performance bond. These instruments take into account the provisions of the Indigenous People's Rights Act (1997), according to which Indigenous people have the right to title over their ancestral lands and to have a say in the management of those lands.

Most expiring TLAs have opted to convert to IFMAs, but CBFMAs are becoming the dominant form of allocation (by area). TLAs whose permits have expired and which have not been converted to IFMAs or CBFMAs become open-access areas.

As of early 2009 there were forest-use agreements covering a total of 7.2 million hectares, comprising:

- Six operating TLAs covering 325 310 hectares of forestlands.
- 148 IFMAs with an operational area of 782 931 hectares of forestlands.
- 1803 SIFMAs covering 34 727 hectares of forestlands.
- 5503 communities with CBFMAs covering 5.97 million of forestlands.
- 198 tree farm and agroforestry farm lease agreements covering 99 994 hectares.^a

Little information is available on the status of management under any of these forest-use agreements.

Under CBFMAs, organized communities operate within allowable-cut limits set by government. They harvest timber and other forest products to sell, use for their own needs, or process, and at the same time protect the forest against illegal logging and other unauthorized activities. The sale of timber, rattan, bamboo and other forest products has provided additional income for upland communities.

All holders of TLAs and IFMAs are required to submit to DENR a five-year medium-term forest management plan, an integrated annual operation plan and a yearly concession report. These plans are oriented to sustainable production based on prescribed selective logging appropriate for the Philippine dipterocarp forest. The general objective of the medium-term forest management plan is to sustainably manage natural forests for the production of high-quality dipterocarp timber without jeopardizing the rights of affected communities, including Indigenous people, or impairing the non-timber benefits obtained from the forest. In dipterocarp forest, only mature and overmature trees of merchantable height with a dbh of 60 cm and above may be harvested on a minimum operable production area of 1200 hectares. Sustained-yield management is supported by growth and yield studies for various forest types.

In the case of IFMAs with attached natural forest, licensees are required to submit a management plan and an integrated annual operation plan for sustainable production from adequately stocked

forest and the conversion to plantations of inadequately stocked natural forest. The cutting of trees in areas greater than 50% slope or within 20 m of rivers and roads is not allowed. Licensees are also required to plant trees in bare areas and to keep them under permanent forest cover. Objectives and prescriptions are similar to the requirements for TLAs.

CBFMA-holders are required to submit a comprehensive management and development plan (oriented to plantation establishment, since forest areas are mainly denuded or degraded). In rare cases, secondary-growth forests are attached to CBFM areas.

The medium-term plan and integrated annual operation plan are submitted to the FMB and DENR for review and evaluation prior to harvesting and other forest operations in the operable production forest. The FMB conducts yearly evaluations of the performance of each licensee, using a composite team of professionals from DENR and the academic sector to determine conformance with rules and regulations on timber harvesting, selective logging, AAC, pre-logging and post-logging operations, forest protection, community services and environmental compliance. DENR also conducts ad-hoc, unannounced field inspections of production areas under licence to detect violations of rules and regulations, illegal logging and poaching, and the improper use of documents such as the certificates of timber origin. These mechanisms have resulted in the suspension and cancellation of licence-holders not following prescriptions and conducting illegal activities.^a The main violations include over-cutting in operable areas, illegal logging in non-operable areas or outside boundaries, poor forest protection leading to encroachment in production areas, and the recycling of permits and documents for harvest and

transport. There are also cases of non-payments of forest charges, silvicultural fees, the environmental guarantee fund, and trust funds for reforestation and timber stand improvement.

In IFMAs with responsibility for the management of natural forests, provisions for the replacement of inadequately stocked natural forest with plantations were often abused, as adequately stocked forest was logged and sold. This led to a suspension of this type of IFMA for several years to prevent further abuse and the destruction of potentially viable secondary forests. There have been no reported violations in IFMAs that are solely conducting plantation activities on denuded and degraded areas.^a

Silviculture and species selection. TLAs for logging in natural forest follow a system of selective cutting, while forest plantations follow a system of clearfelling and artificial regeneration. Many species are used, and it is difficult to determine which are the most commercially important. Most of the species listed in Table 4 are from plantations.

Planted forest and trees outside the forest. There are an estimated 314 000 hectares of planted forests in the Philippines. They include those developed by the government in regular reforestation projects, by communities in CBFMAs and SIFMAs, and by industrial concerns through IFMAs, as well as tree farms developed by small landholders on private lands. No recent aggregated information is available on the survival, growth or yield of plantations, but all are thought to be low. Corporate-sector involvement in the growing of industrial plantations is being encouraged through IFMAs for the development of integrated industrial forest plantations.

Forest certification. As of December 2010, no forest in the Philippines had been independently certified as well managed (e.g. FSC 2010).

Table 4 Commonly harvested species for industrial roundwood

Species	Notes
<i>Paraserianthes falcataria</i> (falcata)	Harvest in 2006 = 413 000 m ³ /year; from secondary forests and planted forests.
<i>Gmelina arborea</i> (yemane)	Harvest in 2006 = 263 000 m ³ /year; from planted forests.
<i>Acacia mangium</i> (mangium)	Harvest in 2006 = 126 000 m ³ /year; from planted forests.
<i>Eucalyptus deglupta</i> (bagras)	Harvest in 2006 = 34 000 m ³ /year; from planted forests.
<i>Swietenia mahoganii</i> (mahogany)	Harvest in 2006 = 78 000 m ³ /year; from planted forests, used in sawmilling and plywood industries.
<i>Shorea negrosensis</i> (red lauan)	Harvest in 2006 = 24 300 m ³ /year; used in sawmilling and plywood industries.

Source: Government of the Philippines (2009).



Young forest-dwellers collect NTFPs in Mindanao.

Estimate of the area of forest sustainably managed for production. Given a lack of information on forest management at the FMU level, the extent of SFM is difficult to gauge. Forest management is still evolving towards community-based approaches, but there is a lack of policies to support communities in adopting SFM practices, and the effectiveness of current arrangements for co-production is a subject of debate. The total area of PFE under management plans is 822 000 hectares (of which about 80% is probably natural forest), a slight decrease over the area reported for 2005 (and less than the 2.25 million hectares reported in FAO 2010). On the basis of an estimate provided by the Government of Philippines, FAO (2010) reported that 4.05 million hectares of natural forest were under sustainable management, the Government of the Philippines reporting that “all forest area covered with management plans is considered to be under sustainable management”. In general, however, data on the quality of management are lacking. The area of natural forest managed sustainably is estimated by ITTO to be at least 79 000 hectares, comprising a forest concession managed with ITTO assistance in Surigao del Sur (Table 5).

Timber production and trade. The production of industrial roundwood in the Philippines peaked at 11.2 million m³ in 1974 (FAO 2001); in 1977 there were 325 sawmills and 70 wood-based panel manufacturing units (ibid.). Production fell to a low of about 401 000 m³ in 2001 before recovering to 857 000 m³ in 2009 (ITTO 2011). In 2009 the Philippines imported 89 000 m³ of logs, 165 000 m³ of sawnwood, 24 000 m³ of veneer and 111 000 m³ of plywood (ibid.).

Non-timber forest products. An estimated 5.15 million linear metres of un-split rattan (from an annual allowable cut of 21.9 million linear metres – FMB 2010), 13.2 million pieces of nipa shingles, 872 000 pieces of bamboo, 196 000 pieces of anahaw leaves, and 248 000 kilograms of almaciga resin were harvested commercially in the Philippines in 2008, and NTFP exports were worth an estimated US\$873 000 (ibid.). The leaves of *Nipa fruticans* are used for thatch and its sap is used for the manufacture of vinegar, alcohol and sugar.

Forest carbon. Changes in land use are the greatest source of GHG emissions in the Philippines. Gibbs et al. (2007) estimated the national-level forest biomass carbon stock at 765–1530 MtC,

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

Reporting year	Natural					Planted		
	Total	Available for harvesting	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
2005*	4700	-	910	0	76	274	274	0
2010	4700	4700**	658^{a,b,c}	0	79^a	314	164^{a,b,c}	0

* As reported in ITTO (2006).

** Note that the Government of the Philippines (2009) reported that 7.2 million hectares were under licence. However, this area is greater than the natural-forest production PFE, and, while it is under some form of contractual arrangement, it is unclear how much of the land is actually forested or is intended to be returned to forest cover. The figure given here equates to the total production PFE.

Eggleston et al. (2006) estimated it at 2503 MtC and FAO (2010) estimated it at 663 MtC. In 2009 in collaboration with Intercooperation, IUCN-Netherlands and GTZ the Government of the Philippines initiated a national process to develop a bottom-up, participatory, multi-stakeholder REDD+ strategy with an emphasis on community-based approaches. The Philippines is a participant in UN-REDD and the REDD+ Partnership.

The Philippines REDD process is designed as a mechanism for consultation with strong civil-society participation with the aim of preventing further deforestation and forest degradation; increasing carbon stocks; delivering co-benefits such as biodiversity conservation, ecological restoration and equitable benefit-sharing; and addressing progressive pro-community land-tenure and forest management policies. The country has a relatively high potential for the enhancement of carbon sinks (Table 6).

Forest for protection

Soil and water. The Philippines has 126 watershed forest reserves covering an area of 1.50 million hectares, of which 87 are managed under the NIPAS Act. Although these reserves are principally protected and managed for soil and water conservation, most do not have management plans. The government has commenced a process to prioritize watersheds for integrated land-use

planning purposes in conjunction with the delineation of forest boundaries, and DENR has provided detailed guidelines on the preparation of integrated watershed management plans through Memorandum Circular 2008-05 (22 October 2008). The watershed and ecosystem management framework prescribed by government will be used principally to strengthen the co-management of watersheds by DENR and local government units.

The Revised Forestry Law (Chapter III) and the Philippine Environment Code (Chapter III and Chapter VI) have provisions on watershed and ecosystem management, including procedures for the protection and management of sensitive areas for soil and water conservation. A July 2007 DENR memorandum order mandated the review of all titled properties within protected areas and proclaimed watersheds.

Biological diversity. The Philippines is rich in biodiversity, containing an estimated 38 600 forest-dependent species of mammals, birds, reptiles, amphibians and fish.^a Thirty-three species of mammal, 57 birds, 28 reptiles, 48 amphibians, one fish, eight arthropods and 31 plants found in forests are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species (IUCN 2011). Thirteen plants are listed in CITES Appendix I and 135 in Appendix II (UNEP-WCMC 2011).

Table 6 Forest carbon potential

Biomass forest carbon (MtC)	% forest with canopy cover >60%	Deforestation/ degradation potential to 2030	Enhancement of carbon sink capacity to 2030	Forest area change monitoring capacity	Forest/ GHG inventory capacity	Importance of forest fire/ biomass burning	Engagement in international REDD+ processes
765–1530	42	+	+++	++	++	+	+++

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

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

Reporting year	Protection PFE	Attributed to IUCN categories I-IV	Allocated for soil and water	With management plans	Sustainably managed
2005*	1540	1540	-	-	-
2010	1340	1950	613**	1340^a	-

* As reported in ITTO (2006).

** FAO (2010).

DENR Administrative Order 2007-01 (22 January 2007) established a national list of threatened Philippine plants and their categories, aligned with CITES appendices. The list includes 99 species that are critically endangered, 187 that are endangered, 176 that are vulnerable, and 64 that are threatened.^a

Protective measures in production forests.

Protective measures and procedures have been prescribed to protect biodiversity and environmental attributes in production forests, focusing on retaining undisturbed areas; protecting rare, threatened and endangered species; protecting features of special biological interest such as nesting sites, seed trees, niches and keystone species; and assessing recent changes on these aspects through inventories, monitoring and assessment programs and comparisons with control areas. The Biological Monitoring System being implemented by DENR's Protected Areas and Wildlife Bureau is used to assess changes in biological diversity in both production forest and protected areas.

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

Extent of protected areas. As of 2007, 107 protected areas covering about 3.34 million hectares had been proclaimed under the NIPAS Act. According to UNEP-WCMC (2010), 1.95 million hectares of forest are in protected areas that conform to IUCN protected-area categories I-IV. Many of the forests in protected areas are residual forests that were previously part of the production forest estate.

Estimate of the area of forest sustainably managed for protection. Management plans are being formulated for conservation reserves and watershed areas with international assistance. For example, the Global Environment Facility and the World Bank are supporting management and implementation activities in the four priority watershed areas of Sierra Madre: the Angat-Ipo and

Dona Remedios Trinidad watersheds, Bicol River Basin, Kanan Watershed and Ligawasan Marsh. The FMB evaluated 14 watershed management plans in 2008.

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

Socioeconomic aspects

Economic aspects. The estimated contribution of the forest sector to GDP was 1.6% in 1975, 0.14% in 1999, 0.05% in 2003 and 0.7% in 2008.^a FAO (2010) estimated total government revenue from the forest sector in 2005 at 136 million Philippine pesos, while the estimated total government expenditure in the forest sector was 1.98 billion Philippine pesos.

An estimated 21 000 people are employed in the forest products industry (excluding furniture-making), of which about 17 000 are male and 4000 are female. About 630 people are employed in direct forest operations under TLAs or IFMAs. The government sector employs about 22 500 professionally qualified people supporting forestry and about 900 trained forest workers.^a FAO (2010) estimated that about 910 people were employed in protected-area management in 2005.

Livelihood values. About one-third of the Philippine population lives below the poverty line. About 25 million Filipinos live in uplands, half of them occupying forestlands and dependent on them for subsistence uses and traditional and customary lifestyles. Communities occupying 1.6 million hectares of forestlands under CBFMA tenure are mostly dependent on government assistance and forest-based subsistence activities while awaiting plantation development.^a

Social relations. The Philippines has been experimenting with people's participation for more than 30 years. CBFM has been given the status of the flagship/banner program of DENR, particularly to address poverty and the lack of economic

development in upland and forest-dwelling communities.

About 12 million Indigenous people representing 110 different ethno-linguistic groups live in various forest, lowland and coastal areas. The Indigenous Peoples Rights Act (1997) recognizes, promotes and protects the following rights of Indigenous peoples: the right to ancestral domains/lands; the right to self-governance and empowerment; the right to social justice and human rights; and the right to cultural integrity. The law provides an enabling legal framework for the participation of Indigenous people in SFM, principally through CBFM and forest protection in their ancestral lands.^a

Nevertheless, Indigenous and non-Indigenous people in many forest areas have limited means of earning cash and many therefore engage in unregistered logging or rattan extraction. Attempts by DENR to police such activities are often seen as unjust, since corporations or local personalities similarly engaged may be prosecuted less readily. Non-indigenous groups have few legal options for protecting their rights, and those that are available are highly bureaucratic. There are many cases of overlapping land-tenure claims by Indigenous and non-indigenous groups, including in the implementation of the NIPAS (Fey 2007).

Summary

The Philippines has lost a substantial part of its natural forest, and timber production has declined dramatically in the last three decades. Considerable efforts have been made to encourage community forestry on degraded forestland. More than 5000 communities have community-based forest management agreements with the government over nearly 6 million hectares, and there is now also a mechanism for individuals to engage in forest stewardship. However, the extent to which these measures provide secure tenure is contested, and national legislation to bring greater certainty to the forest sector is stalled. Carbon capture and storage has the potential to increase the income that can be earned from forest restoration. In the longer term, this could help to improve the ability of upland areas to provide a range of ecosystem services.

Key points

- The Philippines has an estimated PFE of 6.35 million hectares (compared with 6.51 hectares in 2005), comprising 4.70 million hectares of natural production forest (the same as estimated for 2005), 1.34 million hectares of protection forest (compared with 1.54 million hectares in 2005) and 314 000 hectares of planted forest (compared with 274 000 hectares in 2005).
- At least 79 000 hectares of the production PFE are under SFM. No forest is certified, and no data were available on the area of the protection PFE under SFM.
- In addition to existing mechanisms for community forestry, the federal and local governments are beginning to share the stewardship of forests and forestlands with local people under individual property rights agreements, although to date few such agreements have been issued.
- Resources within the Department of Environment and Natural Resources have been reconfigured to focus on the restoration of ecosystem services and the creation of economic opportunities in upland areas.
- A timber-tracking system is being piloted and there are plans to deploy it nationwide in the hope it will facilitate forest law enforcement.
- The Presidential Task Force on Climate Change was created in 2007 to, among other things, provide mitigation and adaptation measures for reducing the impacts of climate change on the forest sector.
- The Government of the Philippines is strongly engaged in international REDD+ processes. The country has considerable potential for carbon capture and storage through forest restoration and afforestation, if forest governance can be improved.

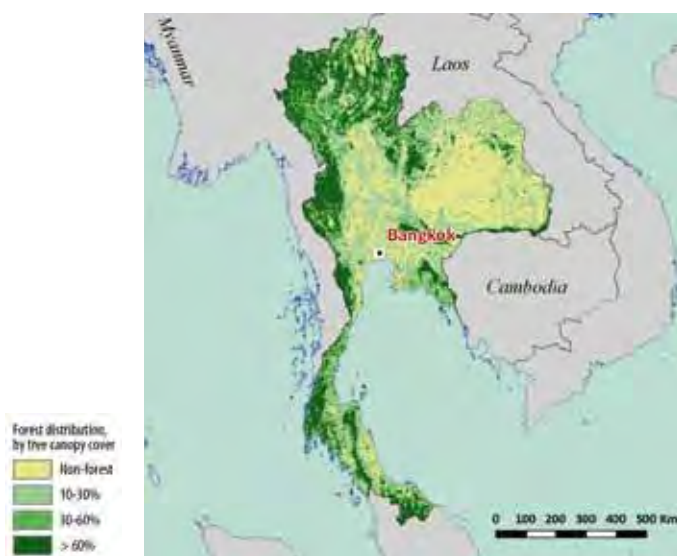
Endnotes

- a Government of the Philippines (2009).
- b ITTO estimate.
- c Personal communications with R. Umali, 2010. Ricardo Umali is President and CEO, Sustainable Ecosystems International Corp., and worked as a consultant in the preparation of Government of the Philippines (2009).

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THAILAND



Forest resources

Thailand is located in the southeastern part of continental Asia, bordered by Myanmar, the Lao People's Democratic Republic, Cambodia and Malaysia. It has a land area of 51.3 million hectares and a population in 2010 of 68.1 million people (United Nations Population Division 2010); it is ranked 87th out of 182 countries in UNDP's Human Development Index (UNDP 2009). Thailand is divided into five regions: Northern, Northeastern, Central, Eastern and Southern, with a total of 76 provinces and 716 districts. Each district is further divided into sub-districts (tambons).^a

Estimates of forest cover include 15.9 million hectares (Government of Thailand 2009) and 19.0 million hectares (FAO 2010). A change in the methodology used to estimate forest cover led to a significant increase in reported forest cover from 1998 (13.0 million hectares) to 2000 (17.1 million hectares; Government of Thailand 2009).

An analysis of 2008 Landsat data indicated that 55.3% of the Northern region, 32.9% of the Central region, 27.4% of the Southern region, 22% of the Eastern region and 16.5% of the Northeastern region were forested.^a

Forest types. The forests can be classified as:

- Evergreen forests with three sub-types – tropical rainforests, semi-evergreen forests and hill

evergreen forests, dominated by species of the genera *Dipterocarpus*, *Hopea*, *Shorea*, *Lagerstroemia*, *Diospyros*, *Terminalia* and *Artocarpus*.

- Pine forests, mainly of *Pinus merkusii*.
- Mangrove and coastal forests, the main mangrove genera being *Rhizophora*, *Avicennia* and *Bruguiera* and the main beach genera being *Diospyros*, *Lagerstroemia* and *Casuarina*.
- Mixed deciduous forest, the dominant species being *Tectona grandis* (teak), *Xylia kerrii*, *Pterocarpus macrocarpus*, *Dalbergia* spp and *Azelia xylocarpa*.
- Dry dipterocarp forest (ITTO 2006a).

Mangrove forests containing more than 35 species occur mainly on the country's west coast. While estimates vary it is likely that about half of Thailand's mangroves have been lost since the 1960s. Currently there are an estimated 248 000 hectares (Spalding et al. 2010).

Permanent forest estate. In Thailand the PFE is not deliberately demarcated and reserved, and the area of reported PFE has, therefore, changed over time. In 1991 the reported area of PFE was 23.5 million hectares, much of it already without forest cover. Table 1 presents an estimate of the current PFE based on a review by ITTO (2006b); it comprises 1.9 million hectares of state-owned plantations, an area of semi-natural teak forest categorized here as part of the natural production PFE, and just over ten million hectares of protection forest. Theoretically, forest reserves (see below) should be classified as PFE. Despite their legal status, however, they lack protection and many of them have lost their forest cover; moreover, few have an inventory or a management plan (ITTO 2006b).

Forest ecosystem health

Deforestation and forest degradation. During the 1960s and 1970s, widespread deforestation was caused by timber extraction and clearing for subsistence farming and commercial agriculture. During this time it is estimated that forest cover declined from 60% of the land area to around 25%

Table 1 Permanent forest estate

Reporting year	Estimated total forest area, range (million ha)	Total closed natural forest ('000 ha)	PFE ('000 hectares)			
			Production		Protection	Total
			Natural	Planted		
2005*	13.0–16.8	10 127	0	1870	8260	10 130
2010	17.2–19.0	6140**	251‡	1900†	10 000	12 160§

* As reported in ITTO (2006a).

** Calculated using the ratio of forest with greater than 60% forest cover estimated by UNEP-WCMC (2010) (32.3%) and the total natural forest area as estimated by FAO (2010).

‡ Semi-natural planted teak forest.

† Derived from STCP Engenharia de Projectos Ltda (2009), including eucalypt, pines, acacias and teak plantations. An addition area of 2.1 million hectares is planted with *Hevea brasiliensis* (but is not counted here).

§ FAO (2010) estimated the PFE to be 16.4 million hectares.

(RECOFTC–ASFN 2010). Growing realization of the importance of forests for environmental protection, ecosystem services and livelihoods led to the introduction of a logging ban in 1989 to protect the remaining natural forest. According to FAO (2010), the annual rate of deforestation has been declining for some years, from 0.77% between 1990 and 2000, to 0.11% between 2000 and 2005, to 0.08% between 2005 and 2010. An increase in the area of planted forest, however, masks a continued decline in the natural forest area (ITTO 2006b). Even taking into account planted forest (excluding plantations of *Hevea brasiliensis*), the Government of Thailand (2009) indicated significantly greater deforestation, from 17 million hectares in 2000 to 15.9 million hectares in 2006, an average annual rate of 1.1%. Many of the remaining native forests have been over-exploited and are now seriously deficient in growing stock and biodiversity^a, although there are about 6.7 million hectares of primary forest (Table 2).

The estimated annual average area of forest affected by fire in the period 2003–07 was 21 000 hectares, which was dramatically less than the 350 000 hectares per year reported for the period 1998–2002 (FAO 2010). Forests are also subject to a range of other disturbances, including those

caused by encroachment for agriculture, refugees from neighbouring countries seeking living space, the development of infrastructure, and illegal logging (ITTO 2006a).

Vulnerability of forests to climate change.

Thailand's weather is greatly influenced by monsoons that produce three seasons in the north and two seasons in the southern peninsular region. As with other countries in the region, Thailand is at risk from sea-level rise, higher temperatures, more frequent droughts, and changes in rainfall patterns that are likely to affect agriculture and cause increased flooding. Data from Thailand's Meteorological Department show that average temperatures have increased steadily in the last 40 years and rains have been arriving later. The agricultural sector, which employs 49% of the population and contributes 10% of GDP, is most at risk. Extreme climatic events, including floods, are likely to become more frequent and/or severe with future climate change (IPCC 2001). Thailand completed a first draft of its National Climate Change Master Plan (2010–2019) in early 2009. As of mid 2010 this was still under review by stakeholders.

Table 2 Forest condition

	PFE	Non-PFE	Total
	'000 ha		
Area of primary forest	-	-	6726
Area of degraded primary forest	-	-	-
Area of secondary forest	-	-	8728*
Area of degraded forest land	-	-	-

* 'Other naturally regenerated forest'.

Source: FAO (2010).

SFM policy framework

Forest tenure. Forests in Thailand are owned by the state, except for planted forests established on private lands. FAO (2010) estimated that 2.2 million hectares of forests were owned by private firms or individuals and the remainder was owned by the state (Table 3). About 250 000 hectares of forests are reserved for Indigenous and local communities (RRI 2009).

Thailand has 1221 national forest reserves covering an area of 23.4 million hectares (nearly half of the country's total land area), although large parts of these reserves are no longer forested. The largest share (11.2 million hectares) of the national forest reserves are in the Northern Region. About 20% of the country's 56 000 villages are located within national forest reserves (ITTO 2006b).

The government has issued various types of tenure rights for people living in national forest reserves. The establishment of community forests is currently permitted in national forest reserves under formal management by the Royal Forest Department (RFD) and in other forests which are not yet occupied or developed for use (RECOFTC–ASFN 2010). Local communities have no formal use rights in protected areas, although they are allowed to collect some basic forest products such as dry fuelwood and NTFPs for household use, with permission from the Department of National Parks, Wildlife and Plant Conservation (DNP).

Criteria and indicators. Although Thailand does not have an official C&I framework for monitoring, assessment and reporting on SFM in natural forests, it has prepared a set of C&I for the sustainable management of planted forests and also benefited from an ITTO C&I training workshop in 2009. The Thai Industrial Standard Institute (TISI), a

government agency that has responsibility for the preparation, adoption and application of standards, has prepared two draft proposals, Sustainable Forest management System: Guidelines for Sustainable Forest Management System Auditing (TIS 1406Y), and Sustainable Forest Management System: Guidelines on Competence of Sustainable Forest Management System Auditors (TIS 1406X), to be approved by the relevant Thai authorities. The submission to ITTO for this report was not in the ITTO C&I reporting format.

Forest policy and legislation. The 1997 Constitution recognizes the right and duty of traditional and other local communities to participate in natural resource management, and the right of the Thai people to participate in national policy formulation regarding resources and environmental development and conservation. A process of drafting a Community Forest Bill to provide a legal framework for community forestry began in 1991, but it has been hampered by a lack of consensus on key issues, in particular whether community forestry should be permitted in protected areas. The Bill was passed by the National Legislative Assembly in November 2007 but it has since been challenged in the Constitutional Court.

Thai forestry is regulated by a number of legislative instruments, including the Forest Control Act (1941), the National Park Act (1961), the National Reserved Forest Act (1964), the Wild Animal Reservation and Protection Act (1992), the Forest Plantation Act (1992) and the Reforestation Act (1992). Overall more than 20 laws and a number of Cabinet decisions are relevant to forest management (ITTO 2006b).

The 1941 national forest policy focused on timber production and dealt solely with the management

Table 3 Forest area, by tenure

Ownership category	Total area	Of which PFE	Notes
	'000 ha		
State ownership (national, state or provincial government)	16 700	12 200	250 000 hectares reserved for Indigenous and local communities, mainly in the Northern Region.
Other public entities (e.g. municipalities, villages)	0	0	
Total public	16 700	12 200	
Owned by local communities and/or Indigenous groups	0	0	
Privately owned by individuals, firms, other corporate	2200	0	

Source: FAO (2010).

of plantations and logging concessions in natural forests. The 1985 forest policy sought to establish the long-term coordinated management of forest resources, envisaging increasing the area of forest to 40% of the land area (15% for conservation and 25% for production).

With the imposition of a logging ban in 1989 the focus of forestry moved strongly towards conservation. The First Policy and Prospective Plan for the Enhancement and Conservation of National Environmental Quality (1997–2016) included guidelines for institutional reforms for the management of community forests, water, biodiversity and watershed protection, and the participation of people and communities. The forest-cover target was set as 50% (30% for conservation and 20% for production) (ITTO 2006b).

References to the forest sector in the country's 9th National Economic and Social Development Plan (2002–06) were general and provided insufficient guidance to government and stakeholders on the development of the forest sector (ITTO 2006b). The 10th plan (2007–2011), however, contains several specific targets to 'conserve natural resources and biodiversity', including:

- Maintaining forest at not less than 33% of the total land area, including conservation forest at no less than 18% of the total land area.
- Restoring 2.9 million rai (464 000 hectares) of conserved forest.
- Developing a GIS database and a 1:4000 information map to be used together with local participation in identifying reserved forest boundaries.
- Promoting community rights and participation in resource management, including through measures that would promote communities as strong social network bases for natural resource recovery and management.

Institutions involved in forests. The RFD was established in 1896 as the sole agency for the administration and management of forest resources. As a result, the ownership and control of all forests were transferred from feudal chiefs to the government. In 2002 the RFD was divided into three departments: the RFD, the DNP and the Department of Marine and Coastal Resources (DMC). All three are under the supervision of the

Ministry of Natural Resources and Environment. The RFD is responsible for forests outside protected areas (protected areas are the DNP's responsibility). The DMC is responsible for the management of coastal flora and fauna, including mangrove forests, and the Forest Industry Organization is responsible for government-owned plantations (Government of Thailand 2009). The total staff employed in public forest institutions in 2007 was 2329 (FAO 2010). The DNP and RFD have regional offices, which are responsible for all forest-related activities. These liaise with the superintendents of national parks and wildlife sanctuaries as well as with provincial and local authorities, such as Tambon administrations. Technical extension assistance to forest farmers is provided by specialized departments and the regional offices (Government of Thailand 2009).

The Forest Industry Organization was established in 1956 to oversee the industrial use of Thai forests. It has evolved into a diversified organization operating in resource management, industrial timber-processing and marketing, tourism, conservation and social development. The organization lacks a clear long-term vision and strategy about its future role (ITTO 2006b).

Some community forest organizations have built regional networks. For example, the Northern Farmer's Network is active across several northern sub-watersheds (Government of Thailand 2009). The Indigenous Knowledge and Peoples Network is a regional network of Indigenous communities throughout mainland Southeast Asia with the aim of protecting, promoting and enhancing the practice of Indigenous landscape and forest management.

Mutual suspicion between NGOs and forest-related public agencies has been diminishing, partly as a result of the opening-up of policy processes to broader participation, and there is an appreciation among most parties of the need to cooperate. However, government policies still tend to be opaque and access to information still needs to be improved. From the government's perspective, the fragmentation of the NGO community makes dealing with them somewhat cumbersome (ITTO 2006b).

Research in forestry is scattered. The RFD Research Division was divided into two when the DNP was established and there is no central body for forestry research, which has resulted in some

overlap and a lack of coordination. Many actors including universities and the private sector are conducting forestry-related research on specific issues of immediate interest to them. The Forest Restoration Research Unit¹ conducts participatory forest restoration research and capacity-building in northern Thailand.

Status of forest management

Forest for production

Prior to 1989, Thailand approached natural forest management on the basis of forest management (working) plans. General management guidelines prescribed that deciduous teak forest should be managed under a 30-year felling cycle. The dry dipterocarp forest was to be managed under the modified 'coppice' and 'coppice with standards' systems, based on a 20-year rotation. For the tropical evergreen forest, the management system adopted was similar to the selection cutting system prescribed for the deciduous teak forest, based on a 30-year felling cycle.

In the period 1960–1988, timber harvesting was carried out through more than 500 timber concessions covering about half the country; under this system the forests were over-harvested and residual stands were badly damaged. In 1989, after disastrous flash floods in 1988 in Nakomsithammarat Province, the government banned logging in natural forests, cancelled all concessions and abandoned the working-plan system (ITTO 2006a).

Despite the logging ban, however, the forests remained accessible and forest clearance and encroachment became widespread. In 1995 it was estimated that about 10 million people were living on state forest lands; these lands were subsequently allotted to the squatters (Nalampoon 2002). In 1996, the Government of Thailand revoked all logging licences in mangrove forests to reduce their destruction. Today, there is no official logging in natural forest.

National efforts by the DNP and the RFD to combat forest loss and degradation have focused on encouraging local community and forest-dwellers to participate in conservation and forest restoration projects as well as on strengthening

law enforcement and public-awareness campaigns. In the Tenasserim Biodiversity Corridor in the provinces of Ratchaburi and Kanchanaburi, a pilot REDD initiative is testing the use of participatory governance structures and mechanisms such as a community revolving fund to enable communities to manage forests and undertake livelihood activities (Government of Thailand 2009).

The most critical constraints impeding progress towards SFM in Thailand are bottlenecks in the regulatory framework; a lack of coherence between public policies; widely varying perceptions among stakeholders about how Thailand's forests should be conserved and managed; a lack of coherent support for communities and the private sector to manage forest resources; institutional uncertainty related to the administration of public forests; deficient information systems; and a lack of systematic strategies for human-resource development and extension (including processing industries) (ITTO 2006b). Effective land-use and land-tenure arrangements are needed in places where forest-dwellers and ethnic minorities claim ancestral land that is now in protected areas (Government of Thailand 2009).

ITTO (2006b) found many gaps and weaknesses in the management of Thailand's forests but formed the view that corrective actions could address many of these, stating that Thailand had accumulated "a wealth of knowledge and well-trained professional human resources, on which basis further progress towards the SFM goal can be made". ITTO has since funded a project to establish a national forest resources monitoring information system to provide change and trend data on timber and non-timber forest resources.

Silviculture and species selection. Various silvicultural systems, such as selection, shelterwood, coppice with standards and modified coppice, have been attempted in Thailand. Thailand has never had a systematically applied, long-term silvicultural management system, however, despite successful experiences in neighbouring countries, particularly Myanmar, with similar forest types. Moreover, the logging ban, in place since 1989, impedes silvicultural improvement in national forest reserves because treatment to liberate trees would involve harvesting (ITTO 2006b).

Another factor inhibiting silviculture is a lack of national-level forest inventories. Prior to the logging

¹ www.forru.org.

ban, inventories were regional or local in scale and only data on teak were collected (ibid.). As part of moves to participate in REDD, Thailand recently commenced a preliminary mapping of tree volume involving a 'panel' approach for plot measurement whereby one-fifth of plots are re-measured each year. The sampling design comprises a single systematic sample of points on a 20 km x 20 km uniform grid, covering Thailand's entire land mass (there are a total of 1287 monitoring points, of which 425 are in forests). Data from sample plots are expected to provide valuable input for updating information on forest cover and deforestation (Government of Thailand 2009).

Prior to the logging ban, the five most important species in the timber market were *Dipterocarpus alatus* (29%), *Shorea obtusa* (12%), teak (8%), *Hopea* spp (8%) and *Xylia kerrii* (5%) (ITTO 2006a). Now, plantation species have taken the place of all but teak (Table 4), which is largely derived from 'semi-natural' forest.

Planted forest and trees outside the forest. The total extent of planted forest, including *Hevea brasiliensis* (rubber), was estimated by FAO (2010) at 3.99 million hectares and by ITTO (2009) at 4.88 million hectares; not all of this is in the PFE (as shown in Table 1). In 2005 the estimated annual rate of reforestation and afforestation was 27 300 hectares. Species planted include teak (see below), *Eucalyptus* spp, *Acacia mangium* and other *Acacia* spp, other broadleaved species, *Pinus merkusii* and other *Pinus* spp, and other conifers (ITTO 2006a). The most important plantation species for the timber industry is rubber; the country's large estate of this species (estimated by FAO 2010 to be 2.1 million hectares), planted originally for its latex, is increasingly being harvested for timber. Timber from agroforestry plots, home gardens, avenue trees and farm trees is also increasing in importance.

The RFD began planting teak in 1906 on an area of less than one hectare. By 1980, the annual area



Planted managed teak forest, Thailand.

planted was about 160 000 hectares, under the *taungya* system. The state enterprises (the Forest Industry Organization and the Thai Plywood Factory) also established teak plantations to feed the industry. In 1992 the government passed the Forest Plantation Act, allowing the private sector to establish plantations on degraded forest land. In 1994 the RFD launched a forest plantation promotion project to encourage and support private landowners and local farmers to establish forest plantations of commercial tree species and to help the country become more self-sufficient in timber.

Forest certification. As of September 2010, forests totalling 19 000 hectares were certified by the FSC (FSC 2010). In Table 5, 11 000 hectares of these are counted as natural forest (being semi-natural teak forests) and 8000 hectares are counted as planted forests.

Estimate of the area of forest sustainably managed for production. With logging activities banned in the natural-forest PFE, there is no natural forest area sustainably managed for timber production. However, semi-natural planted teak forest in which timber production is possible may be considered as natural forest. According to the Government of Thailand, 251 000 hectares of semi-natural forest are subject to management plans^a, in sharp contrast to the 16.4 million hectares

Table 4 Commonly harvested species for industrial roundwood

Species	Notes
<i>Hevea brasiliensis</i> (rubberwood)*	Used in furniture manufacturing.
<i>Tectona grandis</i> (teak)*	Expensive cabinet wood.
<i>Eucalyptus</i> spp*	Cheaper utility wood, pulpwood, cellulosic biofuel.
<i>Acacia</i> spp*	Cheaper utility wood.
<i>Pinus</i> spp*	Construction timber and utility wood.

* Also listed in ITTO (2006). In the case of *Pinus* spp, *Pinus merkusii* was listed in ITTO (2006).

Source: Government of Thailand (2010) and personal communications (see endnote b).

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

Reporting year	Natural					Planted		
	Total	Available for harvesting	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
2005*	0	-	-	-	-	1870	250	1
2010	251**	251	251	11	11	1900	8[‡]	8

* As reported in ITTO (2006a).

** State-owned semi-natural teak forest.

‡ May include forest not in the PFE.

estimated by FAO (2010) (an area that is more than 4 million hectares greater than the total estimated PFE). The two estimates are difficult to reconcile, but in the absence of further information on the extent to which such management plans are current, the smaller estimate has been applied in Table 5 (the semi-natural forests being treated as natural). The 11 000 hectares of certified semi-natural forest is included in the total.

Timber production and trade. Each year more than 40 million tonnes of wood is produced and consumed in the form of fuelwood and charcoal^a (although FAO 2010 reported a total woodfuel harvest of only 7000 m³). The two main sources of industrial wood are eucalypt plantations and rubber plantations; estimated annual production in 2009 was 5.1 million m³, the same as reported for 2005–2008 (ITTO 2011). No estimates were available of the volume of timber harvested illegally.

Thailand exported 1.62 million m³ of sawnwood in 2009 (ITTO 2011), and the total value of wood-product exports – including paper products, fibreboard and wooden furniture – in that year was 100 000 million baht (about US\$3.2 billion at 2010 exchange rates).^a

Thailand is a net importer of primary timber products. In 2009 it imported 272 000 m³ of industrial logs (down from 468 000 m³ in 2004), 1.69 million m³ of sawnwood (1.84 million m³ in 2004) and 217 000 m³ of plywood (ITTO 2011). In 2009 the total value of primary timber product imports was about US\$376 million. By comparison, total primary timber-product exports were worth US\$307 million (ibid.).

Non-timber forest products. At least five million people are thought to be critically dependent on NTFPs, which provide material needs, cash income and employment at levels which are significant to the rural and national economies (ITTO 2006b).

Thailand has twelve genera and about 60 species of bamboo. The most recent survey, in 1998, showed that bamboo covered a total area of 800 000 hectares. On the basis of an average annual yield of 0.1 tonnes per hectare green weight and assuming that this area has been maintained, Thailand's potential annual production of bamboo from natural sources is about 500 000 tonnes. Bamboo is used extensively as a substitute for timber in construction, scaffolding, ladders, bridges, fences and pulp-making. The unregulated removal of bamboo from forests has created a shortage, however, which is a serious constraint for artisans and small and medium-sized enterprises. Shortages of rattan – another important NTFP in Thailand used in furniture manufacture and also as a food – in natural forests have prompted the establishment of plantations: by 2006 nearly 5000 hectares of rattan plantation had been established on state lands (ibid.).

Lac is the resinous secretion of several species of insect (the most common species being *Laccifer lacca*) used as a varnish and dye. Thailand is the second-largest lac-producing country after India. Lac is collected from the branches of numerous tree species (on which it has been secreted) in the natural forests of Thailand's Northern and Northeast regions (the Northern Region accounts for 80–90% of total production) (ibid.).

The national parks system is of growing importance to Thailand's ecotourism industry. With most parks easily accessible by road, there exists excellent potential to expand the number of visitors who use them. There is particular potential for nature-based tourism in northeastern Thailand. National parks close to the Mekong River include sites of prehistoric, archaeological and natural significance. As the Mekong region increases in its exposure and popularity, the number of visitors to these parks is

expected to experience. Ecotourism projects have been attempted since the late 1990s in several of Thailand's national parks and wildlife sanctuaries, with varying success.

Forest carbon. Thailand has an approved Strategic Plan on Climate Change (2008–2012), which emphasizes land use and forests. Gibbs et al. (2007) estimated national-level forest biomass carbon stock at 1346–2215 MtC, and FAO (2010) estimated the carbon content in the living forest biomass at 880 MtC. The Government of Thailand prepared a readiness idea note for the Forest Carbon Partnership Facility and joined the REDD+ Partnership in 2010. A pilot REDD project is being implemented in the Tenasserim Biodiversity Corridor. This project, which started in 2006, covers the largest contiguous stretch of primary forest in Thailand; it is an internationally recognized site for biodiversity and a global priority area for tiger conservation, and it also contains considerable stocks of carbon. However, REDD+ is a controversial issue in Thai society because questions concerning the access of Indigenous people to protected forest lands have not yet been resolved (RECOFTC–ASFN 2010). In order to make broad progress on REDD+ it will be necessary to address Indigenous rights and community forestry and to ensure that local people receive adequate benefits from forest protection efforts.

Forest for protection

Soil and water. The forest area managed primarily for the protection of soil and water is estimated at about 1.33 million hectares (FAO 2010).

Biological diversity. Thailand is endowed with about 7% of the world's known flora and fauna. There are an estimated 12 000 vascular plant species, including 1140 orchid species, and 2145 non-vascular plant species. Thailand also has an estimated 4600 species of vertebrates and 83 000 invertebrates (Chen et al. 2011).

Fifty mammals, 30 birds, four amphibians, four arthropods and seven plants found in forests are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species (IUCN 2011). Fifteen plant species are listed in CITES Appendix I, 232 in Appendix II and one in Appendix III (UNEP-WCMC 2011).

Protective measures in production forests. As there is no timber production in natural forests, all natural forests are considered to be protection forests, although many are still harvested for NTFPs for local consumption.

Extent of protected areas. An estimated 8.85 million hectares of forest is designated for the conservation of biodiversity in Thailand, another 130 000 hectares are designated for 'social services' and a total of 9.43 million hectares of forest is within protected areas (FAO 2010). Thailand has set a target of 25% of the country's total land area in protected areas; in 2006 the coverage was about 20%. The protected-area network comprises 227 declared protected areas (covering 11.3 million hectares, not all of it forest) under the control of the DNP. Although extensive, the protected-area network contain disproportionate amounts of upland forest and very little lowland evergreen forest; nevertheless it is considered to be one of the best in Southeast Asia (ITTO 2006b). UNEP-WCMC (2010) estimated that about 10.2 million hectares of forest were in protected areas that conformed to IUCN protected-area categories I–IV, including 553 000 hectares with 10–30% canopy cover, 2.16 million hectares with 30–60% canopy cover and 7.43 million hectares with >60% canopy cover.

Protected-area advisory committees have been established to assist in the management of protected areas. These are multi-stakeholder bodies, the membership of which includes ethnic minorities, forest dwellers and women. They are working effectively in many protected areas, while others need strengthening (Government of Thailand 2009).

Table 6 Forest carbon potential

Biomass forest carbon (MtC)	% forest with canopy cover >60%	Deforestation/ degradation potential to 2030	Enhancement of carbon sink capacity to 2030	Forest area change monitoring capacity	Forest/ GHG inventory capacity	Importance of forest fire/ biomass burning	Engagement in international REDD+ processes
1346–2215	32	++	+++	+	+	++	+

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

Estimate of the area of forest sustainably managed for protection. Data on the status of management in a large part of the protection PFE are unavailable. Of the total 103 gazetted national parks, the government had prepared master plans for 55 by 2006 (ITTO 2006b). Valid management plans existed for only 15 gazetted parks; another 45 areas had been proclaimed but not yet gazetted. Of the 55 wildlife sanctuaries, only 25 had management plans under preparation. Management plans have not necessarily led to improved protection as they have often lacked implementation (ibid.).

ITTO is providing support for the management of the Pha Taem Protected Forests Complex in northeastern Thailand as part of a wider transboundary biodiversity conservation area between Thailand, Cambodia and Laos. The project extends over an area of 174 000 hectares in Thailand and includes four protected areas and a fifth proposed protected area. ITTO (2006a) included this area in its estimate of sustainably managed protection forest. However, significant deforestation was observed in the Complex between 2002 and 2008 (from 66% cover to 62% cover), mostly in two of the protected areas and the proposed protected area (Trisurat & Gasana 2010). Recent conflict between Thailand and Cambodia in this area has affected project implementation. Therefore, the forests of only two of the protected areas, the Pha Taem National Park (approximately 31 800 hectares of forest) and the Yot Dom Wildlife Sanctuary (approximately 22 400 hectares of forest), are included in the estimate given in Table 7.

Another ITTO project supports the development of the buffer zone of the 348 000-hectare Kaeng Krachan National Park using participatory approaches. The approach to the management of this park is evolving towards a more participatory model (Suwanmanee 2009) and is thought to be consistent with sustainability.

Socioeconomic aspects

Economic aspects. The cessation of commercial harvesting in natural forests had reduced the contribution of forestry to GDP to about 0.1% by 2005 (ITTO 2006b). However, the wood-processing sector has increased production in recent years using timber obtained mostly from plantations, non-forest sources and imports, and the sector's contribution to GDP, therefore, is probably growing. Tourism is the country's primary source of foreign exchange and protected forests are a significant attraction. The government collected 45.7 million baht in forest-related revenue in 2007 (down from 131 million baht in 2002), including licence fees, forest improvement fees and royalties from timber harvesting (FAO 2010).

Livelihood values. Due to the logging ban, villagers are not allowed to fell or harvest any kind of living trees from natural forests for household or commercial purposes, although they have usufruct rights to NTFPs. They may, however, harvest plantation forests for timber and fuelwood, although a permit is required for teak and other 'reserved' species.

Forests have always been integral to rural life in Thailand and they play important social, economic and cultural roles. An estimated 1.2–2.0 million people live in and around protected areas (national parks and wildlife sanctuaries) and rely on forests for livelihoods. Another 20–25 million people live in or near national forest reserves and collect forest products from them, both for household consumption and to sell in markets for cash (ITTO 2006b).

Social relations. In Thailand, mistrust between authorities and communities has constrained implementation of community forestry as a key strategy for improving forest management (FAO 2009). The Community Forest Bill was expected to help community forestry to gain new prominence in Thailand and to resolve conflicts

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

Reporting year	Protection PFE	Attributed to IUCN categories I–IV	Allocated for soil and water	With management plans	Sustainably managed
2005*	8260	5450	9320	-	522
2010	10 000	10 200**	1330	402	402[‡]

* As reported in ITTO (2006a).

** UNEP-WCMC (2010).

‡ Comprises the Pha Taem National Park, the Yot Dom Wildlife Sanctuary and the Kaeng Krachan National Park.

between the national forestry administration and local communities, but activists are challenging it in the Constitutional Court (Government of Thailand 2009). It has been criticized for its potential to negatively affect more than 20 000 communities, which could be prevented from accessing and/or managing their current community forests because they are located within previously designated protected areas (Weatherby & Soonthornwong undated).

Despite various government policies aimed at encouraging it, less than 1% of the forest estate has been brought under community management. Key issues and constraints facing community forestry development include the following (ITTO 2006b):

- Authorities and many vocal NGOs have little trust or confidence in local communities as custodians of forests and fear that community forestry will contribute to further degradation of the remaining forests.
- The number of illegal immigrants is growing, especially in protected areas bordering Myanmar, Laos and Cambodia: it is feared that community forestry would give illegal immigrants use rights to forests and serve as a means for the immigrants to obtain Thai citizenship.
- Individual land-grant programs are transferring land to individual households in both protected areas and national forest reserves, possibly in areas that would otherwise be assigned as community forests.
- From the perspective of many villagers, who already have usufruct rights to forests, a formally registered community forest would appear to bring no additional direct benefits to them but, rather, would bring more responsibilities for forest protection and management.
- The lack of an appropriate regulatory framework has resulted in confusion about what can and cannot be done in a community forest, often contributing to frustration among, and frictions between, concerned parties. Field forestry staff often have to take personal risks to promote community forestry as later it may be determined that such activities were illegal.
- There is an inadequate framework for community forestry, including a lack of policy goals corresponding to local realities regarding

environmental degradation, inappropriate resource use, the imbalance between the demand and supply of forest products, the longstanding ban on logging, and uncertainties in the use of plantations.

The Government of Thailand has officially recognized ten ethnic minority groups known as 'hill tribes', concentrated in 20 provinces in the northern regions of Thailand. Increasing pressure on land and in-migration, especially in the north, has led to the need for measures to protect watersheds and forests in those provinces. The success of such measures, including through REDD initiatives, will primarily depend on the active participation of the hill tribes, and their input is needed to improve REDD planning and implementation (Government of Thailand 2009).

Summary

Logging in natural forests has been banned since 1989 in Thailand, but the forests remain under pressure from encroachment, illegal logging, fire and other agents. The Community Forestry Bill, which was first drafted in the early 1990s, finally passed into law in 2007 but its implementation has been held up by a legal challenge. It has been criticized on the basis that it could prevent some communities from accessing existing community forests because they are inside protected areas. The country's 10th National Economic and Social Development Plan (2007–2011) contains several targets for the conservation of natural resources. The regulatory framework for community forestry is unclear, and there is a lack of trust between forest authorities and forest communities. Plantations (especially of rubberwood) and imports are supplying the country's thriving downstream-processing timber industry. National parks are of growing importance to Thailand's economically important tourism industry.

Key points

- Thailand has an estimated PFE of 12.2 million hectares (compared with 10.1 million hectares in 2005), comprising 251 000 hectares of semi-natural teak planted forest, 10.0 million hectares of natural protection forest (compared with 8.26 million hectares in 2005) and 1.90 million hectares of planted forest (compared with 1.87 million hectares in 2005).

- An estimated 11 000 hectares of semi-natural teak planted forest, and 402 000 hectares of the protection PFE, are under SFM.
- The Community Forestry Bill, which has finally passed into law, is under legal challenge.

Endnotes

- a Government of Thailand (2010).
- b Input by participants at the ITTO Workshop on Criteria and Indicators for the Management of Tropical Forests held in Chiang Mai, Thailand on 26–29 May 2009.

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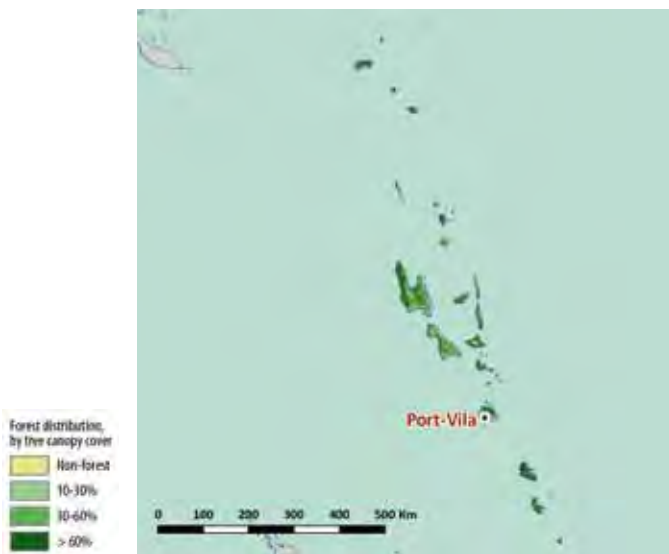
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VANUATU



Forest resources

Vanuatu is an archipelago of volcanic islands and submarine volcanoes extending some 1300 km from north to south in the western Pacific Ocean. It comprises over 80 islands and has a total land area of 1.23 million hectares. The two largest islands, Espiritu Santo and Malekula, comprise nearly 50% of the total land mass. Vanuatu had a population in 2010 of about 246 000 people (United Nations Population Division 2010) and is ranked 126th out of 182 countries in UNDP's Human Development Index (UNDP 2009).

Vanuatu is vulnerable to a broad range of natural disasters. Earthquakes are frequent, although they often originate at considerable depth and are therefore not too destructive. The majority of the rural population (about 80% of the total) lives in a subsistence economy. FAO (2010) estimated the area of natural forests at 440 000 hectares (36% of the land area). There are also about 476 000 hectares of 'other wooded land', some of which may qualify as forest under FAO's definition. The estimate of forest and other wooded land in FAO (2010) is based on data from a forest inventory conducted in 1989–92.

Forest types. The aforementioned forest inventory estimated that forests and other wooded land comprised 205 000 hectares of mid-to-high forest, 239 000 hectares of low forest, 434 000 hectares of thickets, 45 000 hectares of scrub and

380 hectares of woodland. Despite its extensive coastline, Vanuatu does not host a large area of mangroves, due in part to the steepness of its shores and continuing volcanic activities; the total area of mangroves is estimated at about 2050 hectares (Spalding et al. 2010). The mid-to-high forest (canopy height in the range of 20–30 m) and low forest (canopy height in the range of 10–20 m) fall under the broad category of tropical evergreen forests, the main species being of the genera *Calophyllum*, *Camptosperma*, *Dillenia*, *Elaeocarpus*, *Endospermum* and *Gmelina*. The common species in the mangrove forests belong to the genera *Rhizophora*, *Avicennia*, *Lumnitzera*, *Sonneratia* and *Xylocarpus* (ITTO 2006).

Permanent forest estate. Vanuatu has no legally defined PFE. Since all land is owned by individuals or clans, a future PFE will need to be negotiated with and agreed by the respective landowners. The estimates given in Table 1 for 2005 represented the area of forest that could possibly comprise a PFE in the future. In this report, however, the production PFE is shown as zero, since there has been no apparent move to create a PFE. The 2005 estimate is repeated for the protection PFE, since this area has been created, at least in part, with the support of landowners.

Forest ecosystem health

Deforestation and forest degradation. Few data are available on the condition of Vanuatu's forests (Table 2). Using data of "unknown accuracy", the Government of Vanuatu (2008) estimated that about 1700 hectares of forest were cleared annually in the period 2000–2005. The drivers and extent of deforestation and forest degradation vary between islands, with most deforestation occurring on the four main islands of Espiritu Santo, Efate, Tanna and Erromango. An estimated 50% of all deforestation is due to subsistence land use.

Vulnerability of forests to climate change. The climate in Vanuatu varies from wet tropical in the northern islands to drier sub-tropical in the southern islands. The climatic-change patterns in temperature and rainfall are similar to those described for PNG. Recent studies have shown, for example, that the annual and seasonal ocean

Table 1 Permanent forest estate

Reporting year	Estimated total forest area, range (million ha)	Total closed natural forest ('000 ha)	PFE ('000 hectares)			
			Production		Protection	Total
			Natural	Planted		
2005*	0.902	442	117	2.10	8.37	127
2010	0.440	394**	0	0	8.37	8.37

* As reported in ITTO (2006).

** Calculated using the ratio of forest with greater than 60% forest cover estimated by UNEP-WCMC (2010) (89%) and the estimated total natural forest area.

Source: ITTO estimate based on ITTO (2006).

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

All island developing states are highly vulnerable to climate change and sea level rise owing partly to their small land masses surrounded by ocean and their location in regions prone to natural disasters. Vanuatu is subject to frequent cyclones. A total of 124 tropical cyclones affected the country between 1939 and 2005 (Government of Vanuatu 2007); on average, a cyclone causes significant forest damage once every five years.

The Government of Vanuatu established the National Advisory Committee on Climate Change as early as 1989. It finalized its NAPA in 2007 (ibid.). The forest sector is listed in the NAPA as a key sector to be addressed for climate-change adaptation, along with agriculture, fisheries, water and tourism. According to the NAPA the forest sector is vulnerable to the effect of climate variability; for example, cyclones regularly open up large gaps in the forest canopy and allow the invasion of the vine *Merremia*, which hinders regeneration. The sector also presents considerable opportunities: Vanuatu possesses excellent soils and

a climate that is conducive to timber production. Challenges for the sector, as set out in the NAPA, include the development of an SFM plan, the replanting of logged-over areas, the promotion of commercial tree plantations and the expansion of agroforestry (ibid.).

SFM policy framework

Forest tenure. Under Vanuatu's Constitution, all lands, including forest lands, are vested in the Indigenous people as customary owners (Table 3). Only Indigenous citizens who have acquired their land in accordance with a recognized system of land tenure can own it in perpetuity. Land may be leased for a period of up to 75 years. Under the Land Leases Act, leases are administered by the government on behalf of the customary owners. This allows the government to oversee lease transactions in accordance with Article 79 of the Constitution, which requires government permission before land transactions may occur between Ni-Vanuatu (Indigenous people) and non-Indigenous citizens. Land-tenure disputes among tribal groupings are a common feature of Indigenous land-use planning (Government of Vanuatu 2008).

Criteria and indicators. No submission – either in the ITTO C&I reporting format or otherwise – was received from the Government of Vanuatu for this report.

Table 2 Forest condition

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

Table 3 Forest area, by tenure

Ownership category	Total area	Of which PFE
	'000 ha	
State ownership (national, state or provincial government)	0	0
Other public entities (e.g. municipalities, villages)	0	0
Total public	0	0
Owned by local communities and/or Indigenous groups	440*	0
Privately owned by individuals, firms, other corporate	0	0

* 100% of the total forest area assumed to be under customary ownership.

Forest policy and legislation. Article 7(d) of Vanuatu's Constitution states that "every person has the fundamental duty to ... safeguard the natural wealth, resources and environment in the interest of the present generation and of the future generations".

In 1991 the government instituted its national forest program, an important outcome of which was the draft national forest policy of 1995, which was later issued as the formal Vanuatu National Forest Policy Statement of 1997. During its preparation the views of stakeholder groups, including national and provincial governments, chiefs, community leaders, churches and the forest industry, were sought. Consultative meetings and workshops were held in every province. The national forest policy contains an indicative program of action in all aspects of the management of Vanuatu's forests which, if fully implemented, would lead to a significant improvement in forest management (ITTO 2006). It also makes specific recommendations for the management of forests in the various islands.

In 2010 the Vanuatu Department of Forests (VDF) reportedly undertook a review of the national forest policy with the aim of addressing current and emerging issues such as forest products and trade, SFM and climate change. A draft revised policy was circulated in May 2010, and an endorsement of the new policy by the Vanuatu Council of Ministers was expected by the end of 2010 (Tudrau-Tamani 2010).

The principal forest law is the Forestry Act (2001), which superseded the Forest Act (1982). Other laws that support the implementation of the forest policy

include the International Trade (Flora and Fauna) Act (1989), the National Parks Act (1993) and the Timber Rights Guarantees Act (2000). Under the provisions of these acts, several rules and regulations have been issued: e.g. a ban on log exports (1993), a code of logging practice (1996), mobile sawmill regulations (1996) and sandalwood regulations (1997).

Institutions involved in forests. The Ministry of Agriculture, Forestry and Fisheries is responsible for forestry. Within the ministry, the VDF, established in January 1980, is responsible for the management of natural forests through policy development, planning, protection, silvicultural principles and guidelines. It is also responsible for all reforestation, afforestation and small-scale sawmilling. In 2008 there were 19 staff (five of whom were women), including five with university degrees or an equivalent qualification (FAO 2010). This appears to be inadequate for policing adherence to forest-related rules and regulations; the VDF and other departments depend largely on the owners of the resource to come forward to report breaches of the regulations by concessionaires (ITTO 2006). In 2005, total public expenditure on the VDF was 48.5 million Vanuatu vatu and total revenue was 4.9 million Vanuatu vatu (FAO 2010).

The VDF maintains a policy of open cooperation with NGOs and collaborates closely with some programs carried out by them. NGOs such as the Foundation of the People of the South Pacific support and assist in training and extension programs. The Forestry Act (2001) provides a mechanism for wider and more consultative planning in forest management (ITTO 2006).

Status of forest management

Forest for production

Under the system of forest ownership existing in Vanuatu, the role of the government through the VDF is to provide guidance and support to customary owners in planning the use and development of their forest resources. The final decision on how to use the resource is the prerogative of the owners. Guiding regulations include the following:

- Harvesting quotas allocated to each of the four main islands (which are regarded as FMUs), based on estimated AACs.

- Minimum diameter limit set for each timber species.
- Periodic closure of harvesting in sandalwood areas.
- Licensing of operators to help ensure good logging practice.
- Selection logging to be practised.

Even though the importance of long-term forest management plans is emphasized in the Forestry Act (2001), as of 2005 no such plans had been prepared for any of the four main islands or for individual concessions (ITTO 2006). According to the Forestry Act, logging companies are required to prepare and submit a coupe harvesting plan, providing details of all operations, which must be approved by the VDF before logging commences. The national forest inventory estimated that the total forest area suitable for logging in Vanuatu was around 117 000 hectares, about 25% of the total forest resource, and the total forest growing stock was about 13 million m³. The remainder of the forest was considered unsuitable due to steep slopes, dissected land forms and low sawlog volumes and for cultural reasons. The quality of the natural forest for commercial forestry is low: in over 50 000 hectares of harvestable natural forests, the expected timber yield is about 20 m³ per hectare and even in the best parts of it the yield will not be more than 30 m³ per hectare.

A harvesting plan is normally prepared through consultations involving representatives of the provincial government, the VDF, the Department of Environment, the Lands Department, resource owners' representatives and the logging company. The Code of Logging Practice has been developed in consultation with the industry that is designed to foster the application of sustainable forest harvesting to reduce damage, soil disturbance and canopy openings. A lack of monitoring and post-harvest surveying of logging operations means limited information on the quality of harvesting is available. Logging concession agreements are relatively short-term (5–10 years); in 2005, 7200 hectares were allocated for logging under eight separate concessions. The largest concessions were foreign-owned (by operators from Malaysia and New Zealand). The estimated annual sustainable timber yield from the 117 000 hectares of natural forest suitable for logging is 68 000 m³ (ITTO

2006). In the period 2001–05 about 103 000 m³ were harvested under a selective logging regime. In 2001–04 the average volume harvested was about 23 900 m³, but there was a significant (although unexplained) fall in the harvest in 2005, to 7270 m³ (Government of Vanuatu 2008).

Silviculture and species selection. There are no comprehensive guidelines for the silvicultural management of the production forests, although it is broadly suggested that selective logging with minimum diameter cutting limits be employed. About 20 species are generally recognized as marketable but the timber industry in Vanuatu concentrates on just a few species, mainly for domestic sale. Many species cut elsewhere in the Pacific are not used in Vanuatu. Besides the species listed in Table 4, commonly used species are *Syzygium* spp, *Myristica fatua*, *Elaeocarpus angustifolius*, *Antiaris toxicaria* and *Castanospermum australe*. In addition, *Agathis macrophylla* (kauri) is much sought-after for timber and has been an important export in the past. Easily accessible stands are now exhausted. *Santalum austrocaledonicum* (sandalwood), valued for the essential oil in its heartwood, is a major silvicultural challenge, in particular regarding its regeneration (ITTO 2006).

Table 4 Commonly harvested species for industrial roundwood

Species
<i>Dysoxylum confertiflorum</i>
<i>Pterocarpus indicus</i> (bluwota)
<i>Intsia bijuga</i> (natora)
<i>Calophyllum neo-ebudicum</i>
<i>Endospermum medullosum</i> (whitewood)

Source: ITTO (2006).

Planted forest and trees outside the forest. The area of planted forest in Vanuatu is about 2100 hectares, including about 300 hectares of privately owned *Endospermum medullosum*. The annual planting rate is reported to be 30–40 hectares. Agro-industrial plantations of *Cocos nucifera* (coconut), with an area of 215 000 hectares, are an important non-forest source of wood (ITTO 2006).

Planted forests tend to be established in small woodlots, generally of less than one hectare. *Pinus caribaea* and *Cordia alliodora* are the most important plantation species, and *Suietenia macrophylla* and *Tectona grandis* have been used

recently, together with agroforestry tree species. Currently, there is little logging for commercial purposes in planted forests. Considering the inadequacies of Vanuatu's natural forests for production purposes because of their quality, composition and distribution, planted forests will have to play a much larger role if future timber needs are to be met, but, to date, the sector has been short on planning and effective implementation. The national forest policy suggested an initial target of 20 000 hectares of planted forests by 2020. Trees outside the forest are mainly coconut and fruit trees in home gardens. Trees on farms and cattle ranches are important for meeting local needs for timber.

Forest certification. There have been no moves towards certification in the country.

Estimate of the area of forest sustainably managed for production. In the absence of long-term management plans, post-harvest care or recent information on improvements, production forests in Vanuatu cannot be considered to be managed sustainably (Table 5).

Timber production and trade. Total roundwood production in 2005 was estimated at 137 000 m³, of which 105 000 m³ was used as fuelwood (FAO 2010). The production of industrial logs in 2009 was estimated at 30 000 m³, unchanged since 2002 (ITTO 2011). The 2009 log harvest yielded an estimated 14 000 m³ of sawnwood, about 2500 m³ of which was exported (ITTO 2011). Wood-processing units are small and of low technology. The exploitable forest resource is probably too limited and geographically dispersed to encourage the establishment of competitive international-scale mills. There are two significant-sized, fixed-site mills and several smaller mills, plus around 50 portable sawmills. The fixed-site mills generally have some form of wood-preservation treatment facility (ITTO 2006).



Forests protect the Cascades Waterfall, a tourist attraction near Port Vila, Vanuatu. © istockphoto/H. Mette

Non-timber forest products. Being the raw material to produce sandalwood oil, sandalwood (*Santalum album*, *S. austrocaledonicum*) is the most important NTFP in Vanuatu. About 70 tonnes were exported in 2000, much of it to Taiwan Province of China, with a total estimated value of 700 000 Australian dollars (Berry 2002, cited in Robson 2004). The estimated sustainable annual yield of sandalwood is 80 tonnes. An oil-extraction facility has recently been constructed for the domestic production of sandalwood oil. Other important NTFPs that are locally processed and exported include sago fruit shells, *Canarium* nuts and *Barringtonia* nuts. Bamboo, palm fibres, medicinal plants and live birds are important locally. Forest recreation is an emerging activity. There is an ecotourism facility in one of the forested protected areas (ITTO 2006).

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

Reporting year	Natural					Planted		
	Total	Available for harvesting	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
2005*	117	-	0	0	0	2.1	2.1	0
2010	0	0	0	0	0	0**	0	0

* As reported in ITTO (2006).

** 2100 hectares of plantations have management plans but are not shown in the table because they are part of a PFE.

Source: ITTO (2006).

Forest carbon. No forest carbon estimates for Vanuatu are available in the literature. Based on the estimated forest area and assuming the same carbon density found in similar forest ecosystems, the total forest biomass carbon stock could be in the range of 35–60 MtC. Although it appears that there is relatively little deforestation or forest degradation in Vanuatu at present, the pressure on forests could increase in coming years as the supply of roundwood from the Solomon Islands decreases. The Government of Vanuatu submitted a readiness plan idea note to the Forest Carbon Partnership Facility in 2008 and is a member of the REDD+ Partnership. Table 6 shows Vanuatu's current forest carbon potential.

Forest for protection

Soil and water. Much of the natural forest in the mountainous interior plays a primarily protective role. However, some of these forests have been degraded by grazing and, in places, by burning. In some areas, erosion and soil degradation are significant problems. No data are available on the extent or percentage of forest managed primarily for the protection of soil and water, although some areas are reserved for this purpose in coupe harvesting plans (ITTO 2006).

Biological diversity. Vanuatu's forests are relatively species-poor and structurally less complex than the forests of the Solomon Islands and PNG due to the geological youth of the archipelago, its isolation and frequent cyclones. The degree of endemism in the Vanuatu flora is not as great as in neighbouring countries, either; around 15–20% of trees and shrubs are thought to be endemic. Five mammals, six birds, one reptile and one plant found in forests are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species (IUCN 2011). Twenty-six plants are listed in CITES Appendix II (UNEP-WCMC 2011). Vanuatu has national conservation strategies for six commercial tree species (*Endospermum medullosum*,

Agathis macrophylla, *A. silbae*, *Intsia bijuga*, *Pterocarpus indicus* and *Santalum austrocaledonicum*) (ITTO 2006).

Protective measures in production forests.

The Code of Logging Practice has provisions for exclusion zones (e.g. steep slopes, environmentally sensitive and unstable soils and stream buffers), guidelines for establishing infrastructure (e.g. road standards) and operational controls.

Extent of protected areas. ITTO (2006) reported five forest protected areas totalling 8366 hectares. These comprise mid-to-high forest (6349 hectares – 3% of all mid-to-high forest), low forest (1717 hectares – 0.7% of all low forest) and mangrove forest (300 hectares – 12% of all mangroves) (ITTO 2006). According to UNEP-WCMC (2010), no forests are in reserves conforming to IUCN protected-area categories I–IV, but this may be due to the low resolution of UNEP-WCMC data, and the ITTO (2006) estimate is used in Table 7. The boundaries of protected areas are not demarcated on the ground but are mapped using customary land boundaries, which usually use physically prominent features such as trees, coastline, ridges and rivers; they are therefore known to most people living near the area (ITTO 2006). There is limited capacity in the country to implement the National Parks Act for the protection of these areas. Although the system of customary landownership makes it difficult to create new protected areas, more than 50% of existing protected areas were either initiated or supported by landowners and surrounding communities (ITTO 2006).

Estimate of the area of forest sustainably managed for protection. No information on the status of management in protected areas was available for this report (Table 7).

Table 6 Forest carbon potential

Biomass forest carbon (MtC)	% forest with canopy cover >60%	Deforestation/ degradation potential to 2030	Enhancement of carbon sink capacity to 2030	Forest area change monitoring capacity	Forest/ GHG inventory capacity	Importance of forest fire/ biomass burning	Engagement in international REDD+ processes
35–60	89	+	++	+	+	+	++

+++ high; ++ medium; + low; biomass forest carbon estimated by ITTO; estimate of % total forest with canopy cover >60% based on UNEP-WCMC (2010).

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

Reporting year	Protection PFE	Attributed to IUCN categories I-IV	Allocated for soil and water	With management plans	Sustainably managed
2005*	8.37	0	-	-	-
2010	8.37	0	0	0	0

* As reported in ITTO (2006).

Source: ITTO (2006), UNEP-WCMC (2010).

Socioeconomic aspects

Economic aspects. Forestry's contribution to GDP was about 7.7% (US\$2.84 million) in 2000 (ITTO 2006). In 2007 the contribution of formal forestry and logging to Vanuatu's economy was 102 million Vanuatu vatu, which was 0.5% of GDP (Asian Development Bank 2009). An estimated 500 people are employed directly in the logging sector (ITTO 2006).

Livelihood values. Eighty percent of the population lives in rural areas and almost all people are engaged in some form of small-scale commercial or subsistence forestry activities (Asian Development Bank 2009). In addition to commercial forestry operations, fuelwood, herbal medicines, bush meat, edible nuts, thatch grass, and plants used for ceremonial purposes and the manufacture of musical instruments are all part of the subsistence needs of rural communities (ITTO 2006).

Social relations. The Forestry Act (2001) provides a mechanism for a broad consultative planning process comprising a management committee involving a provincial representative, a representative of the resource owner, and representatives of the VDF, the Environment Department and the Lands Department. The low level of literacy in Vanuatu makes it difficult for forest officers to fully explain forestry issues and terminology to landowners (ITTO 2006).

Summary

Vanuatu faces a number of development constraints, including its vulnerability to natural disasters, its small domestic market, and low existing business capacity. Notwithstanding these constraints, however, there is a strong traditional culture that promotes social stability, and the country has valuable natural resources, including its forests and woodlands. ITTO did not receive a submission from the Government of Vanuatu for

this report, and relatively little recent information on the status of forest management was available. No formal PFE has been created in Vanuatu because all forests are under customary ownership. There appears to have been little change in the forest-policy environment since 2005, and no indications of an improvement in the approach to SFM.

Key points

- All lands, including forests, are customarily owned, and there is no formal PFE, although 8370 hectares of protected forests may be considered permanent.
- Production forests are not covered by long-term management plans and therefore cannot be considered sustainably managed. No estimate could be made of the area of protection PFE under SFM.
- The national forest policy contains an indicative program of action on all aspects of the management of Vanuatu's forests which, if fully implemented, would lead to a significant improvement in forest management.

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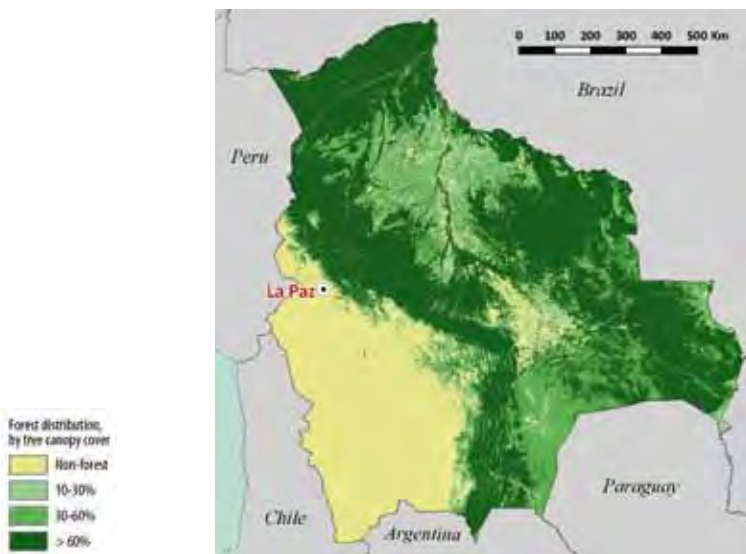
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BOLIVIA



Forest resources

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

Forest types. Few countries have as great a diversity of ecosystems as Bolivia; the major biomes are tropical forests, including tropical humid forests and semi-humid forests; mountain forests and high Andean grassland plains; savannas; and wetlands.^a The tropical forests of Bolivia lie in the departments of Beni, Pando, Santa Cruz, La Paz (the northern

part thereof) and (northwestern) Cochabamba. There are twelve tropical forest types, which are rich in timber species such as *Swietenia macrophylla* (mara), *Hura crepitans* (ochoó), *Calophyllum* spp (palo maría) and rubber, as well as NTFPs such as *Bertholletia excelsa* (Brazil nut). The semi-humid forest, the *Chiquitania*, is located mainly in the department of Santa Cruz and is characterized by species such as *Astronium urundeuva* (cuchi) and *Tabebuia* spp (tajibo). Sub-Andean and Andean forests cover the western flank of the Andean chain at altitudes between 400 and 3500 m. These are characterized by Lauraceae and Meliaceae up to 900 m, by walnut–pine forests (*Juglans australis* and *Podocarpus* spp) between 1200 m and 1700 m and, beyond that up to 2700 m, by *Alnus acuminata* (aliso) (ITTO 2006).

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

Forest ecosystem health

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

Table 1 Permanent forest estate

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

* As reported in ITTO (2006).

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

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

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

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

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

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

SFM policy framework

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

Table 2 Forest condition

	PFE	Non-PFE	Total
	'000 ha		
Area of primary forest	-	-	38 200
Area of degraded primary forest	-	-	10 000
Area of secondary forest	-	-	-
Area of degraded forest land	-	-	3 000

Source: Government of Bolivia (2009).

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

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

The forestland controlled by smallholders is estimated at about 2.6 million hectares, while the total land under colonization in the lowlands is about 3.8 million hectares (*ibid.*). The area of forest in the hands of communities, mainly

Indigenous groups, has also grown over time due to the formalization of Indigenous community lands (*tierras comunitarias de origen* – TCOs).

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

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

Table 3 Forest area, by tenure

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

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

Source: ITTO estimate based on Pacheco (2008).



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

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

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

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

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

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

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

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

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

The Law of Popular Participation (*Ley de Participación Popular*, Ley 1702, 1996) conferred

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

Municipalities propose to the ministry the delimitation of the PFE as municipal reserves (*reservas municipales*) and support ASLs in the management of their delimited forests. They also have control of forest management planning and planned deforestation activities, regulate and control forest use, and detect illegal forestry activities.⁴ However, even though the regulations are clear between these decentralized levels, widespread poverty limits the prioritization of forest management on the local development agenda; a lack of resources is reflected in the weak capacity of local agencies to apply the regulations. At the municipal level, FMUs are also weak due to a lack of funds and because the institutional framework under construction is generating uncertainty among local actors (G. Ulloa, pers. comm., 2010).

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

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

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

Status of forest management

Forest for production

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

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

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

In privately owned forests, a permit for conversion to other economic land uses can also be obtained. The rules for forest management plans are described in Forest Law 1700 and complementary regulations (Supreme Decree 24453/96). A management plan must be prepared by a professional forester who is independent of the concessionaire. In 2003, a total of 86 commercial forest concessions were operating

in an area of 5.47 million hectares, most of them with valid management plans (ITTO 2006). In 2008, 3331 FMUs were in place over a total area of 9.68 million hectares, including 83 commercial forest concessions covering 5.6 million hectares, 243 TCOs covering 930 000 hectares, and 32 ASLs covering 720 000 hectares (see Box 1).^a

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

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

Box 1 Forest permits in FMUs, 2008

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

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

Source: Government of Bolivia (2009).

Table 4 Commonly harvested species for industrial roundwood

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

* Also listed in ITTO (2006).

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

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

There are more than 2000 tree species in Bolivia, of which at least 220 have been used and marketed (ITTO 2006). In the past, forest operations in Bolivia were based on the selective logging of a few valuable species, in particular *Swietenia macrophylla* (mara) and *Cedrela odorata* (cedro). In recent years, the number of harvested species has increased and this has resulted in higher removals. In 1995 (before the enactment of Forest Law 1700), for example, mara accounted for around 16% of the commercial timber removed (ITTO 2006); currently, however, it officially constitutes less than 1%. The volume of cedro harvested in 2000 was more than 100 000 m³; today less than 20 000 m³ of that species is harvested annually.^b In addition to the species listed in Table 4, important timber species harvested in Bolivia include *Anadenanthera colubrina* (curupaú), *Caesalpinia pluviosa* (momoqui), *Vochysia haenkeana* (cambará), *Aniba guianensis* (canelón), *Terminalia amazonica* (verdolago), *Ficus* spp (bibosi), *Swartzia jorori* (jorori), palo maría, *Sterculia apetala* (sujo), *Cariniana ianarensis* (yesquero blanco) and *Schizolobium amazonicum* (serebó).

Planted forest and trees outside the forest. In 2008 the total area of planted forests in Bolivia

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

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

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

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

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

Timber production and trade. The estimated industrial roundwood production in Bolivia in 2009 was 910 000 m³ (ITTO 2010); the Government of Bolivia (2009) estimated the total average annual log production at 1.77 million m³. On average an estimated 460 000 m³ of sawnwood were produced annually between 2007 and 2009 (ITTO 2010). Nearly 100% of log production and 85% of sawnwood are used domestically (ibid.), although there are reports of increased exports in recent years, mainly to China. Although the country produces a significant quantity of certified wood, access to environmentally sensitive international markets is limited.

The wood-products industry consists primarily of small and medium-sized enterprises with mostly obsolete technology producing solid wood products.^a In 2008, 428 sawmills were registered by the ABT and there were an estimated 2100

enterprises in secondary wood-processing.^a The current insecurity of tenure for industrial enterprises has resulted in insufficient investment in forest industry and there is a risk that the relatively high standard of wood-processing will disappear. A major handicap for Bolivia's wood industry is the high cost of production per unit volume due to factors such as a low rate of extraction per hectare; the high cost of forest management; and the cost of essential inputs such as machinery, fuel and transportation. Wood prices are more than twice as high as in Brazil, Bolivia's principal competitor (USAID 2008).

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

Forest carbon. According to inventories of GHG emissions made by the National Climate Change Program (*Programa Nacional de Cambios Climáticos*), the vast majority (83%) of CO₂ emissions stem from changes in land use, in particular the conversion of forests to fields and pastures for agriculture and livestock. Gibbs et al. (2007) estimated the forest biomass carbon stock at 2469–9189 MtC, while FAO (2010a) estimated

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

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

* As reported in ITTO (2006).

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

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

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

Forest for protection

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

Biological diversity. Bolivia is ranked seventh in the world for the diversity of its birds, tenth

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

Protective measures in production forests.

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

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

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

Table 6 Forest carbon potential

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

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

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

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

* As reported in ITTO (2006).

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

The Noel Kempff National Park was extended in 2005 through the buy-out of logging rights for 832 000 hectares of forest by a consortium of three organizations and its incorporation into the national park as part of a large-scale carbon offset project. This first known REDD project has certified nearly 1 million tons of CO₂ (Government of Bolivia 2008). However, no financial compensation has been paid due to a lack of institutional and legal agreements and regulations regarding the distribution of carbon credits.

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

Socioeconomic aspects

Economic aspects. Forestry accounted for 0.9% of GDP (approximately US\$39 million) and the 'wood and wood products' sector represented 1.1% of GDP (approximately US\$45 million) in 2008 (National Institute of Statistics of Bolivia 2010). The forest sector contributes directly to the generation of more than 90 000 jobs, and about 160 000 families benefit from employment in

the forest sector (Government of Bolivia 2008). Community forest-user groups are responsible for less than 6% of forest production (Pacheco 2008) because most of the harvest is conducted on private lands and in forest concessions. A significant informal sector is involved in logging and industrial operations.

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

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

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

Summary

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

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

Key points

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

Endnotes

- a Government of Bolivia (2009).
- b Information derived from discussions held with representatives of government, civil society and the private sector at an international workshop on governance and REDD, held 30 August–3 September 2010, Oaxaca, Mexico.

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BRAZIL



Forest resources

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

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

The two main forest types in the Amazon are dense and open ombrophilous (humid) forests. The dense humid forests are characterized by large and medium-sized trees (with canopy up to 50 m and emergent trees up to 40 m) and abundant lianas

and epiphytes. In the open humid forests the trees are more widely spaced and palm creepers and bamboos are more common.

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

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

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

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

Table 1 Permanent forest estate

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

* As reported in ITTO (2006).

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

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

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

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

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

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

- 80% of rural properties located in forest areas in the Legal Amazon.³

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

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

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

Forest ecosystem health

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

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

² Data are for both federal and state lands.

³ The Legal Amazon was set by law for economic planning reasons. It comprises the states of northern Brazil (Acre, Amazonas, Amapá, Pará, Rondônia, Roraima and Tocantins), part of the states of Mato Grosso and Maranhão, and a small portion of the state of Goiás. It covers an area of more than five million km², which is about 61% of the Brazilian territory.

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

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

Note: Includes the Amazon, caatinga, cerrado and Mata Atlântica biomes; may include some non-forest and some non-tropical forest.

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

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

DETEX (Detection of Selective Logging Activities), developed with the support of the Brazilian Forest Service (*Serviço Florestal Brasileiro*), generates information for monitoring management plans

in forest concessions (created by Law 11 284/06) and in public forests in general. Using images from Landsat and CBERS, multi-temporal DETEX studies have been conducted in national forests and forest concessions, especially in the vicinity of the BR-163 and BR-319 roads to identify instances of exploratory timber activity. All public forests in the Amazon have been monitored by this system since 2008.

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

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

Table 2 Forest condition*

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

* All forests.

** 'Other naturally regenerated forest'.

Source: FAO (2010a).

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

SFM policy framework

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

Extractive reserves are state-owned areas in which use rights are granted to traditional extractive populations whose subsistence is based on the

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

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

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

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

Source: CNUC (2011).

Table 3 Forest area, by tenure*

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

* Tropical forests only.

Source: Government of Brazil (2010).

use, besides being inalienable and unavailable (can not be disposed of or alienated), they cannot be the object of use of any kind by anyone other than the Amerindians themselves.³ Of the 106 million hectares of forest in the Amazon allocated to Indigenous communities, 1.75 million hectares have been 'bounded', 8.1 million hectares have been 'declared', 3.6 million hectares have been 'approved' and 92.2 million hectares have been 'regularized' (i.e. full rights have been secured).³

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

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

Under the new law, squatters occupying up to 100 hectares of land will be given title to the land free of cost. Lots measuring between 100 and 400 hectares

will be sold at a 'symbolic cost', and holdings of 400–1500 hectares will be sold at market prices. Larger lots of up to 2500 hectares will be auctioned to the highest bidder. Anything larger can only be sold with congressional approval.⁴

Criteria and indicators. The Government of Brazil participates in the Tarapoto C&I process coordinated by the Amazon Cooperation Treaty Organization and used the ITTO C&I in its submission to ITTO for this report.³

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

Forest-related legislation includes:

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

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

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

The enactment of the Public Forest Management Law in 2006 was a significant achievement. Previously, although large areas of forest are located

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

In 2010 the Brazilian Development Bank established the ‘Support to Reforestation, Recovery

and Sustainable Use of Forest’ program, the aim of which is to support the reforestation, conservation and forest recovery of degraded or converted areas and the sustainable use of native areas through SFM.

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

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

Status of forest management

Forest for production

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

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

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

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

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

- The maximum allowable harvest is 30 m³ per hectare when harvesting is mechanized and 10 m³ per hectare when the operation does not use heavy machinery, with harvesting cycles of 35 years and ten years, respectively.
- For those forest species whose minimum cutting diameter had not previously been determined, the minimum cutting diameter is set at 50 cm.
- At least 10% of each exploited tree species which could be harvested are to be left standing as seed bearers, selected in each 100-hectare working unit.
- A tracking system (chain of custody) is required for harvested trees.
- The use of waste wood is allowed.

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

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

micro-zoning by enabling the production of maps at a scale of 1:15.^a

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

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

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

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

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

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

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

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

As reported above, the maximum allowable harvest is 30 m³ per hectare when harvesting is mechanized and 10 m³ per hectare when the operation does not use heavy machinery, with harvesting cycles of 35 years and ten years, respectively.

Table 4 lists some commonly harvested tropical timber species.

Box 3 Flow-chart of Amazon logging planning process

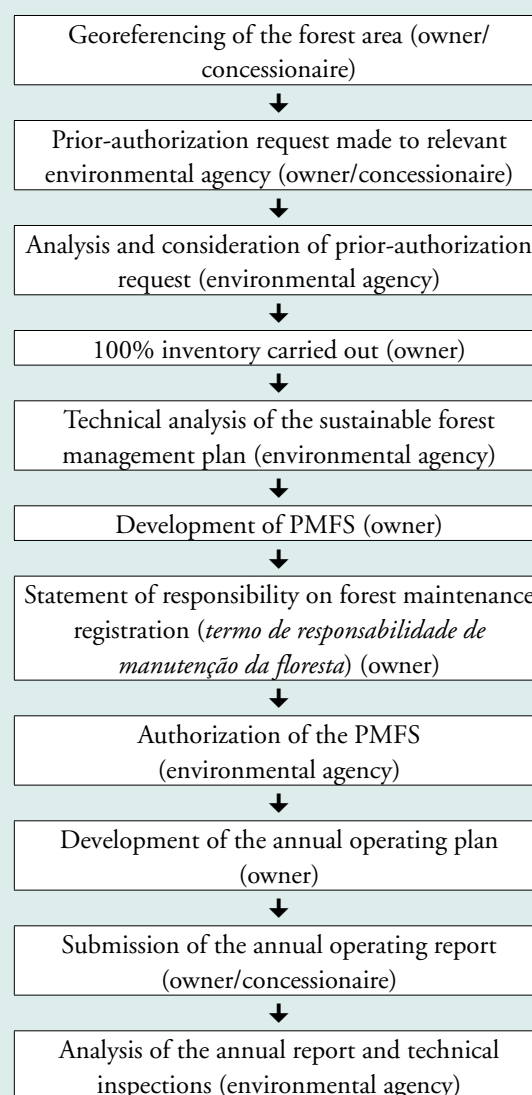


Table 4 Commonly harvested tropical species for industrial roundwood

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

* Also listed in ITTO (2006).

Source: Personal communications – see endnote b.

Planted forest and trees outside the forest.

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

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

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

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



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

area of natural tropical production PFE considered to be under SFM is at least 2.70 million hectares (Table 5).

Timber production and trade. On average, an estimated 247 million m³ of logs were produced annually in Brazil in the period 2005–08, comprising 81 million m³ of logs from natural forests and 166 million m³ of logs from plantations. FAO (2010a) estimated that over half of this is fuelwood.

Brazil produced an estimated 23.7 million m³ of (non-coniferous) tropical logs for industrial purposes in 2009, down from a peak of 29.7 million m³ in 2003. About 15.5 million m³ of tropical sawnwood were produced in 2009 (up slightly from the 14.4 million m³ produced in 2003), of which 1.06 million m³ were exported. In the same year, Brazil produced about 600 000 m³ of tropical plywood, down from a peak of 1.38 million m³ in 2003 (ITTO 2010).

Brazil's production of tropical logs is less than one-quarter of total industrial roundwood production, which was 105 million m³ in 2009. Log-processing capacity in the Legal Amazon declined from 10.4 million m³ per year in 2004 to 5.8 million m³ per year in 2009 (ibid.).

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

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

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

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

* As reported in ITTO (2006).

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

† Tropical and non-tropical.

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

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

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

Brazil is closely engaged in the international REDD+ Partnership and is co-chairing this process in 2011. The country has been a participant in the Forest Carbon Partnership Facility since 2008 and is a recipient country of the Forest Investment Program. Significant investments in forest carbon

are also being made at the state level. In Acre, for example, a US\$100 million investment made through the Inter-American Development Bank was used to initiate, in the period 2007–10, a major investment promotion with the aim of creating a sustainable financing scheme for REDD+ in that western Amazonian state. Through REDDES, Brazil participates in and benefits from an ITTO project implemented by the Amazon Cooperation Treaty Organization for capacity-building on monitoring land use, land-use change and forests in the Amazon region. Table 6 summarizes Brazil's current forest carbon potential.

Forest for protection

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

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

Table 6 Forest carbon potential

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

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

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

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

Protective measures in production forests.

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

Extent of protected areas. There is uncertainty about the extent of protected areas in Brazil; partly this stems from differences in the definition of 'protected' and the extent to which extractive uses are permitted. The estimate of protection PFE given

in Table 1 and Table 7 comprises conservation units of integral protection and Indigenous reserves. The estimate is considerably less than that reported in ITTO (2006), most likely due differences in definition of what constitutes PFE rather than to a significant change in legal status or forest area.

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

Estimate of the area of forest sustainably managed for protection.

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

Socioeconomic aspects

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

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

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

* As reported in ITTO (2006).

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

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

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

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

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

Summary

Significant advances have been made towards sustainable management in the Brazilian Amazon; for example, the area of certified natural forest has doubled since 2005. Despite continuing deforestation, clearance rates have declined dramatically in the last five years. Moreover, funds are being made available to improve forest management and protection, forest law enforcement is being strengthened, and new laws and regulations provide for improvements in forest management. A number of data-gathering services are greatly improving the availability and timeliness of forest-related information, although data on the management of forested protected areas were unavailable for this report. Efforts are also under way to clarify land tenure and to put

FLONAs under management plans, and large areas of forest are managed by Indigenous and other local communities (although the process of recognition and approval of tenure is slow). Nevertheless, significant problems remain in the application of SFM in the tropical PFE. They include poor infrastructure; the remoteness of many forests from centres of commerce and control; the weak competitiveness of SFM as a land use; declining wood-processing capacity in the Amazon; and a lack of awareness about SFM – and its potential benefits – among timber operators. Given that development will continue in the region, probably at an accelerated rate, the Government of Brazil is pursuing several models to improve the competitiveness of natural forest management as a land use. It is also working to address institutional barriers to SFM and recent initiatives offer hope that the area of tropical PFE under SFM will expand significantly in the future.

Key points

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

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

Endnotes

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

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COLOMBIA



Forest resources

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

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

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

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

Box 1 Forest cover, by biogeographical region

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

Source: Derived from IDEAM (2010).

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

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

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

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

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

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

Forest ecosystem health

Deforestation and forest degradation. Based on a visual classification of Landsat images made by IDEAM, FAO (2010b) estimated the average annual rate of deforestation in the period 2000–10 at about 101 000 hectares (0.17%) per year, significantly lower than the estimated 190 000

hectares (0.4%) per year estimated for the period 1990–2000. However, a specific study by IDEAM (2010) using high-resolution MODIS imagery indicated that about two million hectares of forests were lost between 2000 and 2007 – a deforestation rate of nearly 300 000 hectares per year.

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

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

Vulnerability of forests to climate change.

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

Table 1 Permanent forest estate

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

* As reported in ITTO (2006).

** Derived from Government of Colombia (2009) and personal communications (see endnote b).

‡ IDEAM (2010).

Table 2 Forest condition

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

* 'Other naturally regenerating forest'.

Source: FAO (2010).

Box 2 Land ownership ('000 ha)

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

* i.e. between resguardos indígenas and consejos comunitarios.

Source: Personal communications (see endnote b).

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

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

SFM policy framework

Forest tenure. Since 1973 under Law 89/1890 the state has recognized the rights of Indigenous communities to land, and the 1991 Constitution recognizes the ancestral rights to land of Indigenous

and Afro-Colombian traditional communities and their right to control and use their communal forest territories according to their social and cultural values. About half the country's forests (29.8 million hectares) are titled to Indigenous peoples (in what are known as *resguardos Indigenas*) in the wider Amazon region and Afro-Colombian communities in the Pacific region (in *consejos comunitarios*), and most of the remainder is state-owned (Table 3).

Afro-Colombian and Indigenous communities have obtained titles to more than 35 million hectares of land, of which around 29.8 million hectares are forest. In some cases, there is overlap between these titles and national forest reserves (20.4 million hectares of overlap) and national parks (3.5 million hectares of overlap) (IDEAM 2010). About half a million hectares are designated as peasant reserves (*reservas campesinas*), which are set aside as special development areas for rural communities. Box 2 shows the breakdown of state and community owned forests in Colombia.

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

Table 3 Forest area, by tenure

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

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

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

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

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

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

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

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

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

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

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

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

Status of forest management

Forest for production

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

implementation of a national forest inventory, and remote sensing techniques are now used widely and the knowledge base about forest resources is improving.^b

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

IDEAM (2010) reported that more than 14 million m³ were harvested in the period 2004–09. About 251 timber species are used, but nine species predominate. The average harvest in natural forest is in the range of 20–50 m³ per hectare. Many timber species are subject to uncontrolled salvage logging, especially in the Pacific region, among them *Brosimum utile* (sande, huina), *Carapa guianensis* (andiroba), *Cedrela odorata* (cedro), *Prioria copaifera* (cativo), *Campnosperma panamensis* (sajo) and *Tabebuia serratifolia/T. rosea* (cedro rosado). Table 4 lists five commonly harvested timber species in Colombia.

Planted forest and trees outside the forest.

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

Table 4 Commonly harvested species for industrial roundwood

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

* Also listed in ITTO (2006).

Source: Government of Colombia (2009).

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

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

Forest certification. Voluntary certification is gaining ground in Colombia. In 2005 two planted forest areas covering 58 444 hectares were certified (ITTO 2006). In December 2010, three forest plantations covering an area of 96 167 hectares were certified by the FSC; in addition, a group community certification in natural forests has been issued in Chocó (comprising the Darién community and Dos Bocas Río Sucio), covering a total area of 9742 hectares (FSC 2010). Thirty-five chain-of-custody certificates were valid in December 2010.

Estimate of the area of forest sustainably managed for production. Little information is available on the quality of natural forest management in Colombia. Data on the extent of natural forests under forest management plans are scarce, although about 19 million hectares of forest land have been classified or described under forest ‘ordination’ plans, which are the major planning instruments used by regional corporations to manage forest land.^b

ITTO activities support forest management in a number of areas. The forest area influenced by the former ITTO project in San Nicolás/Río Negro continues to benefit from high forest management standards. These areas together cover about 50 000 hectares of natural forests. In addition, the small community managed certified forests in Chocó (9742 hectares) are counted in Table 5 as sustainability managed. Other initiatives that are implementing SFM-based approaches include the USAID-supported More Investment in Alternative Sustainable Development Program (*Programa Mas Inversión para el Desarrollo Alternativo Sostenible*), which funded five community forest projects in the Pacific region in the period 2007–10 over an area of about 120 000 hectares of natural forest. Also in the Pacific region (Department of Chocó) the United Nations Office on Drugs and Crime (UNODC) is funding the Monte Bravo project, which is supporting local communities to formulate a sustainable forest plan for 38 000 hectares of natural forest and to assemble an efficient system for extraction and wood processing. In addition, the European Commission has supported, since 2007, the projects *Bosques FLEG [Forest Law Enforcement and Governance] Colombia* and *Proyecto Forestal Guaviare* over an area of 97 000 hectares in the Amazon region. Thus, the total natural forest area considered to be under SFM in the production PFE is around 315 000 hectares.

Table 5 Management of the production PFE ('000 hectares)

Reporting year	Natural					Planted		
	Total	Available for harvesting	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
2005*	5500	2150	-	0	200	148	80	58
2010	5500	-	-	9	315	405	150	96

* As reported in ITTO (2006).

Timber production and trade. The production of industrial roundwood from natural and planted forests in 2009 was estimated at 2.05 million m³, compared with 3.01 million m³ in 2004 (ITTO 2011). Nearly all this timber served the domestic market. Industrial wood is used in Colombia for sawnwood, plywood, particleboard and pulp. An estimated 723 000 m³ of sawnwood was produced in 2009, compared with 407 000 m³ in 2005 (ITTO 2011). Overall, total domestic production is relatively low compared with the economic potential of the country. Fuelwood production is estimated at 10–12 million m³ per year and has remained more-or-less stable in the past ten years.^a

Non-timber forest products. More than 300 NTFPs are known in Colombia. A wide range of medicinal herbs are gathered and used locally and sometimes sold in local markets or even packaged for more distant markets.^a Few data are available on the variety, value and production systems of NTFPs, however. *Guadua angustifolia* (guadua), a native bamboo, is used mainly for local housing construction but also by modern architectural designers and in handicrafts. In the departments of Caldas, Quindío, Risaralda, Tolima and Valle del Cauca the natural area of guadua is about 21 000 hectares, supplemented by 5100 hectares of plantations; total annual production exceeds 250 000 m³ (CONIF 2004). The principal NTFPs harvested in natural forests are rubber, palm fruits (particularly *Mauritia flexuosa* – canangucha – and *Euterpe precatoria* – asahí), fruits from *Theobroma grandiflorum* (cupoazu), *Euterpe oleracea* (palm hearts), *Chamaedorea* spp (xate leaves) for ornamental use, and wildlife, especially fish and reptiles. Coca, although illegal, is widely grown.

Forest carbon. Information on forest carbon in Colombia is relatively limited, with existing information at the national level distributed among various entities and institutions. Gibbs et al. (2007) estimated the total forest biomass carbon stock

Box 3 Average forest carbon per hectare, by region

Region	Living biomass above ground (t/ha)	Carbon (t/ha)
Andes	251	126
Pacific	182	91.0
Amazon	257	128
Orinoco	203	101
Caribbean	245	122

Note: One tonne of carbon is equivalent to 3.67 tonnes of CO₂e.

Source: IDEAM (2010).

in the range 2529–10 085 MtC, Eggleston et al. (2006) estimated it at 11 467 MtC and FAO (2010) estimated it at 6805 MtC. IDEAM (2010) made a preliminary estimate at the tier 1 level for the five main biogeographical regions (Box 3), and estimated total biomass carbon stock at 7443 MtC. The carbon capture and storage potential of Colombia's forests through reduced deforestation and forest degradation and enhanced forest restoration and establishment is relatively high.

In partnership with ITTO, Colombia implemented one of the first projects on forest carbon storage and sequestration, starting in 1999. This project generated knowledge and experience on carbon accounting and the benefit-sharing issues surrounding a potential REDD+ mechanism; it is now integrated with the World Bank's Biocarbon Fund. Colombia is also participating in international REDD+ initiatives, including the Forest Carbon Partnership Facility (since 2008) and the REDD+ Partnership (since 2010). The Government of Colombia is an observer at UN-REDD. Table 6 summarizes Colombia's current forest carbon potential.

Forest for protection

Soil and water. Colombia is one of the ten most productive countries in terms of freshwater yield (ITTO 2006). Environmental campaigns have been

Table 6 Forest carbon potential

Biomass forest carbon (MtC)	% forest with canopy cover >60%	Deforestation/degradation potential to 2030	Enhancement of carbon sink capacity to 2030	Forest area change monitoring capacity	Forest/GHG inventory capacity	Importance of forest fire/biomass burning	Engagement in international REDD+ processes
2529–10 085	60	+++	+++	++	++	++	++

+++ high; ++ medium; + low; estimate of national forest carbon based on Gibbs et al. (2007); estimate of % total forest with canopy cover >60% based on UNEP-WCMC (2010).

launched in major cities to inform communities about the importance of water conservation. Fifty-two protection forest areas have been classified, covering about 306 000 hectares.^a In addition to the SPNN, over 3.8 million hectares of land are classified for their protective functions, comprising forest reserves (522 000 hectares), productive–protective forest reserves (252 000 hectares), integrated management districts (2.78 million hectares) and conservation districts (300 000 hectares). Through its system of regional corporations, the government promotes watershed reforestation projects: in the past 15 years, more than 310 000 hectares of new protective plantations have been established.^b Many Colombian electricity and water companies charge customers an extra fee to cover the cost of watershed management.^a

Biological diversity. Colombia has one of the highest levels of species diversity in the world, boasting some 55 000 plant species, of which one-third are endemic (Colombia is one of the top 20 countries in the world in this respect), as well as 1721 bird species and 205 reptile species. Forty-three mammals, 73 birds, 203 amphibians, four reptiles, one arthropod and 13 plants found in forests are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species (IUCN 2011). Six plant species are listed in CITES Appendix I, 250 plant species are listed in Appendix II and two species are listed in Appendix III (UNEP-WCMC 2011). Timber species listed in Appendix II include *Swietenia macrophylla*, *S. mahagoni* and *Guaiacum officinale*. At least 40 tree species in Colombia are threatened by over-exploitation^a, including, besides those listed in CITES appendices, *Aniba perutilis* (comino creso), sande, *Cariniana pyriformis* (abarco), *Huberodendron patinoi* (carra) and *Humiriastrum procerum* (chanó).^a

Extent of protected areas. The total extent of protected area in Colombia is 12.6 million hectares, including both forested and non-forested land (IDEAM 2010). The two main categories



Forest landscape restoration under the ITTO–Cornare forest carbon project in Valle San Nicolas.

of protected area are the SPNN and civil-society reserves. The SPNN comprises 55 protected areas in IUCN categories I–IV, covering nearly 10.3 million hectares (9% of the country's land area). Thirteen percent of the Amazon region and 13% of the Andean region are in protected areas, of which 9.34 million hectares are forested (IDEAM 2010, WCMC-UNEP 2010). National parks overlap about 40% of the territories owned by Indigenous communities, or about 1 million hectares (Kernan et al. 2006). No data are available on the connectivity of the protected-area system. According to UNEP-WCMC (2010), about 8.3 million hectares of protected areas in IUCN classes I–IV have a crown cover of 60% or more.

Estimate of the area of forest sustainably managed for protection. In some areas the integrity of forest protected areas is secure but in other areas it is threatened by a lack of control, the activities of guerrillas and paramilitaries, and drug-trafficking. It is considered that the 456 000 hectares of forests that fulfil particular soil and water protection functions are sustainably managed because they are covered by management plans and their management is financed partly by payments for ecosystem services (Table 7).^c Large tracts of other protection forest may also be secure due to their remoteness.

Table 7 Management of the protection PFE ('000 hectares)

Reporting year	Protection PFE	Attributed to IUCN categories I–IV	Allocated for soil and water	With management plans	Sustainably managed
2005*	8860	8860	312	-	-
2010	9340	9340	456**	456	456

* As reported in ITTO (2006).

** Comprises water and soil protected areas and special reforestation areas for water and watershed protection.

Socioeconomic aspects

Economic aspects. Although forests cover more than half of Colombia, their contribution to its GDP is only about 1%.^a This is due partly to the absence of large-scale timber concessions and related industries and to widespread uncontrolled deforestation and degradation, which makes wood abundant and keeps domestic prices for timber and fuelwood low. In Colombia, there is little price incentive for natural forest management.^a The trade balance in forest products is negative because of the import of pulp and paper, although the gap declined from US\$280 million in the 1990s to US\$50 million now.^a It is estimated that the forest sector provides employment for 54 000 people, comprising 24 000 in forest industry and 30 000 in reforestation (ITTO 2006).

Livelihood values. Hundreds of plants are used by local communities for medicinal purposes. The domestication of wild animals is another important economic activity, including species as different as crocodiles and butterflies. The gathering of ornamental plants, particularly orchids, is important in the low-level cloud forest and contributes locally to livelihoods. Illegal coca production and trade remain the most attractive economic activities for many colonists living in the foothills of the Andes in the agricultural frontier areas of Alto Putumayo, Alto Caquetá, Macarena, Guaviare, Nariño and Magdalena Medio. This is despite a sharp decrease in production area, from more than 170 000 hectares in 2000 to 81 000 hectares in 2008 (UNODC 2009).

Social relations. The main forest zones are inhabited nearly exclusively by Indigenous or Afro-Colombian communities. Their traditional lifestyles are linked closely to the use of forest resources through shifting cultivation and hunting, fishing and the gathering of forest products. The 1991 Constitution and laws 99 and 70 (1993) recognize this and make specific reference to such traditional forest uses. There are conflicts over timber resources and illegal crops between local forest users and the armed forces of various factions. A considerable number of Colombian Indigenous and Afro-Colombian organizations are active in the national dialogue on forests, including the *Organización Nacional de Indígenas de Colombia*, the *Consejo Regional Indígena del Cauca*, the *Asociación de Cabildos Indígenas del Norte del Cauca* and the

Organización Indígena de Antioquia. Representing Afro-Colombian communities are the *Proceso de Comunidades Negras*, the *Conferencia Nacional de Organizaciones Afrocolombianas*, the *Asociación de Afrocolombianos Desplazados* and the *Movimiento Nacional Cimarrón*.

Summary

Nearly the entire natural forest estate of Colombia is officially protected and the main forest products are ecosystem services or forest products other than timber. The 1991 Constitution recognizes the rights of Indigenous peoples and Afro-Colombians over their territories and their right to control and use their communal forest territories according to their social and cultural values. Forests in Colombia are administered within the wider context of environmental management, and existing policy goals emphasize protection and conservation functions as well as forest restoration and forest land rehabilitation. Generally, there is little control over forest resources on the ground and illegal activities in forest areas appear to be widespread. Large forest tracts remain inaccessible for legal management activities because rebels and paramilitaries exercise control over them. Despite these difficulties there is progress in the collection of data on tropical forests and biodiversity, the demarcation of property boundaries and the provision of land titles, the implementation of conservation programs, and the enforcement of land-use plans and regulations.

Key points

- Colombia has an estimated PFE of 15.2 million hectares (compared with 14.5 hectares in 2005), comprising 5.5 million hectares of potential production PFE (the same as in 2005, mainly degraded forests available for plantations), 9.34 million hectares of protection forest (compared with 8.86 million hectares in 2005) and 405 000 hectares of planted forest (compared with 148 000 hectares in 2005).
- At least 771 000 hectares of natural forest, comprising 315 000 hectares of production PFE and 456 000 hectares of protection PFE, are considered to be under SFM; about 9000 hectares of community-managed natural forest is certified. Forest land-use plans exist over an area of about 19 million hectares.

- Combined, Indigenous communities in the Amazon region and Afro-Colombian communities, mainly in the Pacific region, own nearly 30 million hectares of natural forests, nearly half the total forest estate.
- No specific standards have been established for large-scale timber production forestry and no policy for timber concessions is in place.
- There are well-established systems for protected areas and biodiversity monitoring.
- The wider role of forests in providing ecosystem services (such as hydrological services) is recognized in Colombia and considerable areas of forest benefit from payments for them.

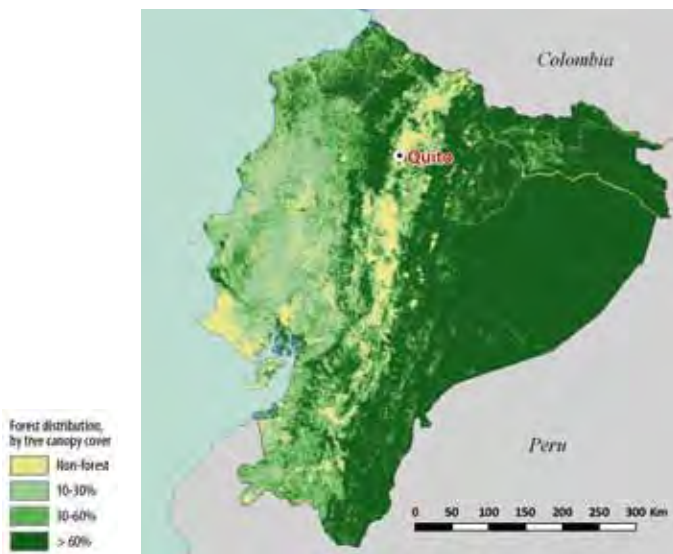
Endnotes

- a Government of Colombia (2009).
- b Discussion and information exchange with the sustainable forest management group (*Grupo de Desarrollo Sostenible de Bosques*), Dirección de Ecosistemas, Ministerio de Ambiente, Vivienda y Desarrollo Territorial, 2011.
- c ITTO estimate.

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ECUADOR



Forest resources

Ecuador has a land area of 27.7 million hectares and an estimated population in 2010 of 13.7 million people (United Nations Population Division 2010). Ecuador is ranked 80th out of 182 countries in UNDP's Human Development Index (UNDP 2009). The country comprises four main biogeographical zones: the Andean mountains (sierra); the Pacific coast; the Amazon Basin; and, 1000 km from the coast in the Pacific Ocean, the Galapagos Islands. FAO (2010a) estimated the forest area at 9.87 million hectares in 2010, which is 36% of the land area. The Government of Ecuador (2009) estimated the total forest area at 11.2 million hectares.

Forest types. There are three major forest types: Amazon rainforest, comprising about 62% of the forest estate; montane (*sierra*) forests of various types in the Andes (on the western and eastern slopes, at lower and upper levels, and towards the Andean high peaks), comprising about 21% of the forest estate^a; and tropical rainforest in the coastal plains of the Pacific region (mainly in Esmeraldas Province), which contains about 17% of the forests. Mangrove forests were once widespread but now cover only about 158 000 hectares (Spalding et al. 2010).

The most common commercial species in the more humid northern part of the country are *Protium* and *Dacryodes* spp, Laureaceae, *Brosimum utile*,

Inga spp, *Pourouma chocoana* and *Ceiba pentandra* (kapok). The main commercial species in the drier semi-humid forests in central areas and the south coast are *Cordia alliodora* (laurel), *Pseudosamanea guachapele*, *Tabebuia* spp and various Bombacaceae (e.g. *Ceiba* and *Bombax* spp, and balsa – *Ochroma lagopus*).

Permanent forest estate. Ecuador has not defined a PFE but there is a clear distinction between forests for (potential) production and forest for protection, and the latter is clearly delimited.^a The Government of Ecuador (2009) estimated the total area that is potentially used as production forest at 4.51 million hectares and the total area of protected forests at 6.55 million hectares, but the production forest area that can be considered as permanent forest estate is only about 2 million hectares (Table 1).^a Protection forests are classified in the national system of protected areas (*Sistema Nacional de Áreas Protegidas* – SNAP). The area of forest that might be considered PFE is about 8.7 million hectares^a, most of it part of the SNAP. Only a small portion of the production PFE is considered economically harvestable due to steep slopes in mountainous terrain, low timber density, difficulty of access, and social constraints (ITTO 2006). There are about 175 000 hectares of planted forests.^a

Forest ecosystem health

Deforestation and forest degradation.

Ecuador has the highest rate of deforestation of any South American country. This is due to a number of factors, including policies favouring the development of pastures and commercial agriculture; colonization; oil and timber exploration; insecure land tenure; and weak public institutions. Aquaculture for shrimp production has expanded rapidly on the Pacific coast in the past 15 years and is responsible for the loss of nearly 80 000 hectares of mangrove forests.^a FAO (2010b) estimated the annual loss of forest cover between 2005 and 2010 at an average 198 000 hectares (1.89%) per year. In relative terms, deforestation is highest in the dry forest of the southern coastal region (more than 2% per year^a), but it is also high in the humid tropical lowland forests of the Pacific coast and is increasing in the Amazon region.

Table 1 Permanent forest estate

Reporting year	Estimated total forest area, range (million ha)	Total closed natural forest ('000 ha)	PFE ('000 hectares)			
			Production		Protection	Total
			Natural	Planted		
2005*	8.4–11.4	10 854	3100	164	4300	7564
2010	9.87–11.2	5813**	1964‡	175	6554†	8693

* As reported in ITTO (2006).

** Calculated using the ratio of forest with greater than 60% forest cover estimated by UNEP-WCMC (2010) (58.9%) and the total natural forest area as estimated by FAO (2010a).

‡ Includes harvested areas in state forests (patrimonio forestal del estado), as reported by Government of Ecuador (2009).

† Includes public protection forests and the area in SNAP. Some of this area may no longer be forested.^a

Illegality and corruption contribute indirectly to deforestation and biodiversity loss by undermining enforcement by government institutions (USAID 2006).

Table 2 summarizes forest condition. Intact or slightly degraded primary forests cover about 3.9 million hectares, and secondary forests and scrublands (*matorrales*) together cover about 6.3 million hectares. Most of the secondary forests are in the Pacific coast region.^a

Vulnerability of forests to climate change.

Ecuador is highly vulnerable to the impacts of climate change due to its geographical location, rugged topography and exposure to El Niño events, as well as to the dependence of key economic sectors on resources that are affected by climate. Many population centres are at high altitudes and rely particularly on receding alpine glaciers and high-elevation forests and grasslands for their water supply. High-altitude ecosystems are likely to suffer more from climate-change impacts than lower-lying areas (IUCN 2009). Uncontrolled forest fires are a major threat, particularly on the Pacific coast; landslides in mountainous regions are also common after heavy rainfall.

SFM policy framework

Forest tenure. Most of Ecuador's forests are owned by local communities and Indigenous groups (ancestral Indigenous or Afro-Ecuadorian), although the majority are not subject to official land titles. The National Strategy for Sustainable Forest Development (*Plan Nacional de Desarrollo Forestal Sostenible*) 2007–2011 includes legal provisions for the allocation of forests to Indigenous communities, farmers and other groups already in possession of forest lands on the condition that they guarantee the sustainable management and conservation of the allocated forests.^a The country's 2008 Constitution also fully recognizes the rights of Indigenous communities (see below).

There is a great deal of overlap between the areas in the SNAP and private and Indigenous lands. International support is needed to help secure tenure, mark boundaries and establish participatory surveillance systems over 1.6 million hectares of Indigenous land.^a Table 3 summarizes the forest-tenure situation.

Criteria and indicators. Ecuador established its own set of C&I for SFM based on those of ITTO. This has been used in strategic planning but today its use is limited.^a The Government of Ecuador used the ITTO C&I in its submission to ITTO for this report.^a

Table 2 Forest condition

	PFE	Non-PFE	Total
	'000 ha		
Area of primary forest	-	-	3900
Area of degraded primary forest	-	-	1300
Area of secondary forest	-	-	1200
Area of degraded forest land	-	-	3800

Source: Derived from Government of Ecuador (2009).

Table 3 Forest area, by tenure

Ownership category	Total area	Of which PFE	Notes
	'000 ha		
State ownership (national, state or provincial government)	3940	-	State production forests and SNAP/ <i>patrimonio forestal del estado</i> .
Other public entities (e.g. municipalities, villages)	-	-	Municipalities regulate freshwater protection and thus also large parts of protection forests.
Total public	3940	-	
Owned by local communities and/or Indigenous groups	6830	-	Includes forested areas and formerly forested areas now used as village agricultural land.
Private owned by firms, individuals, other corporate	40	-	Mainly forest plantations; agroforestry plantations are not considered forest land.

Source: Based on ITTO & RRI (2009).

Forest policy and legislation. Ecuador's 20th constitution since 1830 was approved in September 2008. The rights established by its Article 84 enfranchise thousands of Indigenous people, many of them living in forested areas. Along with Indigenous rights, the Constitution recognizes the rights of nature^a and the role of the state in the conservation, sustainable use and restoration of fragile ecosystems such as the *páramo* (non-forested sub-alpine areas), humid areas, mangroves, cloud forests and tropical dry and humid forests (Article 406). Article 407 prohibits extractive activities in protected areas, including timber harvesting.^b

The Forest Law (*Codificación de la Ley Forestal y de Conservación de Áreas Naturales y Vida Silvestre*, L.74-PCL. RO 64), which dates from 1981, assigns the ownership and control of all forest resources to the national government. The provisions of the Forest Law were never fully implemented, however, and many substantial changes in the administration and control of Ecuador's forests have been made by the Ministry of Environment (*Ministerio del Ambiente*).^a The Forest Law provides the legal basis for the SNAP and for the protected-area system that was created under Article 86 of the 1998 Constitution (*patrimonio de áreas naturales del estado* – PANE).

A new forest law based largely on the examples of Chile and Costa Rica was prepared in 2001 but never approved.^a The Forest Law (1981) is under revision to reflect the new orientation of the state as defined by the new Constitution.^b The baseline of the revision is the National Strategy for Sustainable Forest Development 2007–2011, a multi-stakeholder document that lays out a vision for SFM and forest conservation and which recognizes the important role of local communities and other sectors in achieving SFM.^b

The National Forest and Reforestation Programme (*Plan Nacional de Forestación y Reforestación*), which was approved in September 2006, includes among its goals the creation of 750 000 hectares of new industrial forest plantations, 150 000 hectares of agroforestry schemes and 100 000 hectares of protective plantations in a 20-year period.

In September 2008, the Ministry of Environment launched its *SocioBosque* Program as one of the elements of a national REDD framework (see below). *SocioBosque* provides economic incentives to landowners who voluntarily decide to protect their forest. *SocioBosque* aims to preserve natural forests and other native ecosystems and thereby protect their ecological, economic, cultural and spiritual values. It also aims to achieve a significant reduction in deforestation and associated emissions of GHGs. *SocioBosque* is fully financed by public funds but additional funds are required from international sources, including those associated with REDD, in order to fully accomplish its goals.^a

Institutions involved in forests. Many Ecuadorian government institutions have responsibilities related to forests and the conservation of biodiversity. At the national level, the Ministry of Environment and its Forest Service (*Dirección Forestal*, under the *Sub-Secretaría del Patrimonio Nacional*) administers forests and protected areas, enforces the Forest Law and international treaties, implements international conservation projects, and approves environmental assessments. Through Executive Decree 931 of February 2008, responsibility for industrial plantations and agroforestry was assigned to the Ministry of Agriculture, Aquaculture and Fisheries (*Ministerio de Agricultura, Acuicultura y Pesca*), which subsequently created in the same year a specific institution (*Unidad para el Desarrollo*

Forestal del Ecuador – PROFORESTAL) to fulfill this task. The Ministry of Environment is responsible for the program to establish and manage protective plantations (*Programa de Plantaciones para la Protección y Conservación de los Recursos Naturales*).

The principal state institution in charge of the planning and operation of production forestry is the National Secretariat for Planning and Development (*Secretaría Nacional de Planificación y Desarrollo* – SENPLADES), which is in charge of the implementation of the overall development plan for Ecuador. SENPLADES closely coordinates forest planning with the Forest Service and PROFORESTAL.

Ecuador has more than 60 non-profit environmental NGOs. Some, such as *Fundación Natura*, are large, while others may consist of only a few people working on a specific environmental problem in a restricted geographic area. Indigenous organizations have a profound impact on the conservation of biodiversity and forests because they represent the owners of over 6 million hectares of land, much of it in the biodiversity-rich Amazon.

Many Ecuadorian businesses are involved in the extraction and processing of natural resources. National and international companies involved in oil production, mining, tourism, agribusiness and the wood industry, for example, can stimulate deforestation and forest degradation. Oil is particularly important to Ecuador's economy. Oil exploration, extraction, transport and processing can cause large-scale, permanent direct and indirect negative impacts on forests.

Forest-owners and timber industries are organized in associations (*Asociación Ecuatoriana de Industriales de Madera* – AIMA, *Asociación Ecuatoriana de Productores de Teca y Maderas Tropicales* – ASOTECA and others) and special initiatives (e.g. *Corporación de Manejo Forestal Sustentable* – COMAFORS). They play an active part in policymaking and forest development. Eight universities offer forestry education, including *la Escuela Superior Politécnica de Chimborazo*, *Universidad Técnica Estatal de Quevedo*, *Universidad Técnica de Esmeraldas*, *Universidad Nacional de Loja*, *Universidad Agraria del Ecuador*, *Universidad Técnica del Norte*, *Universidad Estatal del Sur de Manabí* and *Universidad Internacional SEK*.^a

Status of forest management

Forest for production

Forest use is regulated through a number of norms dealing with forest management, particularly:

- Rules on Sustainable Forest Management for Timber Harvesting in Moist Forests (*Normas para el Manejo Forestal Sustentable para Aprovechamiento de Madera en Bosque Húmedo* – *Acuerdo Ministerial* 039, 2004).
- Rules for Timber Harvesting in Plantation Forests and Trees in Agroforestry Systems (*Normas para el Aprovechamiento de Madera en Bosques Cultivados y de Árboles en Sistemas Agroforestales* – *Acuerdo Ministerial* 040, 2004).
- Rights to Timber Harvesting (*Derecho de Aprovechamiento de Madera en Pie* – *Acuerdo Ministerial* 041, 2004).
- Directives on Log-scaling for Forest Control at Road Checkpoints (*Instructivo de Cubicación de Maderas para Controles Forestales en Vías Terrestres* – *Acuerdo Ministerial* 053, 2001).

Forest harvesting in state production forests requires a forest inventory, the preparation of a forest management plan, the physical demarcation of concession limits, social payments and payments for silvicultural treatments. A forest-control entity called *Vigilancia Verde* has been in place since 2001 with the overall task of supervising the flow of forest products from the forest to the marketplace. Another body, *Regencia Forestal*, was created to increase the transparency of *Vigilancia Verde*, to provide technical assistance and support law enforcement in forest operations, and to oversee the implementation of C&I in forest management.

There is no coordinated approach to natural forest management in Ecuador; many potential management techniques have not yet been put into practice. Before 1980, several licensed logging concessions operated in defined areas with specified annual yields. The legal and practical provisions were similar to those operating in many other countries and, as elsewhere, there were serious difficulties of control, supervision and protection. Concession management was abandoned in the early 1980s (ITTO 2006). Ecuador now uses a system of short-term logging licences which, in addition to its impact on the quality and efficiency of logging operations, has encouraged foresters to

consider other ways of ensuring future long-term supplies of timber, particularly through the development of forest plantations and agroforestry. There is strong pressure on the natural-forest resource from informal and illegal operators, who resist regulations they see as unrealistic. Illegal logging is therefore widespread; it is estimated, for example, that 85% of the *Cedrela odorata* (cedro) harvested in the Ecuadorian Amazon is illegal.^a

Most timber harvesting today is done on Indigenous and small-farmer community lands and private lands. Legal harvesting is carried out under three kinds of permit: cutting permits (the great majority until 2005 – ITTO 2006); areas harvested according to simplified forest management plans (*Programas de Aprovechamiento Forestal Simplificado* – PAFSIs), which mainly involve non-mechanized extraction; and areas with integrated management and sustainable management areas (*Programas de Aprovechamiento Forestal Sustentable* – PAFSUs), which involve relatively large areas that are suitable for industrial harvesting. In 2009, 921 forest management permits (PAFSIs and PAFSUs) were issued (up from 815 in 2008). In 2008, a total of 205 000 m³ of timber were harvested from about 10 000 hectares in PAFSUs and 259 000 m³ from about 29 000 hectares in PAFSIs.^a

Silviculture and species selection. Diameter limits are assigned for each harvestable species and are relatively low: for example, the limit is 40 cm for cedro and 35 cm for *Tabebuia chrysantha* and *Myroxylon peruiferum*.^a Post-harvesting treatments in natural forests are compulsory and include liberation thinning, the cutting of lianas and, based on a silvicultural assessment, enrichment planting.^a About 120 timber species are used in the domestic market. The prime species harvested are from forest plantations (eucalypts and pines). In natural forests, 80% of the harvested volume comes from about 25 species (ITTO 2006). Besides those listed in Table 4, important commercial species are



Semi-natural production forest in Ecuador, with *Cordia alliodora* and *Terminalia* spp.

Virola spp, *Otoba glycyarpa* (sangre de gallina), *Cedrelinga catenaeformis* (chuncho), *Podocarpus* spp and *Prumnopitys* spp (romerillo, azucena) from the southeastern forests, and *Tratinnickia glaziovii* (copal).

Planted forests and trees outside the forest.

The creation of new forests and agroforestry plantations is a major goal of Ecuador's forest and environmental policy, and PROFORESTAL was created to fulfill ambitious industrial-plantation and agroforestry targets. The total state budget allocated to this purpose in 2008 was US\$15 million.^a The total area of planted forest in 2008 was about 175 000 hectares, which was 11 000 hectares more than reported in 2005 (ITTO 2006). About 80% of the plantations are composed of eucalypt and pine species and located in the Andes; the remaining 20% is mainly in the coastal region and largely comprises balsa and a range of other indigenous species such as laurel, *Schizolobium parabybum* (pachaco), *Jacaranda copaia*, *Parkia multijuga* (cutanga), chuncho and *Hyeronima alchornooides* (mascarey). Some certified plantations and agroforestry schemes are now exploiting these

Table 4 Commonly harvested species for industrial roundwood

Species	Notes
<i>Eucalyptus globulus</i> (eucalipto)	From plantations in mountainous areas, 190 000 m ³ in 2008.
<i>Ochroma lagopus</i> (balsa)	From plantations more than 40 000 m ³ annually.
<i>Brosimum utile</i> (sande)*	The main natural forest species in the Pacific region.
<i>Cordia alliodora</i> (laurel)*	From secondary forests, pastures and plantations.
<i>Pinus radiata</i> and <i>P. patula</i> (pino)*	From forest plantations in mountainous regions.

* Also listed in ITTO (2006).

Source: Government of Ecuador (2009).

resources. *Tectona grandis* (teak, teca), *Acacia mangium* and *Gmelina arborea* are planted in lowland areas and *Alnus acuminata* (aliso) is planted in the mountains.

Forest certification. As of mid 2010, five FMUs managing planted forests and semi-natural forests were certified under the FSC, covering a total area of 41 200 hectares (FSC 2010). No natural forests were certified.

Estimate of the area of forest sustainably managed for production. The estimated area of natural-forest production PFE under SFM is at least 176 000 hectares (Table 5), comprising forests that are currently managed under PAFSUs with adequate supervision by authorities and some semi-natural forest stands that have been managed for more than 20 years.^a The latter areas include private forest lots and planted and natural forests in the sierra managed by communities.

Timber production and trade. It is estimated that about 4.8 million m³ of roundwood was extracted annually from Ecuadorian forests between 2006 and 2008^a, including for fuelwood. Of the total in 2006 an estimated 460 000 m³ of industrial roundwood was harvested in tropical natural forests and 480 000 m³ were harvested in planted forests.^a Total industrial log production in 2009 was estimated at 711 000 m³, down from 1.81 million m³ in 2000 (ITTO 2011). In 2009 Ecuador exported about 74 000 m³ of logs, 55 000 m³ of sawnwood, 3000 m³ of veneer and 67 000 m³ of plywood (ibid.). There are two large wood industry groups in Ecuador – Durini and Alvarez-Barba – and hundreds of smaller formal and informal wood-using enterprises (USAID 2006).

Non-timber forest products. At least 589 species are used as NTFPs in Ecuadorian forests, of which 79 species are used for their edible fruits, 68 species for their leaves, 28 species for their flowers,

19 species for their roots (mainly as medicines), 25 species for their bark and 19 species for their seeds (Añazco et al. 2004). NTFPs of commercial importance include *Guadua* (bamboo); latex; gum; palm products, particularly palm hearts; and medicinal plants. Tagua (vegetable ivory), the seed of the palm *Phytelephas macrocarpa*, is used commercially in handicrafts, as are fibres of *Bactris gasipaes* and *Carludovica palmata* (paja toquilla). Widely used NTFPs in Ecuador's Amazon forests include *Genipa americana*, a natural colorant; *Poulsenia armata* and *Byrsonima japurensis* for their fibre; *Caryodendron orinocense* and *Plukenetia volubilis* as vegetable oil; and *Uncaria tomentosa*, *Croton lechleri* and *Strychnos peckii* for medicinal purposes.^a On average, exports of NTFPs were worth US\$13 million per year between 2006 and 2008.^a

Forest carbon. One of the objectives of the National Development Plan, designed under the leadership of SENPLADES, is the cessation of deforestation. The Ministry of Environment has identified the following elements of a national REDD strategy: forestry control; management information systems; a GHG monitoring system; land-tenure regularization in forest areas; SFM; afforestation and reforestation; and an appropriate legal and institutional framework. *SocioBosque* is an important element of the strategy.

According to national carbon inventories, Ecuador's forests and other wooded land contain about 420 MtC, of which 320 MtC are in natural forests.^a Gibbs et al. (2007) estimated the national-level forest biomass carbon stock at 351–1379 MtC, and Eggleston et al. (2006) estimated it at 2071 MtC. Ecuador has the highest deforestation rate in Latin America, resulting in significant carbon emissions, mainly in the lowlands; it has considerable potential for carbon capture and storage (Table 6). The Government of Ecuador is taking firm

Table 5 Management of the production PFE ('000 hectares)

Reporting year	Natural					Planted		
	Total	Available for harvesting	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
2005*	3100	-	65	0	101	164	65	21
2010	1964	115	86	0	176**	175	90	41

* As reported in ITTO (2006).

** includes 21 000 hectares of semi-natural forest as enrichment plantings with local species in natural forest areas.

Table 6 Forest carbon potential

Biomass forest carbon (MtC)	% forest with canopy cover >60%	Deforestation/ degradation potential to 2030	Enhancement of carbon sink capacity to 2030	Forest area change monitoring capacity	Forest/ GHG inventory capacity	Importance of forest fire/ biomass burning	Engagement in international REDD+ processes
351– 1379	59	+++	++	++	+	++	+++

+++ high; ++ medium; +low; estimate of national forest carbon based on Gibbs et al. (2007); estimate of % total forest with canopy cover >60% based on UNEP-WCMC (2010).

steps towards REDD (Chiu 2009). For example, it is preparing a low-carbon development plan for 2010–2012 and a national REDD+ strategy with support from the German government and Conservation International (Government of Norway 2010). Ecuador is also involved in the UN-REDD process and the REDD+ Partnership and the government has established permanent forest monitoring facilities through the Center for Remote Sensing.

Forest for protection

Soil and water. Protection and protected forests are regulated through the 2003 Environmental Law (*Texto Unificado de Legislación Ambiental, Libro III: Del Régimen Forestal, DE-3516*) and the 1999 Law of Environmental Management (*Ley de Gestión Ambiental 37, RO-245*). There are 162 registered protection forests in Ecuador, covering an area of about 2.3 million hectares.^a Protection forest lands include state land as well as privately owned or occupied land on steep slopes or water catchments and other areas unsuitable for agriculture or livestock production. Municipal governments provide drinking water and protect forests for this purpose. The provision of clean, abundant water is an ecosystem service that may help pay for conservation; for example, Quito's water fund, FONAG, is paying part of the cost of protecting and restoring the Cayambe–Coca Ecological Reserve.

Biological diversity. Ecuador has a wide range of ecosystems and is considered a megadiverse country. It has more than 20 100 plant species, of which 5317 are endemic^a, and there are also at least 369 native mammals, 1616 birds, 394 reptiles and 415 amphibians. Most of the 1435 species found in forests (34 mammals, 56 birds, 155 amphibians, eleven reptiles, one arthropod, twelve molluscs and 1166 plants) that are listed as critically endangered, endangered or vulnerable on the IUCN red list of

threatened species are endemic to the Galapagos Islands (IUCN 2011). On the mainland, 14 species are so listed (ibid.). Eight plant species are listed in CITES Appendix I and 584 in Appendix II (UNEP-WCMC 2011). *Swietenia macrophylla* and *Cedrela* spp are protected under national law.^a

Protective measures in production forests.

Amendments made in 2004 to the 1981 Forest Law introduced new harvesting rules in accordance with reduced impact logging as a prerequisite for harvesting. Logging is prohibited within specified distances of waterways, lakes and rivers, on slopes greater than 45%, in the highest areas of micro-watersheds (*línea de cumbres de microcuencas primarias*), and in various 'special areas'.^a

Extent of protected areas. The 2008 Constitution defines, in its Article 405, a new sub-category of the SNAP, the PANE, which includes 35 special protected areas, including major national parks, reserves and wildlife preservation areas. On the Ecuadorian mainland, protected areas cover 4.67 million hectares (17% of the total land area), distributed in various categories defined by law (national parks, biological reserves, ecological reserves, geo-botanical reserves, bird reserves, wildlife reserves, etc). The protected area estate also includes about 2 million hectares of soil and water protection areas, mostly forested, classified in IUCN categories V and VI.^a The total protected area comprises non-forested areas and also 1.55 million hectares of lowland rainforest. In addition, the biological reserve of the Galapagos Islands covers 14.1 million hectares of land and marine ecosystems.

Some protected areas are threatened by encroachment. For example, Podocarpus National Park, a unique montane primary forest relict of more than 120 000 hectares, is threatened by illegal gold-mining and associated mercury contamination.

There are three major biosphere reserves besides Galapagos – Yasuní, Sumaco Napo Galeras, and Podocarpus–El Condor – which, combined, cover nearly 3 million hectares. There are also five biological corridors in mainland Ecuador (*corredor ecológico Llanganates-Sangay*, *corredor biológico Awacachi*, *corredor ecológico Cuyabeno-Pañacocha*, *corredor de conservación comunitaria El Ángel-Golondrinas*, and *corredor ecológico Antisana-Llanganates*) connecting 20 protected areas.^a

Estimate of the area of forest sustainably managed for protection. Little information was available for this report on the quality of management in the protection PFE (Table 7). About 2.21 million hectares of protected areas reportedly had management plans in 2009.^a The 129 000-hectare Condor Biosphere Reserve, part of a transboundary conservation area on the border with Peru, was threatened by the expansion of unsustainable agriculture and cattle-ranching, but its integrity has been substantially improved through a project supported by various donors, including ITTO. Forest management planning has advanced in the Yasuni National Park (985 000 hectares) in the Napo region. A United Nations-administered international trust fund, initiated through *SocioBosque*, has been put in place to guarantee payments for non-exploitation of the considerable oil reservoirs in the core area of Yasuni (500 000 hectares). The core areas of the Condor Biosphere Reserve and Yasuni National Park, both nearly 100% forested, are counted in Table 7 as sustainably managed.

Socioeconomic aspects

Economic aspects. The GDP of Ecuador was US\$108 billion in 2009, of which forest-based activities contributed about 2% (USAID 2006). However, data are quite unreliable due to the high level of informality in the forest sector. The forest and timber industry is characterized by

a high number of small timber extractors and wood-processing units with low capital input and by poor working conditions; it has difficulty delivering high-quality processed products. It is estimated that there are more than 500 units of active extractors and timber companies, most of them producing less than 2000 m³ annually. An estimated 235 000 people are in employment linked to the forest and timber industry, which is 8% of the country's active economic population.^a

Livelihood values. Forests have great value for local forest-dwellers, with hunting and fishing the most important activities. Forests are also considered as a land reserve and are converted for subsistence agriculture. About 7.5 million hectares of forest are used directly or indirectly by Indigenous communities to provide at least part of their livelihoods.^a It is estimated that about 850 000 people depend directly on forest resources for their livelihoods.^a

Social relations. The country's population consists of four broad groups – Mestizo (65%); Amerindian (25%); Spanish descendant (7%); and Afro-Ecuadorian (3%) – each of which has a unique culture. Amerindian groups play a particularly important role in the management of forests and the conservation of Ecuador's biodiversity because they control large areas of forested land. Conflicts over oil exploitation and illegal harvesting are widespread and illicit crops are found in certain forest areas (ITTO 2006). Recently, as part of the *SocioBosque* program, Indigenous communities and organizations signed 20-year agreements with the Ministry of Environment under which, in return for preserving native forests, landowners receive annual incentive payments from the government. These agreements reinforce existing titles.

Table 7 Management of the protection PFE ('000 hectares)

Reporting year	Protection PFE	Attributed to IUCN categories I–IV	Allocated for soil and water	With management plans	Sustainably managed
2005*	4300	1790	2403	513	-
2010	6554**	4670†	2355	2211	629

* As reported in ITTO (2006).

** Includes water and soil protection forests and protected areas. UNEP-WCMC (2010) estimated the total area of forested protected areas at 2.085 million hectares. Partly there is overlap of areas in the various categories.

† Includes the land area of the Galapagos Islands, not all of which is forested.

Summary

Ecuador, a megadiverse country, suffers the highest rate of deforestation of any Amazonian country – primarily as a result of increased access, colonization, oil and timber exploration, a lack of incentives for conservation, insecure land titles, and weak public institutions. Ecuador has a large, often contradictory and unclear body of laws and regulations that affects the sustainable management of its biodiversity and tropical forests and which usually is only partially enforced. The Forestry Law is under revision, taking into account the new framework provided by the 2008 Constitution. SFM is a long way from being achieved in most of Ecuador's production and protection forests. On the positive side, there is a declared political willingness to increase the country's capacity to manage and conserve forest resources sustainably.

Key points

- Ecuador has no officially designated PFE. An estimated 8.69 million hectares of forest might be considered to constitute a PFE (compared with 7.56 million hectares in 2005), comprising 1.96 million hectares of natural production forest (compared with 3.10 million hectares in 2005), 6.55 million hectares of protection forest (compared with 4.30 million hectares in 2005) and 175 000 hectares of planted forest (compared with 164 000 hectares in 2005).
- An estimated 176 000 hectares of the production PFE is under SFM. No natural forest is certified. About 2.21 million hectares of protected areas have valid management plans and an estimated 629 000 hectares of the protection PFE is under SFM.
- Information on the forest sector is often poor and contradictory.
- There is strong pressure on the forest from informal and illegal operators resisting change towards SFM, and illegal logging is widespread in all three forest regions.
- Pronounced social and ethnic divisions complicate SFM and forest conservation. In many cases, and despite new legislative provisions, forest tenure remains unclear.
- There is a discrepancy between forest regulations and actual harvesting practice. The high rigour of legal provisions for harvesting operations may push forest users towards illegality.
- Considerable efforts have been undertaken in recent years in the management of the protection PFE and there is increased political support for forest conservation. The emergence of REDD+ could further strengthen the management of the protection PFE.

Endnotes

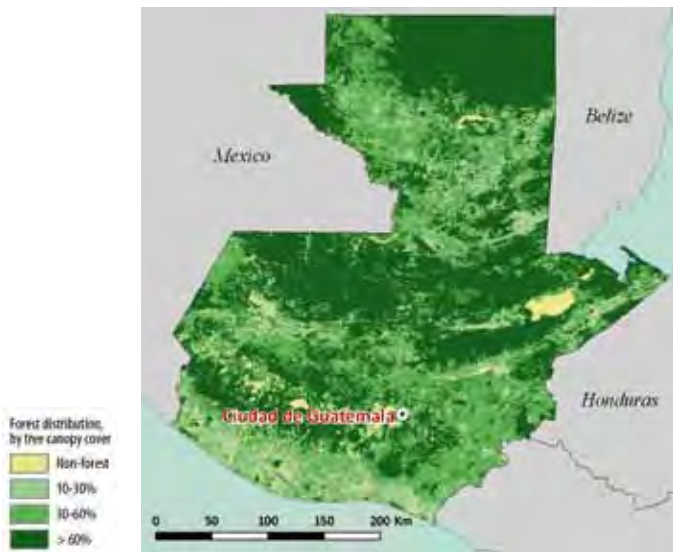
- a Government of Ecuador (2009).
- b Ministry of Environment website, accessed October 2010. Available at www.ambiente.gov.ec.
- e Personal communications with officials in the Government of Ecuador, 2010.

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GUATEMALA



Forest resources

Guatemala has a land area of about 10.9 million hectares and an estimated population in 2010 of 14 million people (United Nations Population Division 2010). It is ranked 78th out of 182 countries in UNDP's Human Development Index (UNDP 2009).

The country can be divided into three main biogeographical regions. The first, where most of the population lives, comprises highlands made up of several mountain chains stretching from the border with Mexico southwards to the border with Honduras. The highest peaks are steep volcanic cones reaching more than 4000 m above sea level; the country's main conifer forests are found there. The second is the Pacific plain, stretching along the Pacific coast, which is characterized by rich volcanic soils and is highly developed for agriculture. The third, the Petén, is a flat, low-lying region in the north of the country bordering Mexico and Belize. This is mainly a limestone plateau covered with dense humid tropical forests, swamps and grasslands, and features the ruins of ancient Mayan cities. Recent estimates of Guatemala's forest area range from 3.66 million hectares (FAO 2010a) to 4.55 million hectares (Government of Guatemala 2010, based on 2003 satellite cover interpretation).

Forest types. Ten physiographic regions, seven biomes, 14 ecoregions, 66 ecosystems and 14 life zones have been identified in the country.^a Forests

in Guatemala are classified as conifer forests, broadleaved forests, mixed forests and mangrove forests. Their characteristics and distribution are as follows:

- Closed natural pine forest in the highlands (*bosque de pino denso*) – these are dominated by one or several *Pinus* spp (pine species), *Abies guatemalensis* (pinabete), *Cupressus lusitanica* (cypress), *Taxodium mucronatum* (sabino) or *Juniperus comitana* (juniperus). The most commercially important species is *Pinus oocarpa*. The closed natural pine forests cover about 300 000 hectares and can be found in Huehuetenango, San Marcos, Quiche, Baja Verapaz and Totonicapan.
- Broadleaved forest (*bosque latifoliado*) – in this tropical humid forest type, more than 300 tree species have so far been identified, but two genera, *Dialium* and *Brosimum*, predominate. The largest areas of broadleaved forest are in the Petén but there are also areas in Alta Verapaz, Izabal, Quiche and Huehuetenango. They cover more than 3 million hectares.
- Mixed hardwood and pine forest (*bosque mixto*) – these cover about 600 000 hectares, composed of two main tree associations: pine–oak, and *Liquidambar styraciflua* (liquidambar). Cypress, Betulaceae (*Ostrya* spp and *Alnus* spp) and Lauraceae (*Ocotea* spp, *Nectandra* spp and *Persea* spp) occur in this forest type. It is predominantly found in Quiche, Huehuetenango, Alta Verapaz, Chiquimula and Zacapa.
- Relicts of mangrove forest (*bosque de manglar*) cover about 17 700 hectares on the Pacific coast, particularly in estuaries and lagoons (Spalding et al. 2010). The largest areas are in the departments of Retalhuleu, Santa Rosa, Escuintla, Jutiapa, Suchitepequez and San Marcos.

Permanent forest estate. The estimated total area of PFE is 2.46 million hectares^a (Table 1), comprising 1.14 million hectares of production forest, 1.24 million hectares of protection forest and 85 000 hectares of planted forest.^b The distribution of the PFE by forest type is as follows: tropical

hardwood forest – 1.7 million hectares; conifer forest – 100 000 hectares; mixed hardwood and pine forest – 130 000 hectares; and open woodlands and secondary forests – at least 500 000 hectares (ITTO 2006).

Forest ecosystem health

Deforestation and forest degradation. According to FAO (2010b), Guatemala lost about 56 000 hectares per year in the period 2006–2010, an annual deforestation rate of 1.47%. Overall, between 1990 and 2010, Guatemala lost 23% of its forest cover, or around 1.1 million hectares (FAO 2010b).

There has been deforestation in the conifer forests of the highlands for centuries, but today it mostly takes place in the Petén. Large-scale deforestation started there in the 1970s as a result of a land colonization program initiated by the government and accelerated in the 1980s, when entire villages of Indigenous people sought refuge during the country's civil war (ITTO 2006). An estimated 78% of the deforestation in the Petén is caused by shifting cultivation and the remainder is caused by cattle-ranching and other causes, such as mineral and petroleum development.^a The degradation and fragmentation of forests result from widespread illegal logging and fuelwood gathering, unmanaged

fires and drug-trafficking.^a The country has about one million hectares of secondary forests (*bosques secundarios, arbustales*). Table 2 indicates forest condition; about 37% of the total forest area is considered to be more-or-less intact.^a

Vulnerability of forests to climate change.

Possible consequences of climate change in Guatemala include variations in precipitation and temperature patterns, accompanied by changes in soil moisture, soil chemistry and species composition and structure. Local and national hydrological cycles could be disrupted, and surface water supplies could become unreliable (Government of Guatemala 2001). Observations in the Petén suggest that lakes and other water bodies there are recording consistently lower volumes than previously. A change in climate could directly affect the productivity of agriculture and forestry and diminish livelihoods (Tolisano & López-Selva 2010). Climate change could also have a significant impact on conservation needs and priorities. For example, under some future climate scenarios, a considerable number of protected areas will no longer be able to fulfill their role of protecting representative habitat for species targeted for conservation (Mansourian et al. 2009). As a consequence, changes to forest management may be required, including habitat restoration with a focus on resilience.

Table 1 Permanent forest estate

Reporting year	Estimated total forest area, range (million ha)	Total closed natural forest ('000 ha)	PFE ('000 hectares)			
			Production		Protection	Total
			Natural	Planted		
2005*	2.85–4.29	2824	1140	71	1240	2451
2010	3.65–4.51	1850**	1140	85[†]	1240	2465

* As reported in ITTO (2006).

** Calculated using the ratio of forest with greater than 60% forest cover estimated by UNEP-WCMC (2010) (50.6%) and the total natural forest area as estimated by FAO (2010a).

[†] According to Government of Guatemala (2010), with the entire area situated in the PFE. FAO (2010a) estimated the total planted forest area at 173 000 hectares, which probably includes tree plantations on agricultural land.

Table 2 Forest condition

	PFE	Non-PFE	Total
	'000 ha		
Area of primary forest	-	-	1620
Area of degraded primary forest	-	-	1800
Area of secondary forest	-	-	1000
Area of degraded forest land	-	-	1100*

* Corresponds to the total area deforested since 1960.

Source: Derived from Government of Guatemala (2010).

SFM policy framework

Forest tenure. Forest ownership in Guatemala may be public or private. An estimated 1.5 million hectares of forest are owned by local and Indigenous communities, 1.4 million hectares are national forests, and about 930 000 hectares are municipally/communally owned (Table 3). Indigenous communal lands (known as *ejidales*) have special status by law. Because of the civil war (which ended formally in 1996), the ownership of about 212 000 hectares of forest is uncertain, although some of this area is owned privately. Land tenure was complicated by the displacement in the 1980s and 1990s of more than one million people from their traditional lands (ITTO 2006) and by the existence of a number of overlapping claims. Despite recent efforts, therefore, tenure rights, particularly among the poor, remain insecure.

Under *Programa de Incentivos para Pequeños Poseedores de Tierras de Vocación Forestal o Agroforestal* (PINPEP) Law No 3937 (*Decreto 51*), which was approved in late 2010 (Rights and Resources Initiative 2011), the National Forest Institute (*Instituto Nacional de Bosques – INAB*) has established a program of incentives for small-scale owners of land with forestry or agroforestry potential to engage in natural forest management and agroforestry. Under the program, economic incentives are available to small-scale landowners with secure property titles in natural forest for up to five years to support approved forest management initiatives, and to small-scale landowners proposing agroforestry activities on land suitable for forestry.^a

Criteria and indicators. Guatemala is involved in the Lepaterique C&I process of Central American countries. For the last decade the country has been

engaged in a major effort to test and adopt FSC standards as a binding instrument for monitoring forest management. The country has also adapted the ITTO C&I to use as an instrument for monitoring progress towards SFM at the national level. The Government of Guatemala used the ITTO C&I in its submission to ITTO for this report.^a

Forest policy and legislation. The present forest law (*Decreto 101-96 Ley Forestal*, October 1996) emphasizes the importance of reforestation and forest conservation and makes reference to SFM (Article 48). New implementation rules for this law were approved in December 2005 (Resolution 01/43), including with respect to the system of incentives for forest management.^a The Law on Protected Areas (*Ley de Áreas Protegidas, Decreto 4-89*, 1989), amended in 1996 and 1997, regulates the Guatemala System of Protected Areas (*Sistema Guatemalteco de Áreas Protegidas – SIGAP*).

The ministry in charge of rural development until 2000 (*Ministerio de Agricultura, Ganadería y Alimentación – MAGA*) established an environmental policy in 1998, identifying sustainable development as its primary goal. The current forest policy, which was formulated in 1999, promotes the concept of productive management of natural forests (*fomento al manejo productivo de bosques naturales*), with the aim of making natural forests a feature of economic development in order to conserve biodiversity and improve the living conditions of forest-dependent people. The policy also defines policies for forest biodiversity and protected areas.^a A national strategy for the conservation and sustainable use of biodiversity was approved in 1999.

Table 3 Forest area, by tenure

Ownership category	Total area	Of which PFE	Notes
	'000 ha		
State ownership (national, state or provincial government)	1367	-	Legal forest estate owned and administered exclusively by government.
Other public entities (e.g. municipalities, villages)	934	-	Community-managed, but governments invariably retain strong authority.
Total public	2301	-	
Owned by local communities and/or Indigenous groups	1531	-	Privately owned forest lands where rights cannot be unilaterally terminated by government.
Private owned by firms, individuals, other corporate	212	-	Other lands, including individually owned forests and also forests with unclear ownership.

Source: Derived from Government of Guatemala (2010).

Based on the forest policy, a strategic plan was developed that includes financial mechanisms such as incentive payments for reforestation (e.g. PINPEP), afforestation/reforestation under the CDM, and payments for ecosystem services, especially water. In 2009, the National Policy for Rural Development (*Política Nacional de Desarrollo Rural Integral*) was approved that addresses forests as an integrated element in rural landscapes.^a The national climate-change policy (2009) emphasizes the role of forests in reducing GHG emissions, particularly through REDD+.^a

Institutions involved in forests. Through a congressional decree approved in December 2000 (*Decreto 90-2000*), the Ministry for Environment and Natural Resources (*Ministerio de Ambiente y Recursos Naturales* – MARN) shares authority over natural resources with MAGA. However, the relative responsibilities of the two ministries for forest management remain unclear.^a

INAB was created in 1996 as an independent and decentralized state agency. It is responsible for developing SFM in natural forests and for the establishment and management of planted forests. MAGA chairs INAB's board (*junta directiva*), which also comprises representatives of MARN, the private sector, civil society and the national association of municipalities. INAB is supported through a national incentive program (*Programa de Incentivos Forestales* – PINFOR). INAB is also responsible for forest inventories and the preparation of forest management plans in both planted and natural forests.

The National Council of Protected Areas (*Consejo Nacional de Areas Protegidas* – CONAP), established under MARN in 1989, is responsible for managing SIGAP, including the Maya Biosphere Reserve in the Petén, the largest tract of closed humid tropical forest in Guatemala, and the Sierra de las Minas Biosphere Reserve. CONAP is also responsible for the delivery and supervision of long-term community and industrial concessions, particularly in the multiple-use zone of the Maya Biosphere Reserve. Some of the communities that became involved in forest management under this concept have managed, with international support, to certify their forest operations.^a

The forest industry is represented politically by *Gremial Forestal de Guatemala*, which is also a member of the INAB board. The *Cluster Forestal*

is a multi-sectoral forum that promotes the role of forests in Guatemalan society. The National Association of Municipalities (*Asociación Nacional de Municipalidades*) represents local governments on the boards of INAB, CONAP and MARN. Local governments are taking increasing responsibility for the management of forests under a process of decentralization that is an expression of national reconciliation after the civil war. Each national institution has its own criteria for decentralization. Municipalities are required to create environmental offices and are encouraged to conduct reforestation projects; municipalities can keep 50% of the revenues from concessions and harvesting licences (ITTO 2006). By the end of 2006, a total of 108 municipal forest offices had been established.^a

An association of NGOs (*Asociación Nacional de Recursos Naturales y Medio Ambiente*) participates in the supervisory committee of INAB and in the consultative groups of MARN and CONAP. Another association, the National Council for Sustainable Forest Management Standards (*Consejo Nacional de Estándares de Manejo Forestal Sostenible para Guatemala*) maintains a national dialogue on forests and promotes forest management standards and certification.

Status of forest management

Forest for production

Forest management goals vary throughout the country. The community forests in the highlands consist mainly of coniferous or mixed forests and principally produce fuelwood and construction wood for household consumption and the domestic market.^a In contrast, community forest operations in the tropical broadleaved forests of the Petén produce timber from both high-value and lesser-known species for national and international markets, as well as NTFPs (Tolisano & López-Selva 2010).

The Maya Biosphere Reserve was created in 1990 and covers an area of 2.11 million hectares. It has three zones: the core zone, consisting of national parks and biotopes (747 800 hectares); the multiple-use zone, where forest concessions are located (864 300 hectares); and the buffer zone, where cooperatives and municipal common lands are located and where land use is generally restricted (about 500 000 hectares). About 540 000 hectares of forests have been granted as forest concessions in the multiple-use zone^a; these concessions constitute

the largest FMUs in the country. Of the 18 FMUs nationally, twelve are community concessions, four are cooperatives or municipal common lands in mountainous areas, and two are industrial concessions situated in the Petén.^a All concessions are required to obtain FSC forest certification within three years of their establishment (Stoian & Rodas 2006).

The 1996 Forest Law made the preparation of forest management plans compulsory for long-term forest users. Timber harvesting in the PFE requires an approved forest management plan and a licence issued through INAB; INAB-approved forest management plans are required for planted forests, including agroforests. Forest concessions in the Maya Biosphere Reserve must fulfil similar review and licensing procedures, but through CONAP.^a Some operators have cited the overlap in forest management responsibilities between INAB and CONAP as a bureaucratic complication.^a

INAB has adopted a methodology prepared by the former Regional Forest Program for Central America and the Tropical Research and Higher Education Centre (*Centro Agronómico Tropical de Investigación y Enseñanza*) involving the preparation of simplified management plans for hardwood forests and forest management plans for Central American conifer forests (ITTO 2006). In 2008, a total area of 692 200 hectares in the PFE was covered by management plans^a, 483 000 hectares of which were in tropical hardwood forests, 172 000 hectares of which were in mixed forests and 37 200 hectares of which were in pine forests. These areas are unchanged since 2005 (ITTO 2006).

The most serious problem in forest management is extensive small-scale illegal logging of single trees. In the tropical hardwood forests, *Swietenia macrophylla* (caoba) and the various species of *Cedrela* are the species most targeted by illegal logging. In the highlands, illegal logging particularly threatens pinabete and cypress (ITTO 2006).

Silviculture and species selection. Forest concessions in the Petén are managed according to a polycyclic silvicultural system with a cycle of 30–40 years.^a The logging intensity is 1.5–3 trees (3–4 m³) per hectare. Thirty per cent of commercial trees must be kept as seed trees.^a The minimum cutting diameter for caoba and *Cedrela odorata* (cedro) is 60 cm (55 cm in certain FMUs); for other species it is 45 cm.

Of the 424 known indigenous tree species, 320 are considered to be suitable for certain uses (ITTO 2006); about 25 species are traded. Traditionally important commercial species in the mountainous areas are pines (*Pinus oocarpa*, *P. pseudostrobus* and *P. maxiinoi*), cypress and *Quercus* spp (roble). Caoba and cedro are the main commercial species in the hardwood forests of the Petén; despite heavy logging in the past 60 years or so, both species occur in abundance in all forest layers (ITTO 2006). Table 4 shows five species that constitute the most commonly harvested species for industrial roundwood.

Planted forest and trees outside the forest. The total planted forest area in 2008 was estimated at 85 000 hectares^a, an increase of about 14 000 hectares over the estimate in ITTO (2006). Most plantations consist of local pine species. About 2.2 million hectares of non-forested land are considered suitable for tree-planting.^a

Relatively small areas of tree plantations are scattered throughout the country; these are often established without a clear purpose (ITTO 2006). Four conifer species (*P. caribaea*, *P. maximinoi*, *P. oocarpa* and *C. lusitanica*) and two broadleaved species (*Tectona grandis* – teak, teca – 4000 hectares, and *Gmelina arborea*) make up 70% of existing plantations, and *Hevea brasiliensis* is planted for both rubber and timber (ibid.). The forest policy seeks to encourage the establishment of 15–20 000 hectares per year through the use of incentives in order to generate wood and other products for the forest industry and local consumption.^a

Table 4 Commonly harvested species for industrial roundwood

Species	Notes
<i>Swietenia macrophylla</i> (caoba)*	50% of total export value in 2008, 17% in volume.
<i>Lonchocarpus castilloi</i> (manchiche)*	Mainly for domestic use.
<i>Calophyllum brasiliense</i> (santa maría)*	Mainly for domestic use.
<i>Bucida buceras</i> (pucte)*	Exported for flooring and parqueting.
<i>Pinus</i> spp (tajibo)*	Most important timber for domestic use.

* Also listed in ITTO (2006).

Source: Government of Guatemala (2010).

Forest certification. The National Council for Sustainable Forest Management Standards has developed national certification standards for both natural and planted forests, which are now implemented throughout the country.^a With international support, considerable effort was made in the period 2002–05 to certify forests in the PFE. By December 2005, a total area of 522 870 hectares in 15 FMUs had been certified under the FSC umbrella (ITTO 2006). In December 2010, there were eight FSC certificates, of which two were group certificates and six were certified FMUs in community concessions; the total certified area was 481 440 hectares (FSC 2010), the majority of which was in the Maya Biosphere Reserve.

While there has been only a relatively small decline in the certified forest area since the last survey, there is a concern that the trend is downward rather than up. In particular, the considerable transaction costs incurred by local communities to maintain certification status, and the lack of adequate price premiums for certified timber and timber products, raise questions over the long-term viability of certification in the Guatemalan context.

Estimate of the area of forest sustainably managed for production. About 700 000 hectares of the production PFE are under some sort of management, of which about 260 000 hectares are conifer and mixed forests, both natural and planted. Assessments of the management of community forest concessions indicate that forest management is being applied in most of these community forests. At least 630 000 hectares of natural-forest production PFE are considered to be under SFM (Table 5), comprising the certified forests and those natural pine forests and mixed forests managed according to defined management principles.^b

Timber production and trade. Total roundwood production, including for fuelwood, was estimated at 16 million m³ in 2008 (Tolisano & López-Selva

2010). Total industrial roundwood production in 2009 was 443 000 m³ (of which an estimated 363 000 m³ was coniferous), slightly more than the estimated 419 000 m³ in 2004 (ITTO 2011). Approximately 90% of harvested timber is destined for the national market. Total sawnwood production declined from about 200 000 m³ in 2000 to 54 000 m³ in 2009 (ibid.); however, the data are unreliable and it is estimated that a large part of the timber production is processed by the informal sector and thus is not recorded in official statistics.

About 75% of total sawnwood production is exported to other countries in Central America and the Caribbean and to North America, mostly as certified products. Caoba is the most important export species by value, followed by *Calophyllum brasiliense* (santa maría), *Cybistax donnell-smithii* (palo blanco), cedro and *Castilla elastica* (castilla). A considerable volume of timber – up to 30–50% of the official roundwood production – is harvested illegally (Stoian & Rodas 2006). Fuelwood and charcoal are important products in local markets.

Non-timber forest products. Among internationally traded NTFPs are pine resin, pine seeds from mountain forests, copal (*Bursera bipinnata*, *Protium copal* and other species), xate leaves (from the *Chamaedorea* palm), *Pimenta dioica* (pimiento) and chicle gum (*Manilkara zapota* – a dominant tree in the primary forests of the Petén). An estimated 4.2 million pounds of xate and 300 000 pounds of chicle gum are produced annually, worth US\$660 000 and US\$ 310 000, respectively.^a Community concession-holders have long-standing experience with forest enterprises through the management, harvesting and marketing of NTFPs, in particular chicle gum and xate. Another species used as an NTFP is hombre grande (*Quassia amara*), a natural biocide used in organic agriculture in the Petén.

Table 5 Management of the production PFE ('000 hectares)

Reporting year	Natural					Planted		
	Total	Available for harvesting	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
2005*	1140	540	697	520	672	71	27	8
2010	1140	540**‡	697‡	481	630	85	27‡	0

* As reported in ITTO (2006).

** Comprising timber concessions, community concessions and community forests.

‡ Since more recent data were unavailable, assumed unchanged since 2005 (as reported in ITTO 2006).

Forest carbon. It is estimated that more than 60% of Guatemala’s GHG emissions are caused by deforestation and forest fires (Government of Guatemala 2008). Thus, efforts to reduce deforestation and unmanaged fires could produce a significant reduction in national GHG emissions. Gibbs et al. (2007) estimated national-level forest biomass carbon stock in the range 787–1150 MtC. FAO (2010a), in contrast, estimated it at only 281 MtC.

Guatemala is one of 37 countries selected by the Forest Carbon Partnership Facility to prepare its national REDD+ strategy, and the country’s readiness idea note was approved in 2008. Guatemala has been participating in the REDD+ Partnership since 2010 and is an observer in UN-REDD. Table 6 summarizes Guatemala’s current forest carbon potential.

Forest for protection

Soil and water. In Guatemala, *in situ* and *ex situ* biodiversity and forest conservation is carried out under the jurisdiction of MARN, the associated National Council for Protected Areas, and INAB. The system of protected areas, SIGAP, comprises nearly 950 000 hectares of special protection forests (*zonas de amortiguamiento*).^a An estimated 201 900 hectares of forest land are managed primarily for soil and water protection; this includes the area managed by PINFOR (18 200 hectares) and several pilot forests (13 000 hectares), as well as 24 700 hectares of protected forests in the Manantiales reserve and the forest area of the Sierra de la Minas Biosphere Reserve (146 000 hectares of a total protected area of 236 000 hectares).^a The Direct Forest Support Pilot Program (*Programa Piloto de Apoyos Forestales Directos*) finances the sustainable protection and conservation of natural forests by providing payments for conservation activities to protect watersheds, particularly natural forests, and water resources. Such payments are designed to



A specimen of caoba (*Swietenia macrophylla*) in the Petén.

reduce the conversion of forest land to agriculture and to improve the security of water supplies in rural areas. Payments are provided to beneficiaries for five years. An estimated 220 registered owners are now participating in the project, with more than 33 000 hectares of natural forest under protection.^a

Biological diversity. Guatemala is a very biodiverse country, with flora and fauna representative of both temperate and tropical America. CONAP (2008) reported the total number of plant species in Guatemala at 10 364 species, although it also noted that floristic research in Guatemala is at an early stage of development. There are 6463 known species of flowering plant, 28 species of conifer, 637 species of fern, 527 species of orchid and 519 species of moss (ibid.). The most recent count of vertebrate fauna reported 3025 species, including 735 bird species, 244 mammal species, 143

Table 6 Forest carbon potential

Biomass forest carbon (MtC)	% forest with canopy cover >60%	Deforestation/ degradation potential to 2030	Enhancement of carbon sink capacity to 2030	Forest area change monitoring capacity	Forest/ GHG inventory capacity	Importance of forest fire/ biomass burning	Engagement in international REDD+ processes
787–1150	51	++	++	+	+	++	++

+++ high; ++ medium; + low; estimate of national forest carbon based on Gibbs et al. (2007); estimate of % total forest with canopy cover >60% based on UNEP-WCMC (2010).

amphibian species, 243 reptile species, and 1033 fish species (IARNA 2009). Thirteen mammals, nine birds, seven reptiles, 81 amphibians, three invertebrates and five plants found in forests are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species (IUCN 2011). Two plants (including the conifer *Abies guatemalensis*) are listed in CITES Appendix I, 288 (including *Swietenia macrophylla* and *S. humilis*) are listed in Appendix II and two are listed in Appendix III (UNEP-WCMC 2011).

According to the list of endangered species published by CONAP, there was an increase of 1.3% in the number of endangered plant species from 1999 to 2006 (CONAP 2008).

Protective measures in production forests.

Concession-holders are required, among other things, to conserve seed trees, set aside areas from which tree-felling is excluded, make special provisions for biological corridors, regulate hunting, and conserve endangered plants and animals (ITTO 2006).

Extent of protected areas. Legally protected areas (i.e. those in the SIGAP), comprising both forest and non-forested land, cover about 3.3 million hectares (Box 1), or 30% of the national territory. This is about 200 000 hectares more than reported in ITTO (2006). However, some of the ecoregions specified in Box 1, although nominally forest, are likely to be partly without forest cover. Forty-seven of the 121 protected areas in Guatemala are interconnected.^a About 1.2 million hectares of those

protected areas are considered to be part of the PFE (ITTO 2006). Forty-three reserves in the SIGAP are smaller than 1000 hectares and five are larger than 100 000 hectares. More than 150 private natural reserves covering about 30 000 hectares are registered with CONAP, and several additional properties are in the process of being registered.^a CONAP maintains responsibility for legally recognizing private natural reserves and INAB collaborates with reserve operators on projects, including payments for ecosystem services.^a

Estimate of the area of forest sustainably managed for protection. Little information is available for estimating the extent of protection PFE under SFM. Those areas protected for water and soil conservation are considered to be under SFM because they are subject to well-resourced management programs, as are the 30 000 hectares of private reserves, which are mostly used for ecotourism (Table 7).

Socioeconomic aspects

Economic aspects. Guatemala's forest sector is estimated to contribute approximately 2.5% of GDP through the production of timber and NTFPs. It generates an estimated 37 000 jobs, involving about 1.5% of the economically active population.^a

Livelihood values. Hunting and the gathering of edible plants such as *Manilkara zapota* have been of great importance for the Mayan culture for centuries. In the humid forest zone, both

Box 1 Distribution of Guatemala's protected areas, by ecoregion

Ecoregion*	Extent of SIGAP protected areas (ha)	% of total ecoregion
Atlantic humid forests	172 800	22
Pine-oak forests	234 000	8
Motagua Valley thornshrub	46 000	20
Petén Veracruz humid forests	2 523 000	53
Sierra Madre Chiapas humid forests	7100	1
Yucatan humid forests	11 300	93
Central American montane forests	251 000	42
Central American dry forests	21 400	3
Mangroves (Belizian coast)	28 500	80
Mangroves (Tehuantepec-El Manchon)	4600	5
Mangroves (northern region)	1800	94
Total	3 301 500	

* Ecoregions without SIGAP areas are the Chiapas montane forests, the depression dry forests, and the Pacific coast dry mangrove forests.

Source: CONAP (2008).

Table 7 Management of the protection PFE ('000 hectares)

Reporting year	Protection PFE	Attributed to IUCN categories I-IV	Allocated for soil and water	With management plans	Sustainably managed
2005*	1240	836	184	-	-
2010	1240	836	235	-	265

* As reported in ITTO (2006).

Indigenous communities and colonists use forest products in their households; products include the fibres of bayal (*Desmoncus* spp) and sabal (palm leaves) for housing. In the highlands, fuelwood harvested in forests is the most important source of energy (ITTO 2006).

Social relations. Guatemala has 24 ethnic groups. More than two-thirds of the population is of Indigenous descent and 61% lives in rural areas (Tolisano & López-Selva 2010). There is a long tradition of forest conservation, particularly in the highlands. For many years Guatemala has been implementing a decentralization policy aimed at engaging municipal governments and traditional and Indigenous communities in the issuing of permits, monitoring, and the enforcement of national policies.^a Local institutions are in charge of forest administration, and a village council generally deals with forest-related issues. However, such local institutions, communities and local NGOs have long been excluded from forest management, except in a few cases in the Petén. Since the end of the civil war there has been participation in the classification and management of protected areas through national and regional roundtables (*mesas de diálogo*) and in forest development through consultation roundtables convened by INAB.

Summary

Forests play an important role in Guatemala. In the uplands, large areas are owned by communities, who manage natural pine and mixed forests for multiple uses. In the rainforests of the Petén, large community-run timber concessions allow local people to improve their livelihoods on the basis of forest resources. However, SFM is hindered by high rates of deforestation and forest degradation driven by agricultural expansion, mining, illegal logging, drug-trafficking and other threats. Great efforts are being made in the country to maintain an active dialogue on forest-based development and various incentive programs are in place to protect existing forests and support the development of planted

forests and agroforestry. A relatively high percentage of the production PFE is certified and more than half of it is considered to be under SFM.

Key points

- Guatemala has an estimated PFE of 2.46 million hectares (compared with 2.45 million hectares in 2005), comprising 1.14 million hectares of natural production forest (as estimated for 2005), 1.24 million hectares of protection forest (as estimated for 2005) and 85 000 hectares of planted forest (compared with 71 000 hectares in 2005).
- An estimated 630 000 hectares of the production PFE are under SFM, including 481 000 hectares of certified forest. An estimated 265 000 hectares of the protection PFE are considered to be under SFM.
- The system of protected areas and the monitoring of biodiversity are both long established. Information on the status of protected-area management is limited, however.
- Considerable efforts have been made in the last decade or so to reorganize the control and management of forest resources; this has included the decentralization of management and law enforcement. There have also been significant efforts to develop an ongoing multi-stakeholder dialogue on forest conservation and development
- There is long-standing experience in the management of conifer forests. The concession management policy introduced in lowland rainforests 6–8 years ago continues to play an important economic and ecological role in the region and is helping to improve livelihoods and support forest conservation. Nevertheless, there are considerable threats, including illegal logging and drug-trafficking.
- A large area (more than one-third) of the production PFE is certified, but there are concerns about the long-term viability of

certifying forests given the considerable transaction costs incurred by local communities to maintain certification status and the lack of adequate price premiums for certified timber and timber products.

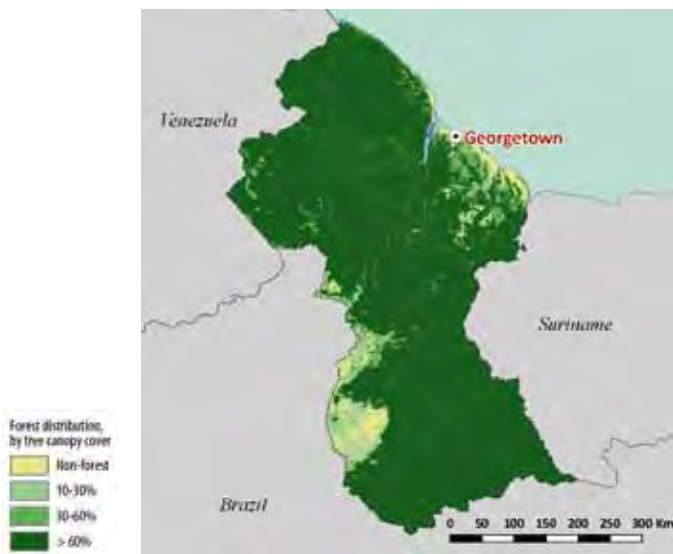
Endnotes

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- b ITTO estimate.

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GUYANA



Forest resources

In 2010 the estimated population of Guyana was 761 000 people (United Nations Population Division 2010) and the country is ranked 114th out of 182 countries in UNDP's Human Development Index (UNDP 2009). It has a very humid climate and can be divided into four biogeographical zones: the narrow coastal plain; the 'rolling hills' – an extensive, forested area with sandy acid infertile soils reaching 90 m above sea level; a Precambrian lowland region of tropical rainforest; and, bordering Venezuela and Brazil, the Pakaraima mountains, a forested sandstone plateau 1000 m or more above sea level. FAO (2010) estimated that Guyana had 15.2 million hectares of natural forest in 2010, which is 71% of the total land area (21.5 million hectares). Guyana has an estimated 39 600 hectares of mangroves, the largest tracts of which are in the northern half of the country (Spalding et al. 2010).

Forest types. The Government of Guyana recognizes the following forest types: dry evergreen forest, marsh forest; montane forest; swamp forest mangrove forest; and mixed forest.^a The composition of the forest changes considerably from north to south and reflects varied topographic and geological conditions. Mixed forest is the most common type and the most important source of timber; common species include *Mora gonggrijpii* (morabukea), *Chlorocardium rodiei* (greenheart), *Vouacapoua macropetala* (sarabebeballi) and

Clathrotropis brachypetala (aromata). Seasonal forests have a lower canopy and include deciduous trees; they are found in the North Rupununi and upper Berbice areas. Dry evergreen forests occupy belts of leached white sands and are also found throughout the Pakaraima mountains (ITTO 2006).

Permanent forest estate. About 13.6 million hectares have been classified as state forest^a, although FAO (2010) estimated that the actual area of this estate is 12.2 million hectares. About 6.85 million hectares of state forest is allocated to commercial use and 1.11 million hectares to research and protection.^b The remaining state forest land, mainly in the south of the country, is unallocated; a lack of ready access and long distances to market make the commercial harvesting of these forests economically infeasible at present. Gazetted state forest is strictly allocated for production, harvesting, biodiversity and research and will not or is not converted in anyway to non-forested uses.^a Therefore, all state forest may be regarded as part of the PFE (Table 1).

Agricultural leases may be issued by the Guyana Lands and Surveys Commission for areas outside state forest. If an agricultural lease overlaps with areas within state forest the lessee must apply to the Guyana Forestry Commission (GFC) prior to any removal of timber.^b

Forest ecosystem health

Deforestation and forest degradation. Most of Guyana's forests are still intact, unexploited and not threatened by the expansion of agriculture, although more than half of the forest estate has been categorized as 'naturally regenerating' (Table 2). In its submission for this report the Government of Guyana did not report the area of forest affected by mining, slash-and-burn agriculture or fire.^a The total area of forest formally converted to agriculture to 2009 was 25 121 hectares. FAO (2010) estimated the deforestation rate in Guyana in the period 2005–10 at 0%. According to a recent study (GFC & Pöyry Forest Industry 2010), the deforestation rate for the period 1990–2009 was 0.02% per year, increasing to 0.06% in 2010.

Table 1 Permanent forest estate

Reporting year	Estimated total forest area, range (million ha)	Total closed natural forest ('000 ha)	PFE ('000 hectares)			
			Production		Protection	Total
			Natural	Planted		
2005*	16.9	16 916	5450	12	980	6442
2010	15.2–20.5	13 600**	11 090‡	12^a	1110	12 212[†]

* As reported in ITTO (2006).

** Calculated using the ratio of forest with greater than 60% forest cover estimated by UNEP-WCMC (2010) (89.2%) and the total natural forest area estimated by FAO (2010).

‡ Includes that part of the Iwokrama forest allocated for production. Also includes 4.24 million hectares of state forest currently unallocated to either production or protection.

[†] Includes forest on Amerindian lands within the state forest estate but excludes forest on private property.

Table 2 Forest condition

	PFE	Non-PFE	Total
	'000 ha		
Area of primary forest	-	-	6790
Area of degraded primary forest	-	-	0
Area of secondary forest	-	-	8415*
Area of degraded forest land	-	-	0

* 'Other naturally regenerating forest'.

Source: FAO (2010).

Vulnerability of forests to climate change.

The mean annual temperature is projected to increase by 0.9–3.3 °C by the 2060s (McSweeney et al. undated). All climate-change projections indicate substantial increases in the frequency of days and nights that are considered hot in the current climate. This will affect forest growth and increase the vulnerability of forest ecosystems. Guyana's low-lying coastal plains are vulnerable to sea-level rises that may occur due to the effects of global warming (ibid.). In its submission to the UNFCCC, Guyana completed a vulnerability and adaptation assessment, the first step towards the formulation of a climate-change adaptation strategy for Guyana. The first draft of the Low Carbon Development Strategy was published in June 2009 and the third draft in May 2010, outlining a comprehensive approach to fostering Guyana's development while combating climate change (Office of the President 2010).

SFM policy framework

Forest tenure. The bulk of Guyana's forests is owned by the state (Table 3). Under the Forest Law and national forest policy, the ownership of all forest resources, except those on private property and Amerindian (Indigenous) Lands, are vested

in the state. About 1.31 million hectares of forest has been formally gazetted as Amerindian lands. State Lands, formerly called Crown Lands, are controlled by the Commissioner of Lands and Surveys. The GFC, the Guyana Geology and Mines Commission (GGMC) and the Lands and Surveys Department administer, respectively, land that is used for forestry, mining and agriculture. Each of these three government agencies may issue titles for different purposes over the same land (National Development Strategy Secretariat 2000).

Criteria and indicators. Guyana was a participant in the development of the Tarapoto C&I, which was coordinated by the Amazon Cooperation Treaty Organization. In 2001 the GFC reviewed both the Tarapoto and ITTO C&I in the development of a new national forest plan. The submission of the Government of Guyana to ITTO for this report was in the ITTO C&I reporting format.^a

Forest policy and legislation. The overall objective of Guyana's national forest policy, as set out in its 1997 National Forest Policy Statement, is "the conservation, protection, management and utilisation of the nation's forest resources, while ensuring that the productive capacity of the forests for both goods and services is maintained or enhanced".^a

Table 3 Forest area, by tenure

Ownership category	Total area	Of which PFE	Notes
	'000 ha		
State ownership (national, state or provincial government)	12 200	12 200	Managed by the GFC.
Other public entities (e.g. municipalities, villages)	0	-	
Total public	12 200	-	
Owned by local communities and/or Indigenous groups	1307	-	Gazetted Amerindian lands.
Privately owned by individuals, firms, other corporate	1676	-	Amerindian areas that have not been gazetted; agricultural leases; transported properties*; etc.
Total	2983	-	

* Privately owned. The owner of a transported property theoretically owns the land from the centre of the earth to the sky above subject to government interests (e.g. airplanes flying overhead, minerals, etc).

Source: ITTO estimate based on data in Government of Guyana (2009) and FAO (2010).

The specific objectives are to:

- Promote sustainable and efficient forest activities which utilize the broad range of forest resources and contribute to national development while allowing fair returns to local and foreign entrepreneurs and investors.
- Achieve improved sustainable forest resource yields while ensuring the conservation of ecosystems, biodiversity and the environment.
- Ensure watershed protection and rehabilitation by preventing and arresting the erosion of soils and the degradation of forests, grazing lands, soil and water; promoting natural regeneration, afforestation and reforestation; and protecting the forest against fire, pests and other hazards.

The policy was prepared over two years through a process of broad consultation with sector interest groups and was formally approved by Cabinet in October 1997. It recognizes that there have been changes in Guyana's economic, social and political environment over the nearly 50 years since the previous forest policy was published. It marks a significant shift in emphasis from the development of the timber resources to a broader approach to management for multiple goods and services for the national benefit.

The Forest Act – Chapter 67:01 of the Laws of Guyana – governed the administration of Guyana's forests from 1953 to January 2009, when the Parliament passed the Forest Bill (2009). As of October 2009, however, this Bill was still awaiting assent by the President of Guyana. When it comes into effect it will repeal Law 67:01 (and others) and is designed to “consolidate and amend the law

relating to forests”. Specifically, it sets out to provide for:

- The sustainable forest management of state forests.
- The protection and conservation of forests (excluding the Iwokrama forest, Kaieteur National Park, and any other area designated as a conservation area, all of which are dealt with under other laws).
- The regulation of forest operations and activities relating to forest produce and quality control for value-added forest produce, having regard to Guyana's international legal obligations.

Features of the Forest Bill (2009) include the following:

- Before granting or renewing any concession over an area of state forest 8097 hectares or smaller, the GFC shall
 - by public notice invite applications for a concession over the area and notify the locations where the relevant documents may be inspected or bought
 - provide any other publicity that the GFC considers necessary to bring the invitation to the attention of persons likely to be interested in obtaining a concession over the area.
- The GFC shall make available for inspection at its offices and for sale at a reasonable price copies of all documents in its possession concerning the forest produce and other features of the area that the GFC considers relevant to the preparation of applications.

- A consolidated effort towards maintaining environmental integrity and social development in communities by using relevant sections of both the Amerindian Act (2006) and the Environmental Protection Act (1996). Specific provisions are made for community forest management and extractive and primary processing forest operations.
- Recognition of the importance of ensuring sustainability in forest resource use. Part 2 of the Bill deals with SFM, recognizing that the minister has overall directive input on all activities.
- Forest concession agreements are streamlined with specific size classes. More importantly, the system for granting and renewing these agreements is systematic and transparent in keeping with international best practices.
- A proposal to make mandatory the submission of annual and management plans by larger concessions, and a further stipulation that all harvesting activities are to be carried out in compliance with approved plans.
- Allowance for competitive bidding in forest area allocation in the event of multiple applications, thereby improving transparency in the process.
- It provides communities with a clear means of acquiring and securing rights to manage forest areas and of benefiting from their local forest while ensuring sustainability, stimulating income generation and fostering environmental stability.
- It addresses areas such as afforestation, occupational health and safety, forest conservation, the maintenance of soil and water quality, and the preservation of biological diversity.
- It guards against pricing below the true market value. The GFC and the Forest Products and Marketing Council of Guyana (FPDMC) advise stakeholders on prevailing market prices.
- The clauses on forest offences and the appeals which may be made are also strengthened to reflect more severe penalties for abuse of power, negligence and misconduct.
- It allows for the more efficient and optimal use of Guyana's state forest resources by strengthening the revenue system. This is done

by creating a more efficient revenue structure which seeks to capture area management fees, fees for the standing stock of timber, an incentive to encourage SFM, and other related charges. The Bill provides for these monies to be paid over to the Consolidated and Contingencies Fund.

- It provides a robust mechanism for the authorization of state forest leases in cases of a change in ownership and effective control.

Institutions involved in forests. The GFC was created in 1979 under the GFC Act 67:02. In 2008 a new law, the GFC Act 2007, was passed by Parliament to “repeal and replace the Guyana Forestry Commission Act 1979, re-establish the Guyana Forestry Commission, and provide for incidental matters”. The GFC is a semi-autonomous public agency with the aim of encouraging the development and growth of forestry in Guyana on a sustainable basis. Among other things it advises the Minister of Agriculture on and carries out forest policy, and administers the Forests Act, including by carrying out the Commission's functions under that Act and collecting and recovering all fees, charges, levies, premiums, fines, penalties, costs, expenses, and other monies payable under the Act.

The GFC is also mandated to:

- Prepare plans, codes of practice and guidelines for the conservation and management of forests.
- Research, collate, analyse, prepare and disseminate data, statistics and other information about forests and all aspects of forestry, including forest ecology and the use of forest produce.
- Make forest inventories.
- Provide or facilitate education and training in forestry and forestry-related jobs.
- Provide forestry extension services and give advice to persons and communities interested or involved in forestry.
- Provide an inspection, certification and accreditation service for quality control of forest produce.
- Represent the Government in regional and international forestry meetings and negotiations, and in relation to Guyana's international obligations concerning forestry.

The GFC is a member of the Cabinet Sub-Committee on Natural Resources and Environment. This body, comprising policy and technical representatives, provides guidance and technical support to Cabinet. Its work is supported by the Natural Resources and Environment Advisory Committee, which is chaired by the Prime Minister and coordinated by the Adviser to the President on Sustainable Development. In 2010, 260 people were employed in public forest institutions, including 60 with university degrees or an equivalent qualification. Total public expenditure in the forest sector in 2010 was 500 million Guyanese dollars.^b

At the operational level, the GFC works in close collaboration with the FPDMC and the Forestry Training Centre. The Minister of Agriculture has established a Technical Committee comprising the GFC and the Forest Producers Association (FPA) and a Ministerial Committee comprising the GFC, the FPA and the Guyana Manufacturing and Services Association as part of efforts to foster a closer working relationship with the private sector and industry stakeholders. These fora allow open dialogue and act as problem-solving mechanisms for issues related to natural resource management, including in areas of harvesting, forest industry and export regulations.

One forest producers' association and a number of smaller, community-based loggers' associations represent loggers and sawmillers in the forest sector and endeavour to ensure collaboration in activities such as training, information, public awareness and institutional development. National environmental NGOs are weak, but international environmental organizations are assuming independent roles in forest control and information-sharing, partly in collaboration with the forest administration.

Status of forest management

Forest for production

The Forest Bill (2009) makes significant changes to the allocation of state forest for harvesting. Under the Bill, the GFC may grant forest concessions up to 8097 hectares in size for the harvesting of forest produce, including timber. Concessions may be larger on application by holders of

exploratory permits (see below) or if they are for 'forest conservation operations', which are defined by the Bill as the preservation of forests for the purpose of carbon sequestration or any other form of environmental service¹; the conservation of biological diversity; or ecotourism. Forest operations under these larger concessions can only be carried out after the GFC has approved a forest management plan of at least five years' duration and an annual operations plan for the concession area.

Exploratory permits may be granted under the Bill for exploratory operations within a specified area of state forest with a view to later applying for a concession in the area. The Bill does not state a limit on the size of the forest area that may be allocated under such permits. The Bill also specifies the parameters of community forest management agreements.

In its submission to ITTO, the Government of Guyana reported forest use on the basis of the Forest Act (1953), since the Forest Bill (2009) was yet to come into effect.^a Under the Forest Act, forest harvesting permits are allocated according to the following three categories:

- *Timber sales agreements* (TSAs): concessions are granted on a lease of 20 years or more over an area of 24 000 hectares or more. As of June 2010, 25 TSAs had been allocated to local and international companies covering an area of 4.53 million hectares (47.7% of all state forest).^a The average size of a TSA is 75 000 hectares (ranging from 50 000 to 100 000 hectares), and companies may hold more than one TSA at a time.
- *Wood cutting leases* (WCLs): licences are granted on 3–10-year leases for areas of 8000–24 281 hectares. As of June 2010, there were two licences covering a total area of about 30 500 hectares.^a
- *State forest permits* (SFPs): cutting permits are granted on an annual basis for areas of state forest up to 8094 hectares in size. SFPs are generally issued to small-scale operators; 386 permits covering a total area of 1.35 million hectares were allocated as of June 2010 (14.2%

¹ This provision is designed to allow conservation organizations to pay an amount equivalent to that which would have been paid for commercial harvesting rights for the exclusion of timber harvesting from particular forest areas.

of all commercial allocations).^{a,b} There are also permits called 'SFPs in conversion'.²

- *State forest exploratory permits*: before a WCL or a TSA is issued, a three-year exploratory permit may be granted to allow the collection of information for the preparation of an investment proposal, an environmental and social impact assessment, and a forest management plan. In June 2010, six exploratory permits covering an area of 797 000 hectares were in effect.^a

In 1998 the GFC introduced the Code of Practice for Timber Harvesting based on FAO's Model Code of Forest Practice. The Code, which was revised in 2002 (GFC 2002), prescribes internationally accepted standards for exclusion areas and buffer zones, 100% pre-harvest inventory, road construction, felling, skidding, trucking, operational and camp hygiene, and occupational health and safety. Besides exclusion areas and buffer zones, the Code restricts logging on slopes greater than 40% and sets a minimum distance of 10 m between harvest trees to minimize the size of canopy openings.

The Code of Practice for Timber Harvesting is not prescribed under the Forest Bill (2009). Instead, the Bill specifies that the GFC "may at any time submit to the Minister a proposed code of practice to regulate any class or description of forest operations". Such a code, if adopted by the minister, must then be adhered to during forest operations.

Guyana's forests are characterized by a predominance of relatively slow-growing, high-density timber species and smaller trees compared with most other tropical regions due to the inherently low fertility of soils derived from the ancient Guiana Shield. Commercial timber occurs in spatially segregated 'reefs' or stands in which one or two commercial species dominate. Nevertheless, a large proportion of the commercial stock in these stands is defective (hollow or crooked), possibly due to the poor nutrient status of the soils and a very low rate of natural disturbance (which

seems to have resulted in overmature stands), and commercially viable stands are usually separated by stands that are nearly devoid of commercial species. Forest harvesting is, therefore, highly selective; on average, 2–3 trees are felled per hectare, with an average yield of about 7 m³. The national forest plan guidelines prescribe a cut of up to 20 m³ per hectare on a 60-year cycle. Owing to the limited range of commonly used species, however, the extraction rate is only about half this maximum allowable cut.

Guyana has developed principles, policies and guidelines for improved forest management and timber harvesting practices. This is reflected in the 1997 national forest policy as well as in forest legislation, forest management guidelines and codes of practice. Among these guidelines are:

- Code of Practice for Timber Harvesting
- Guidelines for Conducting Management-level Inventory and 100%-level Inventory
- Guidelines for the Preparation of Forest Management Plans and Annual Operational Plans.

Prior to the approval of operations, large concessions (TSAs) are required to submit to the GFC a detailed management plan and annual operations plan. The latter specifies, among other things, the forest blocks to be harvested that year and the volume to be extracted. Volume is calculated based on area and felling cycle and tags are issued accordingly. Prior to the renewal of operations for the following year, harvested blocks are inspected by GFC field staff to ensure adherence to the annual operations plan.

Also stipulated in the management guidelines is the requirement that all large concessions allocate 4.5% of the total area to biodiversity conservation for the life of the concession. A number of criteria are set out for the selection and identification of this area:

- The area identified must be representative of the various vegetation types found in that concession and the area identified must represent all flora and fauna found in the concession.
- No harvesting may take place within this area once approved for biodiversity conservation.
- The GFC must conduct a reconnaissance survey to verify that the area selected is indeed

² These are areas exceeding 24 000 hectares that were previously issued as SFPs. These concessions are being regularized and some are being converted to the larger-sized category (TSAs) while others are being reduced to the smaller category (SFPs). The use of these areas is for sustainable production. The word 'conversion' therefore does not refer to land use but to a process of recategorization. These areas were not included in the figures provided for TSAs or SFPs.

representative of the vegetation type(s) found in the concession.

- The GFC must give official approval for this area to be allocated to biodiversity conservation.

A national log-tracking system was established in 1999 and is based on international best practice to ensure transparency.^a It works on the ground through the GFC's 26 forest stations, enabling a forest officer to track timber from the stump. Harvesting can therefore be monitored to ensure that the requirements established in the approval of management plans and annual operation plans are met. The system, further developed in recent years with ITTO assistance, reduces the risk of over-harvesting within a concession and helps ensure that harvesting is carried out only in those areas identified and approved by the GFC for harvesting.

The log-tracking system functions via the use of log tags which are assigned (free of charge) to operators at the annual renewal of their licences. Each operator is given a unique set of tags, which are valid only for a period determined by the GFC (two years for SFPs and one year for large concessions). Half of the tag is affixed to the stump at the time of felling and the other half, which bears the same sequence of numbers, is affixed to the produce being conveyed. All timber is tagged, including logs, lumber, piles, poles and posts.

The system is currently applied to all forestry operations in state forests and on Amerindian reservations and private properties. All timber legally originating in Guyana can therefore be traced back to the stump. A bar-code system is under development. This system of log-tagging appears to have been accepted by the industry and has increased the capability of the GFC to monitor timber transactions.

Reduced impact logging techniques are promoted by the ITTO-funded Forestry Training Centre, Inc, a subsidiary of the GFC, through demonstration forests and hands-on training. To October 2009 the Forestry Training Centre had provided training for 1036 persons from academic institutions, forest administration, NGOs, logging enterprises and communities. This figure includes 345 persons from community-level operations, largely in Indigenous communities, who received training in 2010.^b

The Iwokrama International Centre for Rainforest Conservation and Development (known as the Iwokrama forest) is responsible for the management, conservation and sustainable development of almost 372 000 hectares of tropical rainforest, which the government of Guyana allocated as a way of demonstrating that tropical forests can provide economic benefits while also conserving biodiversity. Its operation has been supported by a range of donors, including ITTO.

The GFC is coordinating a program of work on forest law enforcement and legality with the support of the Forest Products Development and Marketing Council, the Forestry Training Centre Inc., and private-sector counterparts. One of the outputs of this process has been the development of the Guyana Legality Assurance System (LAS) through a process of stakeholder consultation and participation. In June 2006, Proforest (an international firm specializing in forest legality systems) was contracted to assist in the development and field-testing of an independent, transparent and suitable timber legality verification system for Guyana's forest sector. The LAS complements other efforts towards ensuring legality, such as ongoing concession-level monitoring, the national log-tagging and tracking system, and the implementation of the Code of Practice for Timber Harvesting.

A memorandum of understanding between the Government of Guyana and the Government of Norway outlines a number of activities to be undertaken in 2009–10, including the establishment of a system for independent forest monitoring (IFM). This will build on work already under way in Guyana and will allow for the development of a mechanism for assessing illegality in the forest sector. It will cover all significant drivers of deforestation and forest degradation in Guyana and thus has direct links to a REDD+ monitoring program. The IFM is not intended to replace the LAS, ongoing dialogue with the European Union's Forest Law Enforcement, Governance and Trade initiative, or existing legality procedures/systems. Instead, it will serve as a national system of legality assessment at the broader country level, addressing relevant drivers of forest change that are linked to forest legality/illegality and providing a system that can be recognized globally. The IFM will be implemented in state forests and Amerindian villages that opt into the

country's Low Carbon Development Strategy. It will be applied to logs (roundwood, piles, poles and posts) and lumber. It will cover all stages of the chain of custody – harvesting, transportation, processing and export. The initial activity in late 2010 was to be a scoping mission. The GFC will implement recommendations over a one-year period. Thereafter, monitoring assessments will be conducted at two-year intervals (or less).

Silviculture and species selection. The default silvicultural system in use in Guyana is natural regeneration with polycyclic cuts, without post-harvest silvicultural interventions. Under the Forest Act (1953), yield is regulated by a minimum diameter limit of 34 cm, while forest management plans for WCLs and TSAs must specify the cutting cycle and yield per cutting cycle; they must also indicate species for harvesting and harvesting rules. The Forest Bill (2009) does not specify a minimum diameter limit.

There are more than 1000 tree species in Guyanese forests, more than 30 of which are marketed and exported to destinations in Asia, Europe, North America and the Caribbean (Table 4 shows five of these). *Chlorocardium rodiei* (greenheart), *Peltogyne venosa* (purpleheart), *Eperua* spp (wallaba) and *Hymenaea courbaril* (locust) are some of the species most favoured by international markets. In the Iwokrama forest, the second most abundant species after greenheart is *Dicorynia guianensis* (wamaradan, also known as Angelique in French Guiana) (K. Rodney, pers. comm., 2011).

Greenheart is resistant to attack by marine borers and is highly valued, especially as piling for wharves and for other marine applications. The 'special' category of timber, which includes greenheart, purpleheart, bulletwood, red cedar, brown silverballi and letterwood, accounted for about 35% of total log production in 2009.^b The production of piles and chainsaw lumber is not included in these figures. Other important species are *Goupia glabra* (kabukalli), *Trattinickia* spp (ulu), *Pouteria speciosa* (suya), *Aspidosperma* spp (shibadan), *Simarouba amara* (marupa), *Carapa guianensis* (crabwood) and *Catostemma commune* (baromalli).

Planted forest and trees outside the forest. About 12 000 hectares of planted forest, mainly *Pinus caribaea*, were established in the 1960s. They were originally intended to supply a pulp industry but are now maintained as permanent sample plots

under the management of the GFC.^b No new planted forests are being established.^b FAO (2010) reported that there were no planted forests in Guyana.

Forest certification. ITTO (2006) reported that two concessionaires were engaged in the process of obtaining forest-management and chain-of-custody certification under the FSC, while two more had shown an interest in pursuing certification. Currently, however, there is only one certified forest area – the Iwokrama forest (372 000 hectares, including 184 500 of production forests in the 'sustainable utilization area', FSC 2010).³ The estimated sustainable yield in Iwokrama's sustainable utilization area is about 22 000 m³ per year (Iwokrama International Centre for Rain Forest Research and Development 2009).

Estimate of the area of forest sustainably managed for production. Table 5 shows that the total size of the production PFE and the area allocated to concessions or otherwise under licence have both increased compared with 2005. Guyana is making good progress towards SFM and the log-tracking system has added transparency to the system. The Government of Guyana^b reported that "all concession harvesting activities are managed in keeping with sustainable forest management principles ... There is overall compliance with GFC principles and management practices across issued concessions. GFC has 26 field stations as well as mobile stations that monitor forest operations. Additionally, routine monitoring and environmental audits are conducted to test compliance with set principles and practices. These have overall indicated positive results and compliance." On the basis of an estimate provided by the Government of Guyana, FAO (2010) reported that the entire state forest estate (12.2 million hectares) was under sustainable management.

In 2005, two concessionaires were working towards the certification of their forests under the FSC scheme. Several companies have since had some experience with certification (K. Rodney, pers. comm., July 2010):

- Barama Co. Ltd., a wholly-owned subsidiary of Samling Global Limited with concessions

³ The Iwokrama forest was the second Guyanese forest to be certified. The Barama concession was the first, but lost its certificate following an FSC audit (K. Rodney, pers. comm., 2011).

Table 4 Commonly harvested species for industrial roundwood

Species	Notes
<i>Peltogyne venosa</i> (purpleheart)	Used mainly in high-end internal construction applications and for furniture and components.
<i>Chlorocardium rodiei</i> (greenheart)*	Used mainly for outdoor structural applications and marine works.
<i>Swartzia leiocalycina</i> (wamara)	Used mainly for furniture, and components.
<i>Mora excelsa</i> (mora)*	Used mainly for building construction, especially flooring.
<i>Goupia glabra</i> (kabukalli)	Used mainly for heavy construction, house framing, flooring and decking.

* Also listed in ITTO (2006).

Source: Government of Guyana (2009).

Table 5 Management of the production PFE ('000 hectares)

Reporting year	Natural					Planted		
	Total	Available for harvesting	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
2005*	5450	3800	3730	0	520	12	0	0
2010	11 090	6710**^a	4053^a	184.5	520	12	0	0

* As reported in ITTO (2006).

** Existing TSAs, WCLs and SFPs.

covering about 1.6 million hectares of forest (Barama 2010), had certification, but this has lapsed.

- Demerara Timbers Ltd (DTL) has a chain-of-custody certificate in compliance with a UK government standard.
- Variety Woods & Greenheart Limited has sought FSC certification but it is unclear how far it has progressed.
- Toolsie Persaud Ltd underwent a pre-assessment audit with The Forest Trust.
- Iwokrama's joint venture partner (Tigerwood Guyana Inc) has an FSC chain-of-custody certificate.

Although Iwokrama is the only operation in Guyana with an FSC forest-management certificate, the strong field presence of the GFC, moves by several companies towards certification, and the development of a trained cadre of forest operators suggests that a significant area of the Guyana's forest is being managed in a way that is consistent with sustainability. At the very least it seems unlikely that the area under such management has declined since the previous report.

Timber production and trade. Total industrial log production was 299 000 m³ in 2009, down from 474 000 m³ in 2006 and 366 000 in 2004 (ITTO 2011). About 64 000 m³ of sawnwood were

produced in 2009, an increase over the 56 000 m³ produced in 2004 and the 50 000 m³ produced in 1999. Plywood production, on the other hand, declined from 87 000 m³ in 1999 to 54 000 m³ in 2004 and to 21 000 m³ in 2009 (ibid.).

The total export value of logs, sawnwood and plywood in 2009 was US\$48.1 million, compared with US\$38.3 million in 2004 and US\$31.3 million in 1999 (ibid.). In 2009, Guyana exported 91 000 m³ of logs, 49 000 m³ of sawnwood and 17 000 m³ of plywood (ibid.).

In January 2009 the Government of Guyana introduced a national log export policy that increased the export commission rate on key species used locally in value-added production. The policy was in response to the perceived need among various stakeholders to stimulate more value-added activities in Guyana, to increase the use of lesser-used species, and to ensure that domestic downstream processors of logs receive adequate supplies of materials. The policy has three elements:

- Raise the export commission rate from 2% to 7% from January 2009, to 10% from January 2010, and to 12% in the period January–December 2011, for logs of the following species: purpleheart, *Cedrela fissilis*, *C. odorata* (red cedar), *Piratinera guianensis* (letterwood), *Manilkara bidentata* (bulletwood), *Bagassa guianensis* (cow wood), *Diploptropis purpurea*

(tatabu), kabukalli, shibadan, *Humiria balsamifera* (tauroniro), *Tabebuia serratifolia* (washiba), *Loxopterygium sagotii* (hububalli), *Dipteryx odorata* (tonka bean), *Hymenolobium flavum* (darina), greenheart and *Licaria canella* (brown silverballi).

- Raise the export commission rate from 2% to 7% in January 2009 and to 10% in the period January 2010 to December 2011 for logs of the following species: *Swartzia benthamiana* (itikiboroballi), *Ocotea rubra* (determa), wamara, *Tabebuia capitata* or *insignis* (hakia), mora, *Parahancornia fasciculata* (dukali), *Ocotea puberula* (keriti silverballi), wallaba, *Terminalia amazonica* (fukadi) and *Jacaranda copaia* (futui).
- Impose the same export commission rates as specified in the first part of the policy to the export of squares with dimensions of 20.3 cm x 20.3 cm and greater (or 8" x 8" and greater) to the following species: purpleheart, red cedar, letterwood, kabukalli, shibadan, washiba, hububalli and tonka bean.^a

Only companies holding forest concessions are permitted to export logs. The log export policy is expected to induce a reduction in the volume of wood exported in log form and as squares.

Non-timber forest products. Many NTFPs are harvested from natural forests but only a few are extracted commercially. Significant volumes of *Euterpe oleracea* (palm heart, manicole) are exported in canned form; in 2008 about 2.7 million palm hearts were harvested in Guyanan forests, up from 2.48 million in 2007.^b Nibi and kufa (rattan-like *Heteropsis flexuosa* and *Clusia* spp) are used for furniture-making and exported to the Caribbean islands, the United Kingdom and North America. Fibres of *Mauritia flexuosa* (ité palm) are used to make baskets, mats and other items for export. Other products include latex from *Manilkara bidentata* (balata), *Bixa orellana* (annatto dye) and *Carapa guianensis* (crabwood oil). Mangrove bark is

exported for tanning leather. There is a legal trade in wildlife, especially birds, reptiles and amphibians.

Forest carbon. Gibbs et al. (2007) estimated Guyana's forest carbon at 2490–3740 MtC and FAO (2010) estimated it at 1629 MtC. Since 2000, GHG emissions from deforestation are estimated to have averaged about 22.6 million tonnes of CO₂e per year (Government of Guyana 2008). In preparing its REDD+ strategy the Government of Guyana engaged with the Forest Carbon Partnership Facility and UN-REDD, and it is an active member of the REDD+ Partnership. On 9 November 2009 the governments of Guyana and Norway signed a memorandum of understanding that sets out how the two countries will “work together to provide the world with a relevant, replicable model for how REDD+ can align the development objectives of forest countries with the world's need to combat climate change”. Norway committed to providing financial support of up to US\$250 million by 2015 for results achieved by Guyana in limiting emissions from deforestation and forest degradation under its Low Carbon Development Strategy (Office of the President 2010). This strategy sets out Guyana's approach to transition to a green economy, with the stated aim of combating climate change while simultaneously promoting economic growth and development. It sets out how Guyana's economy can be realigned along a low-carbon development path by investing payments received for avoided deforestation into strategic low-carbon sectors (Government of Guyana 2011). The increase in deforestation reported in 2010 may be due partly to an expectation of tighter controls under this strategy.

Guyana has also established a National Climate Committee comprising representatives of a number of government agencies, NGOs and the private sector. This committee has a reporting responsibility to the Government and the Parliament of Guyana. The National Climate Unit within the Ministry of Agriculture is the implementing entity for the

Table 6 Forest carbon potential

Biomass forest carbon (MtC)	% forest with canopy cover >60%	Deforestation/ degradation potential to 2030	Enhancement of carbon sink capacity to 2030	Forest area change monitoring capacity	Forest/ GHG inventory capacity	Importance of forest fire/ biomass burning	Engagement in international REDD+ processes
2490–3740	89.2	+	+++	+++	++	+	+++

+++ high; ++ medium; + low; estimate of national forest carbon based on Gibbs et al. (2007); estimate of % total forest with canopy cover >60% based on UNEP-WCMC (2010).

Table 7 Management of the protection PFE ('000 hectares)

Reporting year	Protection PFE	Attributed to IUCN categories I-IV	Allocated for soil and water	With management plans	Sustainably managed
2005*	980	980	-	243	243
2010	1110	1040	-	332**	332**

* As reported in ITTO (2006).

** Comprises Conservation International's conservation concession (which, strictly speaking, is part of the production PFE but is not counted there), the protected portion of the Iwokrama forest, and Kaieteur National Park.

committee and manages and coordinates day-to-day climate-change procedures. Guyana has also established an Office for Climate Change and a REDD+ Secretariat to execute aspects of climate-related activities and REDD+. Table 6 summarizes Guyana's carbon potential.

Forest for protection

Soil and water. Forests are still intact over large areas. There are, however, threats to biodiversity and to soil and water, of which mining – particularly for gold – may be the greatest. Small-scale gold-mining takes place over a wide area; impacts include localized deforestation, the removal of topsoil and the pollution of watercourses with sediment and mercury. Trees felled by gold-miners cause blockages to rivers, sometimes resulting in downstream flooding. Guyanese soils are essentially alluvial; they are acidic, with a pH as low as 3.6, and quickly degenerate once trees are removed (Clarke 2006).

Biological diversity. Guyana's large areas of intact forest ecosystems have a very high conservation and ecological value. More than 1200 vertebrate species were counted in a 1997 inventory, including 198 mammals, 728 birds, 137 reptiles and 105 amphibians, and more than 6000 flowering plant species, of which about one hundred are forest trees of commercial interest. It is almost certain that many more species remain to be discovered. No species found in Guyana's forests are listed on the IUCN red list of threatened species (IUCN 2011). Guyana has two plant species listed in CITES Appendix I, 42 in Appendix II and one in Appendix III (UNEP-WCMC 2011). Bulletwood is protected under the Forest Act for its value to Indigenous communities and because of the limited occurrence of this species in Guyanan forests.

Protective measures in production forests. The Code of Practice for Timber Harvesting includes provisions for protecting watercourses, reducing the impact of logging on residual stands and conserving protected wildlife. Forest management plans must

identify representative biodiversity reserves covering at least 4.5% of the productive forest area that are then excluded from harvesting. The GFC's monitoring division monitors TSAs against the standards prescribed by the Code.

Extent of protected areas. Guyana has two formally established protected areas in forests (both of which are established under separate laws): the Kaieteur National Park, which is 63 000 hectares in size, and the Iwokrama forest, of which 187 500 hectares are set aside for forest conservation purposes. Under the proposed National Protected Areas System, more areas could be allocated for protection, including Shell Beach (which includes mangrove forests), Kanuku Mountains, Mount Roraima, and Orinduik Falls.⁴ In 2002 Conservation International was awarded a 30-year conservation concession of 81 000 hectares to the south of Iwokrama called the Upper Essequibo Conservation Concession.⁵ There are also eleven 'GFC reserves' covering a total area of 17 800 hectares. UNEP-WCMC (2010) estimated that there were 1.04 million hectares of forest in IUCN protected-area categories I-IV.

Estimate of the area of forest sustainably managed for protection. The estimated area of protection PFE under sustainable management is at least 331 500 hectares (Table 7). This area comprises the Kaieteur National Park, Conservation International's conservation concession, and the conservation area set aside in the Iwokrama forest. The area under sustainable management has increased since 2005, due mainly to the addition of CI's conservation concession but also to a slight amendment in the size of Iwokrama's conservation area.

4 www.guianashield.org/joomla/index.php?option=com_content&view=article&id=173:wwf-grant-agreements&catid=1:latest-news&Itemid=50 =en, accessed 9/9/09.

5 www.conservation.org/FMG/Articles/Pages/guyana_conservation_concession.aspx, accessed 9/9/09; the Upper Essequibo Conservation Concession Guyana fact sheet; seen at http://www.conservation.org/Documents/guyanaconcession_factsheet.pdf.

Socioeconomic aspects

Economic aspects. An estimated 24 100 people are employed in forest operations in Guyana and 19 800 people in the forest products industry.^b There is also considerable – but un-estimated – informal and unrecorded employment and economic activity. The total value of wood exports in 2008 was US\$56.7 million^b; the country also exported fuelwood valued at about US\$151 000 and NTFPs (not including canned palm hearts) valued at about US\$96 000.^a

Livelihood values. Forests are an integral part of Amerindian culture and are important for the supply of building materials, fibres for textiles and weaving, and tannins and dyes, as well as for wildlife, fruit, seeds and nuts that are hunted or gathered for food. Medicines are obtained from more than 130 plant species (van Andel et al. 2003). Some communities have undertaken the commercial harvesting of these resources.

Social relations. Amerindians comprise 9.1% of the Guyanese population and own 13.9% of the land. Amerindian communities are generally located in areas remote from urban centres and rely on subsistence fishing, shifting cultivation and hunting. The creation of a Ministry of Amerindian Affairs in 1992 has facilitated a more participatory role for these communities in national development. The Amerindian Act (2006), too, gives Amerindian communities legal powers to manage and conserve their lands. Ninety-six communities have titles, but another ten communities do not have formal legal title to the lands they occupy. Guyana's Low Carbon Development Strategy identified, as a priority activity, the titling of these areas.^b The Amerindian Act empowers Amerindian communities to create and enforce protected areas on their lands. A community can, for example, prohibit or control entry and access to its territory and traditional knowledge, prohibit or control mining, zone its lands, protect sacred sites, and regulate hunting, fishing, tourism and research. All Amerindian lands are owned collectively by communities (called 'villages') and administered through village councils (Anon. 2008).

Amerindian communities are afflicted by severe social and health problems, particularly in communities adjacent to gold-mining and timber concessions. The Ministry of Amerindian Affairs and the GGMC have collaborated to train a



A greenheart tree in a logging concession, Guyana.

number of rural residents as rangers to complement GGMC's monitoring efforts in mining districts. The Iwokrama forest initiative has had significant success in involving local Amerindian communities in forest management (Bakken Jensen 2005).

The GFC has managed a number of outreach, communications and extension programs with communities and Amerindian groups. It has established a community forestry program which entails the formation of community forestry organizations, which are provided with access to state forest lands and, in some cases, with equipment. Several Amerindian communities have also been provided with extension services and training in reduced impact logging. In the North Rupununi area, a community forestry project has been implemented, reduced impact logging skills transferred and other forest management services extended (Government of Guyana (2008).

When it comes into force the Forest Bill (2009) will provide communities (including but not restricted to Amerindian communities) with a means of acquiring clear and secure rights to manage and benefit from their local forests on a sustainable basis in order to help meet local needs, stimulate

income generation and economic development, and enhance environmental stability. Under the Bill, properly established community groups can apply to the GFC for community forest use agreements that would authorize the group to occupy a specified area of state forest and to manage it in accordance with the agreement.

The GFC's Community Development Unit, which sits within its Planning and Development Division, has a mandate to build capacity in forest-based communities. Community forestry is being formally undertaken on an area of about 114 000 hectares under SFPs.^a

Summary

Most of Guyana's forests are still intact, unexploited and not threatened by the expansion of agriculture. Guyana is pursuing a well-designed forest management and control system in its timber production forests. A new law, the Forest Bill, is awaiting assent by the President of Guyana. This law will provide for the sustainable management, protection and conservation of state forests and the regulation of forest operations, and it will also make considerable changes to the allocation of state forest for harvesting. The Guyana Forestry Commission appears to be well-organized and responsive and has a substantial field presence. Guyana has made progress in a number of areas, including the development of a legality assurance system and independent forest monitoring, which will not only provide a basis for international scrutiny and access to REDD+ initiatives but also enable the validation and improvement of existing forest management systems. At the forest industry level, however, significant progress is required to fully realize the SFM goal.

Key points

- Guyana has an estimated PFE of 12.2 million hectares (compared with 6.44 million hectares in 2005), comprising 11.1 million hectares of natural production forest (compared with 5.45 million hectares 2005), 1.11 million hectares of protection forest (compared with 980 000 hectares in 2005) and 12 000 hectares of planted forest (the same as reported in 2005).
- A new forest law is due to come into effect.
- Gold-mining is a significant cause of forest degradation and environmental pollution.
- At least 520 000 hectares of production PFE is being managed sustainably. Given the general lack of threats to the forest, the high-quality training available to forest operators, and positive moves by the Guyana Forestry Commission to institute improved tracking and monitoring systems, this is likely an underestimate.
- At least 332 000 hectares of protection PFE is being managed sustainably. Given the general lack of threats to Guyana's forests, this is also likely to be an underestimate.
- Wood exports make a significant contribution to Guyana's foreign-exchange earnings. A new national log export policy has been introduced with the aim of encouraging local wood-processing.
- Guyana has considerable potential for participation in a global REDD+ scheme for avoided deforestation and forest degradation.

Endnotes

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 b Personal communications with officials of the Government of Guyana, 2009, 2010.

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HONDURAS



Forest resources

Honduras, the second-largest country in Central America, has a land area of 11.2 million hectares and an estimated population in 2010 of 7.6 million people (United Nations Population Division 2010). Honduras is ranked 112th out of 182 countries in UNDP's Human Development Index (UNDP 2009). It comprises three distinct biogeographic regions. The central highlands cover about 60% of the country, with fertile valleys and steep slopes between 700 m and 1900 m above sea level, the highest peak reaching more than 2800 m. A second region is the vast northern coastal plain abutting the Caribbean Sea, which can be divided into two subregions: the central plain covered mainly by grassland, swamps, secondary palm forests and pine forests; and the northeastern plain – the Mosquito Coast (*La Mosquitia*) – which is sparsely populated and covered by pine forests, humid forests and some mangrove forests. The third biogeographic region is a narrow strip of land along the Gulf of Fonseca on the southern Pacific coast, which mainly comprises agricultural land and some remnant mangroves.

According to the most recent national forest inventory (ENF 2006), forests cover an area of 5.79 million hectares (52% of the land area), including 4.83 million hectares of assessed forests and another 960 000 hectares of unclassified forests. The Government of Honduras (2010a) estimated the total forest area at 6.66 million hectares on the basis

of a 2009 analysis. FAO (2010a) estimated the total forest area at 5.19 million hectares, which is more than the estimate reported in FAO (2006) of 4.65 million hectares.

Forest types. The central highlands and the Mosquito Coast savannas are covered by nearly two million hectares of pine and mixed forests, while about 3.5 million hectares of broadleaved forests cover much of the Caribbean coast, the Agalta mountains and the eastern lowlands (ENF 2006); these constitute the country's major closed forests. Honduras is one of the few tropical countries with large areas of natural conifer forests, which are composed of one or several of seven *Pinus* species, as well as species of the genus *Abies*. At lower altitudes (up to 700 m above sea level), *P. caribaea* (pino costanero) dominates; between 700 and 1400 m, *Pinus oocarpa* (pino ocote) occurs often in pure stands; and between 1500 m and 1900 m above sea level a mixture of pino ocote, *P. maximinoi* (pino llorón) and *P. tecumumanii* (pino rojo) constitutes the major forest layer. Above 2000 m, *P. ayacahuite*, *P. pseudostrobus* (pinabete), *P. hartwegii* (pino de montaña) and species of the genus *Abies* occur. Natural pine forests are used intensively by local communities and by industry.

Tropical broadleaved forests are found mostly in the north. The most common species are *Vochysia hondurensis*, *Virola koschnyi*, *V. sebifera*, *Luehea seemanii*, *Terminalia amazonia*, *Cordia alliodora*, *Cedrela mexicana*, *Ceiba pentandra*, *Carapa guianensis* and *Tabebuia guayacan*. The *Acrocomia* palm is common in all these forests. Mangroves are found on the Caribbean coast, notably in protected lagoon and estuarine formations; they extent over about 62 000 hectares (Spalding et al. 2010).

Permanent forest estate. Honduras defines its PFE as those forests that are included in protected areas and declared micro-watershed areas, and those areas of production forests that are covered by forest management plans.^a In all those areas, it is prohibited to change the land use from forests to other uses. As of 2009 the entire area of the production PFE and 57% of the protection PFE had been delimited on the ground.^a The PFE extends over an estimated area of 3.62 million hectares, including about 2.5 million hectares of

tropical broadleaved forests, 1.1 million hectares of conifer forests (some of them mixed with broadleaved species) and 70 000 hectares of mangrove forests (Table 1).^a The potential PFE (i.e. including forests that could be included in the PFE in the future) has been estimated at 4.68 million hectares (ENF 2006).

Forest ecosystem health

Deforestation and forest degradation.

Deforestation averaged an estimated 120 000 hectares per year between 2005 and 2010, an annual rate of 2.16% (FAO 2010b), the highest rate in the Americas. Deforestation is most prevalent in the eastern tropical broadleaved forest. In the past, deforestation was due to agro-industrial development, mainly for banana plantations. Today, demand for land by small-scale farmers is thought to be the major cause (ITTO 2006); often, such small-scale farmers ultimately sell the deforested land to larger farmers and agro-industrial owners. In recent years, people involved in illegal activities (i.e. drug-trafficking) have also acquired this sort of land.

Forest degradation is also widespread in the humid broadleaved forests, due mainly to small-scale illegal logging (Paaby Hansen & Florez 2008).

The existence of pine forests in Honduras is closely linked to repeated fire, which aids their regeneration, but frequent human-induced fires have led to their widespread degradation. The productivity and genetic quality of the pine forests have declined, mainly as a result of fire, disease and selective felling. Table 2 shows that the majority of remaining natural forest in Honduras is considered to be degraded primary forest.

Vulnerability of forests to climate change. While Honduras is largely unaffected by the earthquakes that afflict other Central American nations, it is vulnerable to hurricanes and frequent flooding along the north coast and in other regions. Climate models project an increased frequency and severity of such storms, constituting a risk to forest ecosystems and the people who depend on them. In terms of the relative number of deaths and economic losses (Harmeling 2010), Honduras was one of three countries (the other two being Bangladesh and Myanmar) most affected by extreme weather events between 1990 and 2009.

SFM policy framework

Forest tenure. With the passing of a law on the modernization of agriculture (*Ley de Modernización Agrícola, Decreto 31-92*) in 1992, some state-owned

Table 1 Permanent forest estate

Reporting year	Estimated total forest area, range (million ha)	Total closed natural forest ('000 ha)	PFE ('000 hectares)			
			Production		Protection	Total
			Natural	Planted		
2005*	5.38	3811	1590	48	1600	3238
2010	5.19–6.66	2630**	1096[‡]	48	2521[†]	3617

* As reported in ITTO (2006).

** Calculated using the ratio of forest with greater than 60% forest cover estimated by UNEP-WCMC (2010) (50.6%) and the total natural forest area as estimated by FAO (2010a).

[‡] According to Government of Honduras (2010b).

[†] Includes the declared protected areas and proposed protected areas according to ENF (2006).

Table 2 Forest condition

	PFE	Non-PFE	Total*
	'000 ha		
Area of primary forest	-	-	457**
Area of degraded primary forest	-	-	3823
Area of secondary forest	-	-	550
Area of degraded forest land	-	-	-

* Based on a total forest area of 4.8 million hectares, as per ENF (2006).

** Primary tropical broadleaved forests only. The figure for secondary forests includes young pine and broadleaved forest.

Source: ENF (2006).

forests were transferred to municipal and private ownership (ITTO 2006). Today, forest ownership may be public (*tierras nacionales*), which is under the direct administration of the forest service, municipal, community or private (Table 3).

There are still many claims for the use of forests, particularly over public lands, and large tracts of humid forest have no clear ownership status. Thus, there is still considerable uncertainty about forest tenure. An estimated 60% of forest administrators do not know exactly the areas and borders of their FMUs (ENF 2006).

The 2007 Forest Law (*Decreto 98-2007*) provides for the participation of communities in forest consultative councils and the regularization of forested lands through the demarcation of areas for protection, conservation and community management. According to a recent decree, the ownership of public lands that have been appropriated informally by communities and private landowners will be defined and given legal status, and the administration of public forest lands will be strengthened. The law's implementing regulations were finalized in early 2009. Since the law was passed, five new titles of 40 000 hectares have been granted to five communities, and four consultative councils have been established, increasing community participation in the process of drafting regulations (ITTO & RRI 2009). Indigenous property rights have not been resolved, however.

Criteria and indicators. Honduras has adopted the ITTO C&I to monitor progress towards SFM. The Forestry Action Plan (*Plan de Acción Forestal – PLANFOR*) 1996–2015 is aligned to the principles

of sustainable forest development, the conservation of ecosystems, integrated watershed management, forest utilization and industrialization, and forestry extension and research. The Government of Honduras used the ITTO C&I in its submission to ITTO for this report.^a

Forest policy and legislation. Forest Law 98 (*Ley Forestal, Areas Protegidas y Vida Silvestre*), enacted in 2007, replaced Forest Law 85 (1972). The new law addresses the conservation of national forests and introduces provisions to support the management of forests by communities, such as technical support and subsidies for tree-planting. Nevertheless, in general the legal provisions pertaining to forests remain weak and illegal activities by some actors persist as a serious hindrance to the widespread adoption of SFM.

The vision for the period 2002–2025, articulated in the national forestry policy, views the sector's contribution to economic development as follows: "Forest resources and their biodiversity are conserved and managed efficiently, increasing production and productivity of goods and services, increasing forest cover, recuperating deforested areas and generating benefits through the three main basic functions of forest – economic, social and environmental/ecological – significantly contributing to the socioeconomic development of all Honduran people and specifically supporting poverty reduction".

Local governments have increased responsibilities for forests and protected-area management under the 2007 Forest Law and the 1990 Municipalities Law (*Ley de Municipalidades* 134-90, revised

Table 3 Forest area, by tenure

Ownership category	Total area*	Of which PFE	Notes
	'000 ha		
State ownership (national, state or provincial government)*	2230	-	Including 1.2 million hectares of forest protected areas.
Other public entities (e.g. municipalities, villages)	570	-	<i>Ejidal</i> **/municipal (335 000 hectares) and communities (235 000 hectares).
Total public	2800	-	
Owned by local communities and/or Indigenous groups	160	-	Tribal and forest consultative councils.
Private owned by individuals, firms, other corporate	1840	-	Private individuals (1.83 million hectares) and enterprises (30 000 hectares).

* Based on a total forest area of 4.8 million hectares, as per ENF (2006).

** Community land.

Source: Derived from ENF (2006).

in 2010). In state forests and private forests this responsibility is limited to information and control but, in the case of *ejidales* (areas of community land), management has been entirely decentralized to municipalities, as long as the activities undertaken are embedded in a sustainable development approach (for details see Vallejo & Coronado 2006). Box 1 shows the responsibilities of municipal governments in the management of forests in the *ejidales*.

Institutions involved in forests. Three institutions have responsibilities for forests and biodiversity at the national level: the National Institute of Conservation of Forests, Protected Areas and Wildlife Development (*Instituto Nacional de Conservación y Desarrollo Forestal, Áreas Protegidas y Vida Silvestre* – ICF), which replaced many of the functions of the former State Forestry Administration (*Administración Forestal del Estado–Corporación Hondureña de Desarrollo Forestal – AFE-COHDEFOR*), the Secretariat for Natural Resources and Environment (*Secretaría de Recursos Naturales y Ambiente* – SERNA); and the Secretariat for Agriculture and Cattle Ranching (*Secretaría de Agricultura y Ganadería* – SAG).

Perhaps the most significant change in recent years is that the forest administration (i.e. the ICF) is now administratively and financially independent of the SAG. The ICF was established in 2008 by Decree No 98-2007 as a dependency of the

President’s Office and has a mandate to implement the National Policy on Conservation, Forestry, Protected Areas and Wildlife (*la Política Nacional de Conservación y Desarrollo Forestal, Áreas Protegidas y Vida Silvestre*; Article 14). It brings many previously disparate activities, roles and responsibilities into one organization, including:

- Supporting the creation and operation of community consultative boards to improve participation and transparency in the management of forest resources.
- Supporting forest management and reforestation programs through government-funded incentive programs.
- Implementing the national forest program 2010–2030, which is now a legal obligation.

The Research System for National Forests, Protected Areas and Wildlife (*Sistema de Investigación Nacional Forestal, Áreas Protegidas y Vida Silvestre*) has been created to promote applied and scientific forestry research, involving municipalities and other organizations capable of sustaining forest research. In addition, the state, through the ICF, will promote and support forest certification as an incentive for SFM and to guarantee the quality of forest products.^a

The National Forestry School (*Escuela Nacional de Ciencias Forestales*) provides technical support for the implementation of forest policy along

Box 1 Municipal government responsibilities for forest management in *ejidales*

Area	Responsibilities
Exploitation	<ul style="list-style-type: none"> • Rationalize the use and exploitation of municipal resources.
Protected areas	<ul style="list-style-type: none"> • Create municipal areas. • Provide a hearing for the procedure of including <i>ejidal</i> forest in the public forest register.
Economic resources	<ul style="list-style-type: none"> • Obtain resources and invest them in environmental protection. • Charge taxes for extracting or otherwise exploiting forest resources.
Protection	<ul style="list-style-type: none"> • Protect municipal ecosystems and the environment. • Preserve forests for water protection and preserve watersheds. • Participate in the prevention of forest fires, pests and diseases.
Administration and norms	<ul style="list-style-type: none"> • Grant permits or contracts for the establishment of forest industries. • Assist in administering forest law enforcement and governance. • Grant permits or contracts together with the forest authority, when they concur on forest exploitation.
Reforestation	<ul style="list-style-type: none"> • Promote reforestation projects. • Implement reforestation works at the sources of water supply.
Control and monitoring	<ul style="list-style-type: none"> • Supervise compliance with the norms related to waste industries. • Monitor protected areas and sources of water supply.

Source: Modified from Vallejo & Coronado (2006).

with the *Agenda Forestal Hondureña*, an organized stakeholder platform promoting SFM. About 690 people dealing with forests are employed in governmental institutions.

Status of forest management

Forest for production

Forest management plans have been mandatory in production forests for more than 15 years, based on management and silvicultural norms established in 1995–96. Before a forest management plan is prepared, the forest owner must clearly establish legal tenure (ITTO 2006). Besides directions for silviculture and harvesting, management plans should contain prescriptions covering the protection of soil, water and biodiversity and measures for the management of fire, pests and diseases.

Forest harvesting is based on a contract between the ICF and the forest owner, which also specifies the silvicultural and conservation measures of the forest management plan. Before harvesting, the owner must give a bank guarantee in favour of the ICF, which is cancelled once all silvicultural and conservation measures are complete. Incentives to promote SFM include exemption from taxes up to a certain amount if a forest owner invests in reforestation; technical assistance to prepare reforestation plans; and the provision of seeds and nursery stock.

The sustainable management of pine forests should be relatively straightforward. Honduran pine forests have a great capacity for regeneration if fire can be controlled and used effectively to accelerate re-growth and if regenerating seedlings are protected from animals. Pines are fast-growing and, if management guidelines are followed, continuous production is assured (ITTO 2006). However, in many cases the harvesting plan is the only component of the forest management plan applied. Illegal practices are still common in FMUs and there is a general problem of non-compliance with management prescriptions.^a As a result, average production has dropped to 1–2 m³ per hectare per year, much less than the 4–5 m³ per hectare per year considered feasible if sustainable silvicultural practices were to be applied.^a

There is little experience in the management of broadleaved forests in Honduras and there are few management prescriptions for SFM. A former



Pine forest area in central Honduras.

ITTO project examined the impact of intensive harvesting on lesser-used species in the broadleaved forests of northeastern Honduras and resulted in the development of new management prescriptions. Honduran broadleaved forests carry a total commercial timber volume of about 33.5 million m³, with an average stocking of 22 commercial trees per hectare (ENF 2006). The commercial stock of conifer forests is estimated at 72 million m³.

As of early 2010, management plans covered a total of 1 095 622 hectares of pine forests, most of them privately owned, and 96 000 hectares of tropical moist forests.^a In total, 903 FMUs had management plans, 97 of which were in public forests, 78 in forests under the responsibility of municipal governments and 728 in private forests.^a The total AAC in the pine forests was 1.97 million m³.^a

The extent to which management plans are being applied is unclear, however. In 2005, the Environmental Investigation Agency (EIA), an NGO, described what it believed was an “illegal logging crisis in Honduras”, in which an estimated 80% of mahogany and up to 50% of pine was being produced in violation of government regulations (EIA 2005).

Silviculture and species selection. Of 332 forest tree species inventoried in the country (ENF 2006), about 25 are used commercially in significant quantities. The two most important species by far are pino costanero and pino ocote (Table 4). Important hardwood species in the broadleaved forests, in addition to those listed in Table 4, are *Dialium guianensis* (andiroba), *Vochysia guatemalensis* (san juán), *Brosimum alicastrum* (ramón, breadnut), *Virola koschnyi* (palo de sangre), *Terminalia*

Table 4 Commonly harvested species for industrial roundwood

Species	Notes
<i>Pinus caribaea</i> (pino costanero)*	From natural pine forests and plantations.
<i>Pinus oocarpa</i> (pino ocote)*	From natural pine forests.
<i>Calophyllum brasiliense</i> (santa maria)*	Mainly for domestic use.
<i>Cordia alliodora</i> (laurel)*	From off-forest areas, village plantations and natural forests.
<i>Ceiba pentandra</i> (ceiba)*	Mainly off-forest trees are harvested.

* Also listed in ITTO (2006).

Source: Government of Honduras (2010b).

amazonica (cumbillo), *Swietenia macrophylla* (mahogany), *Carapa guianensis* (macho), *Cedrela odorata* (cedro) and *Tabebuia rosea* (apamate).

Planted forest and trees outside the forest.

Because natural pine forests are so abundant, there has been relatively little development of planted forests. Based on data from 2000, the planted forest estate is estimated at about 48 000 hectares (no more recent data were available for the preparation of this report, although there are indications that new planted forests have been established, especially on the north coast). Nearly all planted forests are privately owned and the main plantation species are native pines (up to one-third of all plantations). Species such as *Gliricidia sepium*, *Leucaena* spp, *Gmelina arborea* and eucalypt species are an essential part of agroforestry; another important planted tree is *Tectona grandis* (teak, teca).

Forest certification. Certification is supported by the ICF and promoted by the Honduran Council for Voluntary Forest Certification (CH-CFV), which is a national initiative of the FSC. However, there is little market incentive for certification. In 2010 a total area of 34 300 hectares was certified in natural broadleaved and pine forests for wood production and 76 600 hectares were certified for NTFPs (*Elaeis oleifera* and *Carapa guianensis*) (FSC 2011). An additional 3370 hectares of planted forest was certified.

Estimate of the area of forest sustainably managed for production. About 700 000 hectares of the production PFE are subject to some kind of management, a figure which includes an estimated 265 000 hectares of pine and mixed forests outside the humid forest zone (ITTO 2006). It is estimated that an area of at least 276 000 hectares of natural PFE is sustainably managed (Table 5). This comprises about 180 000 hectares of natural pine forests managed effectively by communities (of which a portion is certified)^a and the certified

forest area for the production of timber and NTFPs (see above). It also includes an area of about 45 000 hectares of tropical broadleaved forests in the upper Cangrejal River Basin, where local communities have benefited from considerable support from the international community in managing their forests.

Timber production and trade. Total annual roundwood production in 2006 was estimated at 10.8 million m³, of which about 9.9 million m³ was fuelwood (FAO 2010a). In 2009, the estimated production of industrial pine logs was 750 000 m³ (compared with 920 000 m³ in 2005 and 744 000 m³ in 2000), while the production of tropical hardwoods was 20 000 m³, compared with 15 200 m³ in 2005 and 12 000 m³ in 2000 (ITTO 2011). Total sawnwood production in 2009 was 349 000 m³ (342 000 m³ of which was coniferous), compared with 406 000 m³ in 2005 and 437 000 m³ in 2000 (ibid.).

Nearly all Honduran wood production serves the domestic market, although a small amount of pine sawnwood is exported to other countries in the region. Official production figures do not take into account timber harvested illegally. Based on data in EIA (2005), illegal production might have exceeded official production by a factor of 3–4 as recently as 2004, but few data are available on whether such illegal production has since been curbed. In 2008, a timber-tracking manual (*Manual de la Cadena de Custodia para Madera Aserrada de Bosque Latifoliado*) was introduced but, to date, it has only been applied in the Río Plátano Biosphere Reserve.^a

Non-timber forest products. Fuelwood in the form of firewood and charcoal (70% of which comes from hardwood forest species such as *Quercus* spp – roble) is the most economically important NTFP in Honduras. It is an essential energy source for many people, especially rural people. Internationally tradable NTFPs include pine resin,

Table 5 Management of the production PFE ('000 hectares)

Reporting year	Natural					Planted		
	Total	Available for harvesting	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
2005*	1590	1070	671	37	187	48	28	0
2010	1096	1096	1096	111	276	48	31	3.4

* As reported in ITTO (2006).

with an estimated production in 2008 of 14 800 barrels^a, liquidambar resin (76 barrels in 2008^a (compared with 251 barrels reported in ITTO 2006), and pine seeds for export. Also, Indigenous communities in the forests of the Mosquito Coast have been producing about of 80 000 litres of batana oil (derived from the American oil palm – *Elaeis oleifera*) for export per year for the last seven years (C. Sandoval, pers. comm., 2010), and their operations were certified recently by the FSC (FSC 2011). Besides its use as timber, *Brosimum alicastrum* also produces what is known as Mayan nut, which has been a staple food for the Maya for more than 2000 years.

Forest carbon. ENF (2006) estimated the total forest carbon stock in the living biomass at 294–402 MtC, Gibbs et al. (2007) estimated it at 852–1268 MtC, and FAO (2010a) estimated it at 330 MtC. The potential for carbon capture and storage by reducing deforestation and by restoring forests and expanding planted forests is relatively high (Table 6). Forest fires are frequent: it is estimated that more than 55 000 hectares of forests burn each year.^a Honduras has submitted a readiness idea note to the Forest Carbon Partnership Facility and is a member of the REDD+ Partnership.

Forest for protection

Soil and water. Many municipalities manage micro-watersheds declared for the protection of freshwater sources (ITTO 2006). Such micro-

watersheds are delimited in the field (generally fenced) and no activities are permitted other than for the protection of water resources. A total forest area of 544 000 hectares has been classified for the primary purpose of protecting water and water resources, of which 319 000 hectares are in the PFE.^a In addition, about 494 000 hectares have a specific role in soil protection as well as other functions (ENF 2006).

Biological diversity. The forests of Honduras are characterized by flora and fauna that are representative of both temperate and tropical America. Detailed biological inventories are not unavailable, although it is known that there are more than 700 breeding bird species and an additional 225 that are migratory (ITTO 2006). Five mammals, seven birds, six reptiles, 60 amphibians and four plants found in forests are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species (IUCN 2011). Two plant species are listed in CITES Appendix I, 171 in Appendix II and two in Appendix III (UNEP-WCMC 2011).

Protective measures in production forests. Forest management plans contain detailed prescriptions for protective purposes, such as the maintenance of unlogged strips along watercourses, reduced impact logging, logging restrictions on slopes and vulnerable areas, and specific provisions for biodiversity conservation in both pine and broadleaved forests.^a

Table 6 Forest carbon potential

Biomass forest carbon (MtC)	% forest with canopy cover >60%	Deforestation/ degradation potential to 2030	Enhancement of carbon sink capacity to 2030	Forest area change monitoring capacity	Forest/ GHG inventory capacity	Importance of forest fire/ biomass burning	Engagement in international REDD+ processes
852–1268	51	++	++	+	+	+++	+

+++ high; ++ medium; + low; estimate of national forest carbon based on Gibbs et al. (2007); estimate of % total forest with canopy cover >60% based on UNEP-WCMC (2010).

Extent of protected areas. SERNA, in partnership with The Nature Conservancy and WWF, undertook a conservation gap analysis to 2008 to better define conservation priorities. As a result, Honduras established a 12% conservation goal for the country's 59 terrestrial ecosystems. In 2009 there were 51 declared terrestrial protected areas, covering nearly all ecosystems over a total area of 1.37 million hectares. Another 21 areas covering 509 000 hectares were proposed to be added to the protected-area network in order to address deficiencies identified in the gap analysis (Paaby Hansen & Florez 2008). UNEP-WCMC (2010) estimated the forest area in IUCN categories I–IV at 976 000 hectares. The Río Plátano Biosphere Reserve in northeastern Honduras is designed to protect the largest intact lowland tropical and pine forests within Honduras and includes community-based production forest (some of which is certified). All cloud forests (*bosques nublados*) are protected in ten national parks, eight wildlife reserves and 18 biological reserves; even so, most are degraded (ITTO 2006). Honduras is part of the Mesoamerican Biological Corridor.

Estimate of the area of forest sustainably managed for protection. In 2010, management plans had been prepared for 19 protected forest areas covering a total area of about 608 000 hectares.^a Areas that are co-managed by NGOs or that receive support from the international donor community (e.g. USAID, UNDP, the Global Environment Facility and the World Bank) have approved protected-area management plans in place, including the Río Plátano Biosphere Reserve, The Tawahka Biosphere Reserve, the Patuca National Park, the El Chile Biological Reserve, the Güisayote Biological Reserve, the Cuero y Salado Wildlife Refuge, the Jeannette Kawas Park, the Wildlife Refuge and Islas de la Bahía. The Río Plátano Biosphere Reserve, which covers 439 000 hectares, is part of the largest extant area of relatively undisturbed tropical rainforest in Honduras and one of the few remaining in Central America. Management plans are being implemented in its totally protected portion and considerable efforts are being made in forest law enforcement. This area is counted here as sustainably managed (Table 7), although until recently a threat was posed by illegal loggers seeking mahogany and other valuable hardwoods (EIA 2005).

Socioeconomic aspects

Economic aspects. Forestry contributes significantly to Honduran national income, peaking at more than 10% of GDP late in the 1990s. In 2006, the sector's economic contribution was 9.9% of GDP, making forestry the fourth most important economic activity (AFE-COHDEFOR 2008). The forest sector generates nearly 68 000 direct jobs and a similar quantity of indirect jobs (*ibid.*).

Livelihood values. Honduras has high levels of poverty in both rural and urban areas. Forests constitute an important supplement to livelihoods – both in the provision of goods and services and for land. Informal harvesting and trade in a variety of forest products are important in forested areas to sustain livelihoods. Nevertheless, these issues need to be tackled to make informal forest use compatible with the objectives of SFM (ITTO 2006).

The concept of payments for ecosystem services has gained momentum in recent years, but experiences are nascent. Most focus on water resources as the principal service emanating from forests, and other services such as carbon sequestration and ecotourism warrant further exploration.

Social relations. Even though the law has made provisions for local communities to own forests, there are great difficulties in practice in protecting these forests from encroachment, timber theft and illegal hunting. For example, the La Mosquitia Biosphere Reserve and the Indigenous communities of Miskito, Pech and Garifuna are greatly threatened by unregulated colonization (ITTO 2006).

Summary

It is estimated that 80 000–100 000 hectares of mainly broadleaved forests are lost annually to the expansion of agriculture as well as to forest fire and illegal felling. Pine forests sustain the livelihoods of many communities in the highlands of Honduras. These forests, although stable in area, have declined in productivity and genetic quality. This is of concern because the forest sector, which is largely reliant on this resource, generates an estimated 68 000 direct jobs.

Management of the broadleaved natural forests in Honduras is sometimes more a matter of extracting the most valuable species than of silvicultural

Table 7 Management of the protection PFE ('000 hectares)

Reporting year	Protection PFE	Attributed to IUCN categories I-IV	Allocated for soil and water	With management plans	Sustainably managed
2005*	1600	434	352	-	-
2010	2521	434	319	608	439

* As reported in ITTO (2006).

management. Silvicultural and conservation measures described in forest management plans are often not respected and there is a risk that logged-over areas will become degraded. Illegal logging is probably widespread. More attention has been paid to protected areas in recent years but in many areas they remain vulnerable to degradation and clearing.

Key points

- Honduras has an estimated PFE of 3.62 million hectares (compared with 3.24 million hectares in 2005), comprising 1.1 million hectares of natural production forest (compared with 1.59 million hectares in 2005), 2.52 million hectares of protection forest (compared with 1.6 million hectares in 2005) and 48 000 hectares of planted forest (as in 2005).
- An estimated 276 000 hectares of the natural production PFE is under SFM, including 111 000 hectares of certified forest. An estimated 439 000 hectares of the protection PFE is under SFM.
- The broadleaved moist forest could make a larger contribution to sustainable development in Honduras if all goods and services were taken into account and illegal activities controlled.
- A new forest law has been in place since 2007. A new forestry administration assumed oversight of forest production in 2008, under the direction of the President's Office.
- Management norms for the pine forests have been formulated and are being implemented in some of these forests. Silvicultural prescriptions for the sustainable management of moist broadleaved forests also exist but the extent to which they are being applied is unclear.
- Forest tenure, particularly on public land, remains subject to dispute, and large tracts of broadleaved forests have no clear ownership status.

Endnote

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MEXICO



Forest resources

With a land area of 194.2 million hectares, Mexico is the third-largest country in Latin America after Brazil and Argentina. It had an estimated population in 2010 of 110 million people (United Nations Population Division 2010). Mexico is ranked 53rd out of 182 countries in UNDP's Human Development Index (UNDP 2009). The country is mainly mountainous, with more than half of its land area above 1000 m. The northwest of the country supports dry, open forest but tropical moist forests are found further south, where rainfall is higher. The Southern highlands are composed of a number of steep mountain ranges, deep valleys and dry plateaux, including the Chiapas highlands bordering Guatemala, which constitute an important forest zone. CONAFOR (2010) and FAO (2010a) estimated the total forest area at 64.8 million hectares, of which 31.4 million hectares are in the tropics. According to the definition of forest (adopted at a workshop held in March 2009) used in the context of climate change, there were about 85.5 million hectares of forests in Mexico in 2007, including shrub forests (*matorales*) and 'vegetation' cover in arid zones (Government of Mexico 2010a).

Forest types. Mexico's eco-climatic zones can be divided into three approximately equal areas: tropical (in the south and southeast), subtropical/temperate, and semi-arid/arid. The tropical region includes rainforests, which originally covered about 6% of the country. The major forest type in the

temperate/subtropical region is *Quercus* (oak) forest, which may be pure or mixed with other temperate-climate broadleaved species such as *Liquidambar styraciflua* (sweet gum) and *Fagus mexicana* (beech). The 'conifer and broadleaved forests' category of the national forest inventory is characterized by a few dominant species, such as *Pinus* and *Abies*, combined with various species of *Quercus*, *Cupressus* and *Juniperus*.

Tropical forests are found on slopes along the Gulf of Mexico and the Pacific Ocean, on the Isthmus of Tehuantepec and in southern Yucatán in the states of Campeche, Chiapas, Oaxaca, Quintana Roo, Tabasco and Veracruz. They can be divided into three major types: high forests (*selva alta*), with a canopy height of 30 m and above composed of a large variety of species such as *Brosimum* spp, *Bursera* spp, *Cedrela odorata*, *Dialium* spp, *Lonchocarpus* spp, *Manilkara zapota*, *Tabebuia* spp, *Terminalia* spp and *Swietenia macrophylla*; medium forests (*selva mediana*), with a canopy height of 15–30 m and species such as *Lysiloma* spp, *Bucida buceras*, *Manilkara zapota* and *Ceiba* spp; and low forests (*selva baja*) with a height of 4–15 m and species such as *Annona glabra*, *Calophyllum brasiliense* and *Eugenia* spp.

Mexico has 770 000 hectares of mangroves (Spalding et al. 2010). They occur in a considerable variety of settings and formations on both the Pacific and Atlantic coastlines and in conditions that range from arid to wet tropical.

Permanent forest estate. Mexico does not have a formally allocated PFE. The estimate of tropical production PFE shown in Table 1 for 2005 was based on data supplied by the Government of Mexico to ITTO in conjunction with a C&I workshop convened in April 2005 and the estimate of protection PFE was based on data reported by an ITTO diagnostic mission to Mexico. The estimates for 2010 are based on data supplied in Government of Mexico (2010a and 2010b).

Forest ecosystem health

Deforestation and forest degradation. Mexico suffered rapid deforestation and degradation in the period 1970–2000. For example, the estimated average annual deforestation rate in the

Table 1 Permanent forest estate

Reporting year	Estimated total forest area, range (million ha)	Total closed natural forest ('000 ha)	PFE, tropical forests only ('000 hectares)			
			Production		Protection	Total
			Natural	Planted		
2005*	64.0–65.2	33 120	7880	100	5600	13 580
2010	64.8	22 600**	8400	171[‡]	3649	12 220

* As reported in ITTO (2006).

** Calculated using the ratio of forest with greater than 60% forest cover estimated by UNEP-WCMC (2010) (35.1%) and the total natural forest area as estimated by FAO (2010a).

[‡] Tropical, including plantations for production and for protective functions.

period 1990–2000 was about 354 000 hectares (FAO 2010b). In the past decade, however, the annual rate of net forest loss has diminished, to about 155 000 hectares, although an estimated 250 000–300 000 hectares of forest were degraded between 2005 and 2010 (Government of Mexico 2010a). Uncontrolled logging (over-harvesting and/or illegal logging), forest fires, grazing in forests, forest diseases and pests, fuelwood harvesting, population pressure and shifting cultivation are the main direct causes of forest degradation.^a

Various factors have helped to reduce forest loss in recent years. These include greater government support for forestry and conservation; low prices for agricultural commodities; a general shift of people from rural areas to urban centres; and the low suitability for agriculture of most remaining forest lands. In addition, efforts are being made to address deforestation and forest degradation through an emerging REDD agenda. According to the Government of Mexico (2010b), deforestation in areas where forest management plans are being executed is significantly lower than in areas where no management plans are established, indicating that forest management may reduce deforestation. The same is true for areas within and outside federally protected areas. Table 2 shows the best available estimates of forest condition.

Vulnerability of forests to climate change.

The climate varies greatly from north to south. The varied topography results in further climatic differences between the various regions of the country. In the north, rainfall can be as low as 50 mm per year, while in the south and the central highlands there are distinct wet and dry seasons, with rainfall of up to 550 mm per month. The rainfall received in these regions is controlled largely by the North American monsoon and the position of the Intertropical Convergence Zone. Coastal areas are vulnerable to hurricanes from both the Atlantic and Pacific oceans.

Mean annual temperature has increased by 0.6 °C since 1960, a rate of around 0.13 °C per decade, with the rate of increase most rapid in the dry season (McSweeney et al. undated). Mean annual rainfall in Mexico has not shown any consistent increase or decrease since 1960. Climate models project an increase in average annual temperature in Mexico of 1.1–3 °C by 2060 and substantial increases in the frequency of days and nights that are considered 'hot' in the current climate (ibid.).

In the tropical part of Mexico, an increased frequency and intensity of tropical storms has been observed in the past 10–20 years.^a Climate models suggest that tropical hurricanes are likely to become more intense under a warmer climate as a result of higher sea surface temperatures, but there is uncertainty over changes in frequency and

Table 2 Forest condition

	PFE	Non-PFE	Total*
	'000 ha		
Area of primary forest	-	-	34 300
Area of degraded primary forest	-	-	-
Area of secondary forest	-	-	30 500
Area of degraded forest land	-	-	-

* All forests – no data available specifically for tropical forest.

Source: CONAFOR (2010).

changes to storm tracks and their interactions with other features of climate variability, such as the El Niño–Southern Oscillation (ibid.). Fire is a serious problem, particularly in the semi-arid parts of the country, and is caused mainly by agricultural and grazing activities.

SFM policy framework

Forest tenure. Tenure rights are relatively secure in Mexico, although agrarian conflicts persist in some areas.^a Article 5 of the 2003 Forest Law (see below) states that the forest resources belong to communes (*ejidos*), local communities, Indigenous peoples and Indigenous communities, private landowners or the government, depending on the location of the forest (ITTO 2006). Most of Mexico's forests (55–68%, depending on the source) are owned by 8500 communities and *ejidos* or by individuals (27–33%), with relatively few state-owned forests (Table 3).

The risk of deforestation and degradation is higher in areas with unresolved land-tenure conflicts, where illegal logging and forest fires are the most common problems (Government of Mexico 2010a, 2010b). Problems of access to some areas where conflict is high due to the presence of organized crime (sometimes drug-related) or political unrest hampers further the clarification of land rights. About 2 million hectares are disputed among Indigenous groups or between Indigenous and other communities.^b

Criteria and indicators. Mexico has a comprehensive national forest program as well as the National Strategic Forestry Plan 2025 (*Programa Estratégico Forestal* – PEF 2025). Combined, these set the framework for SFM. Mexico has developed

C&I frameworks for both its temperate forests (based on the Montreal Process framework) and its tropical forests (based on the ITTO C&I). Mexico's submission to ITTO for this report was not in the ITTO C&I reporting format.

Forest policy and legislation. As one of the main actions specified in PEF 2025, a new forest law (the General Law for Sustainable Forest Development, *Ley General de Desarrollo Forestal Sustentable* – LGDFS) was prepared in 2003 and its regulations enacted in 2005, when the incorporation of the forest sector in a broader environmental framework was formalized. The law emphasizes the importance of forest ecosystem services and their consideration in forest management.

The LGDFS establishes eight instruments: Forest Development Planning (*La Planeación del Desarrollo Forestal*); the National Forest Information System (*Sistema Nacional de Información Forestal*); the National Forest and Soil Inventory (*Inventario Nacional Forestal y de Suelos*); forest zoning; the National Forest Registry (*Registro Forestal Nacional*); official forest regulations (*Normas Oficiales Mexicanas en Materia Forestal*); the National System of Forest Management (*Sistema Nacional de Gestión Forestal*); and an annual satellite assessment of forest-cover change.

A number of special programs have been set up in the last 15 years to bring greater consistency to forest policy. Among the most important are the Forest Development Program (*Programa de Desarrollo Forestal* – PRODEFOR); the National Reforestation Program (*Programa Nacional de Reforestación*), which is designed to promote the reforestation of deforested and/or degraded areas; the Program for the Conservation and Sustainable Management of Forest Resources in Mexico

Table 3 Forest area, by tenure

Ownership category	Total*	Of which PFE	Notes
	'000 ha		
State ownership (national, state or provincial government)	2900	-	National forests and forests that have not been allocated to a non-state owner.
Other public entities (e.g. municipalities, villages)	0	-	
Total public	2900	-	
Owned by local communities and/or Indigenous groups	45 700	-	The total area is unclear and varies according to source.
Privately owned by individuals, firms, other corporate	17 000	-	The total area of privately owned forest is unclear. Plantation development also affects the area that is classified under privately owned forests.

* Includes non-tropical forests. Note that the total differs to that shown in Table 1 due to differing sources.
Source: Government of Mexico (2010b), CONAFOR (2010).

(*Programa de Conservación y Manejo Sustentable de Recursos Forestales en México*); the program for promoting and developing commercial plantations (PRODEPLAN) and, among various programs for ecosystem services, the Program for Payments for Environmental and Hydrological Services (*Programa de Pago por Servicios Ambientales e hidrológicos*) under the broader ProÁrbol program of the National Forestry Commission (*Programa de Desarrollo Forestal* – CONAFOR). These programs are geared mainly towards community development and the reduction of poverty through the restoration of natural capital.

Institutions involved in forests. Mexico is a representative, democratic and federal republic comprising 31 states and one federal district. Each state is autonomous in all internal affairs. Many of the states have considerable interest in environmental issues such as forest restoration and conservation, and several have their own secretariats for environmental and forestry issues (ITTO 2006). At the federal level, the Secretariat for Environment and Natural Resources (*Secretaría de Medio Ambiente y Recursos Naturales de México* – SEMARNAT) is the government agency responsible for natural resources, including forests. With the new forest law entering into force, SEMARNAT was assigned the task of “formulating and running the national policy for sustainable forest development, and assuring its coherence with environmental and national natural resources as well as those policies related to rural development”. This function is carried out in coordination with CONAFOR through the eight instruments established in the LGDFS.

SEMARNAT is responsible for the sectoral plan and maintains control over the formulation of forest management plans. Through its recently created 32 state offices, CONAFOR is responsible for, among other things, the implementation of PEF 2025.^b CONAFOR has the objective of developing, encouraging and driving activities associated with production, conservation and restoration in forests, as well as participating in the formulation of plans and programs and the application of SFM policy. The Federal Office for Environmental Protection (*Procuraduría Federal de Protección al Ambiente* – PROFEPA) is in charge of inspection, surveillance and sanctions within forest production areas and natural protected areas. There are also technical and capacity-building institutes such as the

National Forest and Agriculture Research Institute (*Instituto Nacional de Investigaciones Forestales y Agropecuarias*).

Other institutions that play a supportive and/or complementary role in conserving and managing Mexico's forest estate are the National Commission for Natural Protected Areas (*Comisión Nacional de Áreas Naturales Protegidas*); the National Biodiversity Commission (*Comisión Nacional para el Conocimiento y Uso de la Biodiversidad*); and the National Institute of Ecology (*Instituto Nacional de Ecología*).

NGOs play a major advocacy role on behalf of communities and are also important in information-sharing and capacity-building for collaborative forest management. Community organizations have a strong influence on the use and management of forest areas. However, communities still need to be more strongly involved in the development of forest policy if they are to become active agents in the design of solutions rather than simply receivers of subsidies (Government of Mexico 2010a).

Status of forest management

Forest for production

SEMARNAT issues authorizations to owners for forest harvesting, based on technical studies and forest management plans (*programas de manejo forestal*) as required by forest law. Three kinds of harvesting permit are available: small-scale, for areas of up to 20 hectares; medium-scale, for areas of 20–250 hectares; and commercial scale, for areas larger than 250 hectares in size (ITTO 2006). PROFEPA is responsible for the enforcement of harvesting authorization. Even though capacity for law enforcement is growing and forest law clearly establishes measures to punish unauthorized land-use change and illegal logging, insufficient human and financial resources are available to enforce laws effectively. Moreover, there are areas within the country where government personnel have limited access due to the presence of organized groups of illegal loggers and drug-traffickers (Government of Mexico 2010a).

Tropical production forests in Mexico are located in the states of Campeche and Quintana Roo, where forest management is conducted largely by *ejidos*. *Ejidos* not only harvest natural forests, they also

conduct enrichment planting and forest restoration activities on the basis of forest management plans. The total area of potentially managed tropical forests is estimated at 8.4 million hectares.^a Logging in tropical forests is carried out by forest owners and communities as well as by contractors working for timber traders or the forest industry. Forest owners must employ at least one forestry professional who is in charge of forest management, and they must also present a forest management plan and a yearly harvesting plan. Minimum cutting diameters vary by state. In Quintana Roo, for example, the minimum diameter is 55 cm for high-value species and 35 cm for other species (ITTO 2006).

The majority of forest production is carried out by *ejidos*. The extent of forest within *ejidos* varies, from around 300 hectares to nearly 450 000 hectares. An estimated 9 million hectares of closed forests (both temperate and tropical) are covered by management plans^c for the production of timber and/or NTFPs. The estimated total tropical forest area harvested annually is 750 000 hectares, distributed in 584 forest management units.

Timber harvesting in moist tropical forest involves the selective cutting of high-value tree species, in particular *Cedrela odorata* (cedro rojo) and *Swietenia macrophylla* (caoba) and 20–30 common hardwood species. Well-established silvicultural systems known as the Silvicultural Development Method (*Método de Desarrollo Silvicola*) and the Mexican Method of Forest Management (*Método Mexicano de Ordenación de Montes*) are applied in temperate and pine forests. In the Mayan zone in the state of Quintana Roo, several well-functioning FMUs are applying polycyclic forest management and some are certified (ITTO 2006). In general, however, *ejidos* find themselves in a vicious circle: income derived from forest activities is often insufficient to justify the long-term investments required to improve their operations.^b

A national forest and soils inventory involving 26 220 geo-referenced permanent plots was carried out between 2004 and 2007. About 20% of the plots were re-measured in 2008–09.

Silviculture and species selection. According to Government of Mexico (2010b), approximately 1.4% of total national timber production comes from tropical species (common and precious). Caoba and cedro rojo are the most economically important species harvested in natural forests. In some *ejidos* these two species are also used in plantations and for enrichment planting. Besides the species listed in Table 4, the following species are harvested in significant volumes: *Brosimum alicastum* (ramón), *Bucida buceras* (pucte), *Ceiba pentandra* (seiba), *Bursera simarouba* (chaka), *Dalbergia* spp (guanciban, granadillo), *Dendropanax arboreus* (sac-chaca), *Dialium guineense* (tamarindo), *Enterolobium cyclocarpum* (guanacaste), *Pseudobombax ellipticum* (amapola), *Simarouba glauca* (pasak), *Tabebuia donnell-smithii* (guayacán) and *Terminalia amazonica* (roble).^a

Planted forest and trees outside the forest. In 2006 Mexico had an estimated 170 000 hectares of planted forests in the tropics, including 88 000 hectares for timber production.^a FAO (2010a) reported a total planted forest area (tropical and temperate) of 3.20 million hectares and estimated the annual increase in the total area of planted forests country-wide in the period 2005–10 at 162 000 hectares.

The main planted species in tropical Mexico are eucalypts (*Eucalyptus urophylla*, *E. grandis* and *E. urograndis*), *Gmelina arborea* (melina), *Hevea brasiliensis* (hule, for timber production) and *Tectona grandis* (teca). The latter is becoming increasingly important, with plantations now covering about 19 000 hectares.^a Increasingly, native species are being used in new plantations.

Table 4 Commonly harvested species for industrial roundwood

Species	Notes
<i>Swietenia macrophylla</i> (caoba, kobchi)*	The most important harvested species by value; together with cedro rojo accounts for about 15% of the annual production.
<i>Cedrela odorata</i> (cedro rojo)*	Both caoba and cedro rojo are being planted due to shortage of supply.
<i>Lysiloma latisiliquum</i> ; <i>L. bahamensis</i> (tzalam)*	Known also as sabicu or wild tamarind. Wood is highly valued, especially for shipbuilding.
<i>Lonchocarpus lanceolatus</i> (machiche)*	Common wood for construction and furniture.
<i>Metopium brownei</i> (chechen, palo roso)*	Decorative species for interior use.

* Also listed in ITTO (2006).

Source: Government of Mexico (2010b).

The estimated area of cedro rojo and caoba plantations in 2010 was 25 000 hectares.^a There are about 4000 hectares of plantations of other native species, in particular *Terminalia amazonica*, *Tabebuia* spp and *Ceiba pentandra*; outside the tropics, most plantations are of pines.^a *Chamaedorea elegans* (palma camedor) is the main tree species planted for NTFPs. A national forest inventory in 1994 estimated that 10.7 million hectares of land were available in Mexico for the establishment of planted forests, although only 4–5 million hectares are suitable for that purpose (ITTO 2006).

Forest certification. As of February 2011, about 614 000 hectares of forest were certified (mostly outside the tropics, down from 750 000 in mid 2010) (FSC 2011). In December 2010 an estimated area of 98 960 hectares of forests (in both tropical and temperate areas) were in the process of certification.^b A total of 31 FMUs of natural and planted forests are FSC-certified, the great majority of them in *ejidos*. In 2006 there were six FSC-certified FMUs covering about 163 000 hectares of tropical forests in Quintana Roo, but as of December 2010 none of those certificates remained valid. The main reason for the non-renewal of certificates appears to have been financial rather than technical, particularly the high transaction costs for maintaining certification status and the lack of a sufficient price premium for certified timber and timber products. The only valid certified forests in tropical Mexico were two planted forests covering an area of about 20 600 hectares and a small area of 12 000 hectares of natural forests (FSC 2011).

Estimate of the area of forest sustainably managed for production. As most forests are either community or privately owned, the implementation of SFM requires extensive and continuous consultation with landowners. SEMARNAT estimates the total area managed sustainably in the country at 9 million hectares, while 12 million

hectares of production forests are not yet sustainably managed (Government of Mexico 2010b). Of the 8500 *ejidos*, about 2500 were conducting commercial harvesting in 2008 (ibid.). Staff at CONAFOR estimate that about 750 000 hectares of the tropical production PFE is under sustainable management.^b This is the figure used in Table 5; it includes the six formerly certified natural forests (where management has not changed significantly since certification lapsed) and semi-natural planted forests in three other *ejidos* now in the process of certification.

Timber production and trade. Total roundwood production in Mexico was estimated at more than 40 million m³ in 2008.^a There are differing estimates of tropical hardwood production. About 495 000 m³ of tropical industrial roundwood was produced in 2008 (7.3% of total industrial roundwood production), of which 37 683 m³ were of the 'noble' species cedro rojo and caoba and the remainder were of common hardwood species.^c ITTO (2011) reported a total non-coniferous tropical industrial roundwood production of 942 000 m³ in 2008.

Nearly the entire volume of industrial roundwood production is for internal consumption. The area of cedro, caoba and teak plantations is increasing to help satisfy demand for high-quality hardwoods.^a

Non-timber forest products. NTFPs play an important role in the economies of many *ejidos* in the tropical part of Mexico.^a More than 1000 species are used as NTFPs throughout Mexico, of which 70 are subject to some form of control (ITTO 2006). NTFPs include ornamental plants, resin, bamboo fibres, wax, tannin and gums, medicine, fruits, nuts, spices and honey. Natural gum (chicle natural) from *Manilkara zapota* recently became an important niche product for export, providing employment for more than 2000 people in the states of Campeche, Quintana Roo and Yucatán.^a Besides chicle, the most important

Table 5 Management of the production PFE ('000 hectares)

Reporting year	Natural (tropical forests)					Planted		
	Total	Available for harvesting	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
2005*	7880	8600	8600	163	163	100	34	0
2010	8400	8400	750	12	750**	171	84	20.6

* As reported in ITTO (2006).

** Includes semi-natural planted forests.

products from tropical regions include copal, products from different palms such as *Chamaedorea* spp (palma camedor or palmilla), *Sabal* spp (palma de sombrero), *Scheelea liebmannii* (palma real), *Byrsonima crassifolia* (fruits of nanche) and *Pimenta dioica* (pimienta gorda).

Forest carbon. According to Gibbs et al. (2007), Mexico's tropical forests contain 4360–5920 MtC in their biomass. Masera et al. (2001) estimated the total forest carbon stock of Mexican forests (temperate and tropical) at about 17.8 GtC. According to the Government of Mexico (2010a), 14% of Mexico's total GHG emissions are produced by deforestation and forest degradation, including as a result of forest fire, erosion and pests. In preparing for REDD+, Mexico has been able to build on its relative strengths, such as policy experience in community forestry and ecosystem services as well as on past investments in forest assessment and management (Government of Mexico 2010a). Mexico is engaged in the Forest Carbon Partnership Facility and is one of the recipient countries of the Forest Investment Program. It is also a leading country in the REDD+ Partnership and is engaged in UN-REDD as an observer. Mexico has a REDD working group in CONAFOR, a working group on climate change in SEMARNAT, and an inter-secretary commission on climate change to ensure the consideration of forests in the wider climate-change agenda. Table 6 indicates Mexico's forest carbon potential.

Forest for protection

Soil and water. Large parts of Mexico's forest estate are classified as water protection areas (*cuencas de amortiguamiento*), particularly in the tropical south-eastern part of the country. For example, 40% of the country's freshwater is produced in the *Selva Lacandona*, a tropical forest in the state of Chiapas.^a The Government of Mexico supports watershed protection through a system of payments for



Chicle and timber production in a certified *ejido* in Quintana Roo (left: tree of *Manilkara zapota*; right: tree of *Swietenia macrophylla*).

ecosystem and watershed services (*programa de pago por servicios ambientales e hidrológicos de ProÁrbol*). ProÁrbol produces maps that identify zones that are eligible for payments for hydrological services. No figures are available on the extent of forests set aside for mainly water and soil protection purposes.

Biological diversity. Mexico is one of the world's top ten most biologically diverse countries with regard to the number of vertebrate and vascular plant species. It has the highest diversity of reptiles of any country and is third for bird diversity and fourth for terrestrial mammals. There are more plant species in Mexico than in the United States and Canada combined. Seventy mammals, 26 birds, 54 reptiles, 196 amphibians, eight arthropods and 47 plants found in forests are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species (IUCN 2011).

Table 6 Forest carbon potential

Biomass forest carbon (MtC)	% forest with canopy cover >60%	Deforestation/ degradation potential to 2030	Enhancement of carbon sink capacity to 2030	Forest area change monitoring capacity	Forest/ GHG inventory capacity	Importance of forest fire/ biomass burning	Engagement in international REDD+ processes
4360–5920	35*	++	+++	+++	+++	+++	+++

+++ high; ++ medium; +low; estimate of national forest carbon based on Gibbs et al. (2007); estimate of % total forest with canopy cover >60% based on UNEP-WCMC (2010).

* Tropical forests only.

Mexico has listed 53 plant species in CITES Appendix I and 1439 plant species in Appendix II, including *Swietenia macrophylla* (UNEP-WCMC 2011).

Extent of protected areas. About 24.4 million hectares of tropical and temperate forests and semi-arid woodlands are officially declared as protected areas (*áreas naturales protegidas*), of which 53% (12.9 million hectares) are part of the national system of protected areas (*Sistema Nacional de Áreas Naturales Protegidas* – SINAP).^a This figure is significantly higher than that reported in ITTO (2006), of 17.9 million hectares. Discrepancies remain in the definition and number of protected areas; for example, it appears that some designated protected areas are on private land, and their protection status is unclear (ITTO 2006). In the tropical zone, 19 forested protected areas and one monument – with various designations, such as biosphere reserves, national parks, flora and fauna reserves, and monuments – are integrated in SINAP, covering a total area of about 3.015 million hectares (Box 1).^a In the temperate zone, twelve forested protected areas are part of SINAP, covering an area of 1.25 million hectares.^a

Estimate of the area of forest sustainably managed for protection. The majority of Mexico's tropical forests have protected-area status; generally,

this status is respected and laws are enforced.^a Consequently, all those protected areas in SINAP are considered in this report to be under SFM (Table 7).

Socioeconomic aspects

Economic aspects. The direct contribution of the tropical timber sector to employment could be as high as 90 000 jobs, but a considerable number of people employed in the sector work informally and are not counted in official statistics.^a The contribution of the national forest sector to GDP in 2007 was about US\$2 billion (1.5%)^a, compared with 1% in 2003 (ITTO 2006). In 2009, about 26% of the national consumption of wood products was produced domestically and the remainder (mainly cellulose and paper) was imported, valued at more than US\$5 billion (CONAFOR 2010).

Livelihood values. It is estimated that 12–13 million people live in forest areas in Mexico, about five million of whom are Indigenous. Most forest-dependent Indigenous people live in conditions of extreme poverty, with limited access to education, public services and labour (Government of Mexico 2010b). Impoverished people tend to rely on fuelwood as an energy source for cooking, which may cause forest degradation where fuelwood is scarce. In Mexico, tropical forests are nearly entirely

Box 1 Forested protected areas in tropical Mexico

Protected area	State	Area (ha)
Calakmul Biosphere Reserve	Calakmul, Campeche	723 185
Sian Ka'an Biosphere Reserve	Quintana Roo	528 148
Los Tuxtlas Biosphere Reserve	Veracruz	155 122
Montes Azules – Selva Lacandona Biosphere Reserve	Chiapas	331 200
Parque Nacional Isla Contoy	Quintana Roo	5126
Pantanos de Centla Biosphere Reserve	Tabasco	302 707
Chamela – Cuixmala Biosphere Reserve	Jalisco	13 142
La Encrucijada Biosphere Reserve	Chiapas	144 868
Yum Balam Flora and Fauna Protection Area	Quintana Roo	154 052
Arrecifes de Sian Ka'an Biosphere Reserve	Quintana Roo	34 927
Lacantún Biosphere Reserve	Chiapas	61 874
Área de Protección de Flora y Fauna Chan-Kin	Chiapas	12 185
Área de Protección de Flora y Fauna Uaymil	Quintana Roo	89 118
Ría Lagartos Biosphere Reserve	Yucatán	60 348
Ría Celestún Biosphere Reserve	Yucatán and Campeche	81 482
Los Petenes Biosphere Reserve	Campeche	282 858
Parque Nacional de Xcalak	Quintana Roo	17,949
Parque Nacional Huatulco	Oaxaca	11 891
Monumento Natural Bonampak	Chiapas	4357
Total		3 014 539

Source: www.conanp.gob.mx/que_hacemos/sinap.php.

Table 7 Management of the protection PFE ('000 hectares)

Reporting year	Protection PFE	Attributed to IUCN categories I-IV (tropical only)	Allocated for soil and water	With management plans	Sustainably managed
2005*	5600	1040	-	-	-
2010	3649**	3015	-	3015	3015

* As reported in ITTO (2006).

** Only forested protected areas classified in SINAP in tropical areas.

owned by *ejidos*, and forest management for timber and NTFPs generates a significant part of family livelihoods.^a

Social relations. Communities in Mexico are greatly involved in both forest management and conservation. There are many models for good resource management and forest enterprises, such as the PROCYMAF (*Programa de Desarrollo Forestal Comunitario*), a community forest management project.^a Generally, however, *ejidos* and communities lack the organization and funds to manage forests and woodlands effectively.^a There is also often a divergence between national interests to protect and manage forests and particular local interests. There is an ongoing conflict in tropical forests in the states of Chiapas and Oaxaca over a lack of access to land and insecurity of tenure (Government of Mexico 2010a).

Summary

The management of Mexico's forests differs greatly between the pine and oak forests in the temperate zone, the forests in semi-arid regions, and the moist tropical forests in the south. The majority of tropical forests are managed by communities. Problems that obstruct progress towards the sustainable management of closed forest areas in *ejidos* include a lack of resources and know-how for the economic use of forest resources, and discrepancies in the objectives between communities, the private sector and forest authorities. There have been considerable advances in policies that give greater recognition and rights to *ejidos* and communities. Nevertheless, land allocation and land-use change remain a key issue in Mexico's forests.

Good progress has been achieved in forest certification, although to date much of it has been outside the tropics. The government has taken steps to tackle deforestation and forest degradation through REDD+, address shortcomings in the

sector, combat illegal logging and improve fire management.

Key points

- Mexico has no formally designated PFE. Nevertheless, about 12.2 million hectares (compared with 13.6 million hectares in 2005) of tropical forest may be considered to constitute a tropical-forest PFE, comprising 8.40 million hectares of natural production forest (compared with 7.88 million hectares in 2005), 3.65 million hectares of protection forest (compared with 5.60 million hectares in 2005) and 171 000 hectares of planted forest (compared with 100 000 hectares in 2005).
- Differences in estimates of the PFE between 2005 and 2010 are most likely due to the lack of a formal PFE rather than to real change.
- Overall, the rate of deforestation has apparently slowed but is still high in some states. Over-harvesting and the illegal harvesting of forest resources are still widespread, although now less so in the tropics than in the temperate zone.
- An estimated 750 000 hectares of the tropical production PFE and the entire protection PFE is under SFM.
- Considerable efforts are under way to increase the planted-forest estate, including with local broadleaved species.
- *Ejidos*, local communities and private owners hold tenure rights to more than 90% of Mexico's forests. The area of state-owned forests is less than 5%. Nevertheless, continuing conflicts over land use and land-use change are apparently inhibiting SFM in some states, including in the tropics.
- Mexico is actively pursuing REDD+ as a major new instrument for encouraging the protection

and management of natural forests, mainly through community-based forest management.

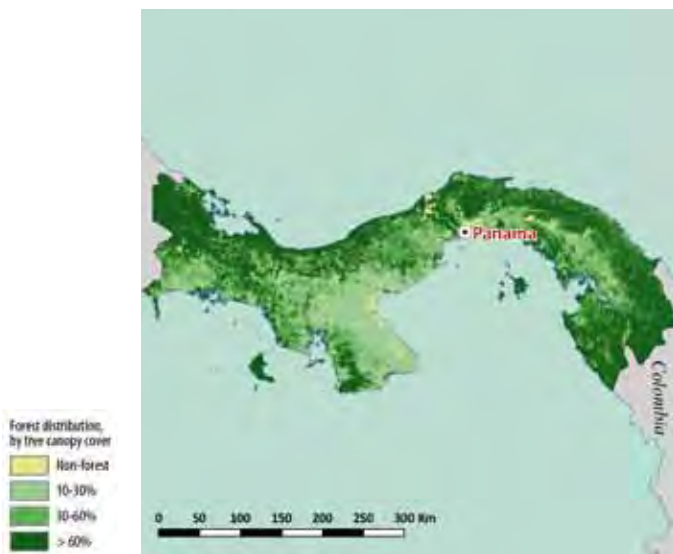
Endnotes

- a Government of Mexico (2010b).
- b Information derived from discussions held with representatives of government, civil society and the private sector at the international workshop on governance and REDD, held 30 August–3 September 2010 Oaxaca, Mexico.
- c Personal communications with officials at SEMARNAT, 2010.

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PANAMA



Forest resources

Panama has a land area of 7.48 million hectares and an estimated population in 2010 of 3.5 million people (United Nations Population Division 2010). Panama is ranked 60th out of 182 countries in UNDP's Human Development Index (UNDP 2009). It can be divided into four biogeographical zones: the Cordillera de Talamanca, which extends southwards from Costa Rica in the west, with peaks of more than 3000 m; the central lowlands, which are bisected by the Panama Canal; the largely forested eastern region (*Darién*), characterized by a series of mountain ranges (San Blas and Portobello) up to 1000 m in altitude and hilly landscapes up to 800 m; and the lowlands on the Caribbean coast. Nearly 90% of the country lies below 1000 m.

FAO (2010a) estimated the forest area at 4.29 million hectares (57% of the land area), while the Government of Panama (2009a) estimated it at 3.07 million hectares (41% of the land area).

Forest types. The prevalent forest type in Panama is deciduous tropical semi-humid forest, together with dry, moist submontane and montane forests. Stands of the tropical semi-humid deciduous forest are heterogeneous, with *Cavallinesia platanifolia* an emergent species above the forest canopy. *Anacardium excelsum* and *Hura crepitans* are among the most common species in the dominant storey. The lower storey contains various species of palms

as well as species from the Cicadaceae, Rubiaceae, Mirsinaceae, Musaceae and other families.

Panama's mangroves cover about 174 000 hectares (Spalding et al. 2010) on the Pacific coast and, to a lesser extent, on the Atlantic coast. Tropical evergreen humid forests, receiving 2500 mm rain per year or more, occur typically in low-lying and medium-altitude areas of the Atlantic coast, where they cover a considerable area. Other forest types characterized by the dominance of a few species are:

- Oak (*Quercus* spp) montane forests, which are found in the Talamanca mountains. These are sometimes fully closed, with a dominant storey of two species of oak and a few other species.
- Cativo (*Prioria copaifera*) forests, which are found alongside mixed forest stands, always in the proximity of rivers on inundated areas at low altitudes, covering about 40 000 hectares.
- Orey (*Campnosperma panamensis*) forests, which occur on poorly drained ground in the western Atlantic coastal region in Bocas del Toro Province, covering about 3500 hectares.

Permanent forest estate. According to existing land-use plans, 75% (5.6 million hectares) of the land area in Panama is suitable for forest use.^a In some areas, forests are used in shifting cultivation and for cattle-ranching with low productivity. The 1994 Forest Law (*Ley Forestal 1/94*) classifies forest into production, protection and 'special' areas; the latter includes scientific, historic, educational, tourism and recreational areas. Indigenous territories (*comarcas*¹) contain an estimated 150 000 hectares of production forest. About 140 000 hectares in the provinces of Colon, Bocas del Toro and Veraguas have not yet been harvested and may also be considered potential production forest. The Government of Panama (2009a) reported 2.3 million hectares of permanent production forests, which is an increase of nearly 300 000 hectares over that reported for 2005. The production PFE shown in Table 1 is unchanged from 2005 but the protection PFE has increased due to the classification of additional protected areas.

¹ In Panama, the *comarca indígena* is an administrative region for an area with a substantial Indigenous population. Three *comarcas* are equivalent to provinces and two smaller *comarcas* are subordinate to provinces and considered equivalent to a *coregimiento* (municipality).

Table 1 Permanent forest estate

Reporting year	Estimated total forest area range (million ha)	Total closed natural forest ('000 ha)	PFE ('000 hectares)			
			Production		Protection	Total
			Natural	Planted		
2005*	2.9–3.5	3052	350	56	1580	1986
2010	3.1–4.3	2110**	350‡	71	1880‡	2301

* As reported in ITTO (2006).

** Calculated using the ratio of forest with greater than 60% forest cover estimated by UNEP-WCMC (2010) (49.2%) and the total natural forest area as estimated by FAO (2010a).

‡ According to Government of Panama (2009a).

Forest ecosystem health

Deforestation and forest degradation. On average, Panama lost an estimated 42 000 hectares of forest per year in the 1990s (1.18% per year, FAO 2010b). ANAM (2008) estimated the deforestation rate of natural forests between 2000 and 2008 at about 27 800 hectares (0.96%) annually, significantly less than in the previous decade, and FAO (2010b) put the rate at 0.36% for the period 2005–10. The highest rate of deforestation was in Darien Province, where nearly 4400 hectares were being cleared per year, followed by Colon Province (3700 hectares), the Ngäbe Bugle *comarca* (3400 hectares) and Bocas del Toro Province (3000 hectares) (ANAM 2008). Drivers of deforestation include urbanization, cattle-ranching, agro-industrial development, unregulated shifting cultivation (*rozas*), open mining, poor logging practices, charcoal-making and fire (ITTO 2005). Table 2 shows the estimated area of degraded and secondary forests.

Vulnerability of forests to climate change.

Human-induced forest fire currently affects, on average, about 7000 hectares of forest annually.^a The main issue related to vulnerability and adaptation to climate change pertains to low-lying villages and communities that would be threatened by a rise in sea level. This is especially true for

the Kuna Yala (also known as San Blas) *comarca*, since most of its 47 communities are on low-lying coralline atolls. Some communities have already indicated a need to re-locate to the mainland.

SFM policy framework

Forest tenure. Forest ownership is divided into public, private, *comarcas* and, since 2008, a new category of Indigenous land rights known as *tierras colectivas*. The majority of the forest estate, however, is state-owned (Table 3). The 1972 Constitution recognizes *comarcas* and gives the Indigenous communities therein authority to manage their lands. In total, the *comarcas* comprise 28% of the national territory, several of which are mostly forested (e.g. Emberá Wounaan *comarca*, 90%; Kuna Yala *comarca* 86%, Government of Panama 2009b). As of 2008, the government agency responsible for legal landholding titles, *Programa Nacional de Administración de Tierras*, had legalized 102 000 land titles, but none in natural forest areas.

Criteria and indicators. The Government of Panama used the ITTO C&I in its submission to ITTO for this report.^a

Forest policy and legislation. Forests do not receive high political priority in Panama due to their low contribution to economic development.^a

Table 2 Forest condition

	PFE	Non-PFE	Total
	'000 ha		
Area of primary forest	-	-	700
Area of degraded primary forest	-	-	2000
Area of secondary forest	-	-	730
Area of degraded forest land*	-	-	900

* An estimated 2 million hectares of former forest land is thought to be heavily degraded, mainly in the Central Cordillera.

Source: Government of Panama (2009a).

Table 3 Forest area, by tenure

Ownership category	Total area	Of which PFE	Notes
	'000 ha		
State ownership (national, state or provincial government)	3955	3955	The 1994 Forest Law states that state forests include all natural forests, the soils on which those forests are located, and state lands suitable for forestry. Nevertheless, under certain conditions state forest lands can be titled (Larson 2006).
Other public entities (e.g. municipalities, villages)			
Total public	3955	3955	
Owned by local communities and/or Indigenous groups	753	753	Natural forests in <i>comarcas</i> .
Private owned by individuals, firms, other corporate	60	0	Regulations for forest management clearly recognize private property rights to forests.

Source: Government of Panama (2009a).

Under a recent amendment to Law 30 (*Ley sobre Estudios de Impacto Ambiental*, 1994), environmental impact assessment processes may be bypassed if the government determines there is a 'social interest' in doing so. In 2010 an office was created in the Ministry of the Presidency (*Ministerio de Presidencia*) called ProDar, the goal of which is to develop the Darien Gap, an area of forest separating Darien Province from Colombia. Plans that could affect forests there include the construction of a connecting road with Colombia (the 'missing link' in the Pan American Highway), the construction of an electricity transmission line to Colombia through the Emberá Wounaan *comarca*, and petroleum exploration. Mining is another development priority for the government, which could affect forests in the Cordillera de Talamanca.

In 2008 the Government of Panama published the National Forest Development Plan (*Plan Nacional de Desarrollo Forestal: Modelo Forestal Sostenible*). Key elements of that policy are the establishment of a PFE; inventories and forest management plans for production and protection forests; and environmental impact assessments for production forestry. With a change of government, however, the future of this plan is uncertain.

The main laws pertaining to forests are set out below.

- Panama's first specific forest law (Law 1/94) was passed in 1994, replacing Law 39 (1966), with the aim of conserving and managing forest resources sustainably. It emphasizes logging and reforestation and established the National Fund for Forest Development and Protection (*Fondo de Protección y Desarrollo Forestal* – FONDEFOR) to assist in forest promotion, protection, management, supervision, control

and research, and extension. By mid 2010, however, the fund was still not functioning, and all forest-related taxes were going to general revenue.^a Law 1/94 is currently being revised with a view to incorporating, among other things, forest management planning, forest certification, forest auditing, regulations for FONDEFOR, direct and indirect incentives for natural and planted forests, the demarcation of the PFE, the participation of stakeholders, and the creation of a C&I national commission.

- Law 24/1992 created incentives for reforestation and Article 43 of Law 1/94 states further that all private forest land covered by forests, either natural or planted, is exempt from national taxes, provided that the landowner is registered in the *Registro Forestal* and a certificate of ownership has been issued. Although aimed at enterprises, associations, community organizations and cooperatives, according to some commentators only commercial enterprises have benefited from the incentives so far. Problems relate to tax evasion, the over-stating of costs, and a failure to maintain plantations over time.
- The Wildlife Law (24/95) establishes that wildlife is part of the natural patrimony of Panama and provides for the protection, restoration, research, management and development of the country's genetic resources, including rare species.
- The 1998 General Law on the Environment (*Ley General de Ambiente*, 41/98) establishes the basic principles and norms for the protection, conservation and restoration of the environment and promotes the sustainable use of natural resources. It governs the administration of the

environment and integrated social and economic objectives, and recognizes the right of Indigenous communities to manage forests in the *comarcas* (Article 98).

- Decree Law No 2 (2003) approves a set of forest management guidelines for Panama.
- Law 5 (*Ley sobre Delito contra el Medio Ambiente*, 2005) sets out penalties for environmental crimes, such as illegal logging.
- The *Tierras Colectivas* Law (*Ley 72 sobre Tierras Colectivas*, 2008) establishes a procedure for the awarding of collective ownership of lands traditionally occupied by Indigenous peoples and communities that are not within the *comarcas*.

Panama is highly centralized, but this may change. The aim of Law 37 on the Decentralization of Public Administration, enacted in 2009, is “the promotion of systematic decentralization of public administration in the municipalities, to achieve sustainable development of the country through the delegation and transfer of administrative, economic, political and social competence of the Executive Body, in a gradual, progressive, orderly, regulated and responsible manner”.

Institutions involved in forests. The 1998 General Law on the Environment established the National Environment Authority (*Autoridad Nacional del Ambiente* – ANAM) as an autonomous entity. ANAM has a mandate to rule on matters of natural resources and the environment, including forests, and to ensure compliance with and the enforcement of applicable laws, regulations and national policies. ANAM develops basic principles and norms for the protection, preservation and restoration of the environment and promotes the sustainable use of natural resources, including forests. There are about 130 forest professionals in Panama, of whom approximately 50 work for ANAM.^a Within ANAM, the forest department (*Departamento de Desarrollo y Manejo Forestal*) is responsible for the implementation of the National Forest Development Plan, but it has limited capacity.

In 2008 the Aquatic Resources Authority (*Autoridad de los Recursos Acuáticos de Panamá*) assumed responsibility for mangrove forest management outside protected areas. The Authority of the Panama Canal (*Autoridad del Canal de Panamá*) has a specific mandate for the

management and conservation of forests in the vicinity of the Panama Canal.

Various NGOs are active in forest management and conservation, including the National Association for the Conservation of Nature (*Asociación Nacional para la Conservación de la Naturaleza*), the NATURA Foundation (*Fundación NATURA*) and the National Reforestation Association of Panama (*Asociación Nacional de Reforestadores de Panamá*).

Status of forest management

Forest for production

Integrated land-use planning has been applied in several provinces since 2005. In that year, the first integrated forest plan was prepared for 27 000 hectares in the Emberá-Wounaan *comarca*, with the help of WWF. Plans have also been prepared for an additional 45 000 hectares in the *comarcas*.

Forest management in natural forests is carried out by way of various types of timber-cutting licences. These include logging permits for domestic use (e.g. for housing and boat-building), special permits for subsistence (granted to poor individuals for cutting a small number of trees for personal use or for sale to commercial enterprises), five-year forest concessions for areas 1000–5000 hectares in size, and 20-year concessions for areas larger than 5000 hectares.

Logging in natural forests on private lands requires a forest inventory, a management plan and the marking of the trees to be cut. On state lands, an environmental impact assessment is also required.

The allocation of concessions larger than 5000 hectares is subject to public bidding. On sites smaller than 5000 hectares, the entity seeking the concession must publish its intentions for three consecutive days in a national newspaper so that any conflicting claims on the area in question can be addressed. If any of the area overlaps with a *comarca*, authorization by the *comarca* authority is required.

Under the Forest Law (1994), permits and concessions for logging on *comarcas* and Indigenous reserves are authorized by ANAM and by the congress of the respective *comarca*, after a study of the “scientific management plan” (Article 44). Nevertheless, virtually no incentives or special programs are available to promote or facilitate the



Twelve-year-old teak plantation on former pasture land in Panama.

management of natural forests, which encourages the high-grading of forests (mainly through cutting permits), without regard to sustainability.^b

Before 2002, 29 forest concessions were granted over 67 150 hectares; since then, no new forest concession licences have been requested or issued. Seventeen permits (covering 3400 hectares of forest) have been issued on private farms and 66 permits (covering 15 000 hectares) have been issued to communities. Six community permits have been in operation since the end of 2004, while ANAM had granted 5854 subsistence permits as of 2008.^b

As of mid 2009, forest inventories had been conducted over 127 000 hectares (including 94 500 hectares in the PFE). Seventeen forest management plans had been approved in the PFE for an area of 25 300 hectares, integrated forest/land-use management plans had been developed for about 47 000 hectares, and an additional 140 000 hectares were under consideration for further management planning.^a Nevertheless, over the majority of the

production PFE, selective logging is conducted under existing community permits, generally done without regard to forest management guidelines (ITTO 2005). Moreover, Indigenous communities have been known to sell their rights to such permits to private companies at low prices.^a

Forest management is occurring in some privately owned plantations and national parks, and in privately owned tracts of forests located mostly in eastern Panama. The Forest Law stipulates that the granting of licences for new concessions is conditional on the preparation of integrated forest management plans for SFM and independent monitoring of implementation, but few such plans have been prepared.

Silviculture and species selection. No formal silvicultural systems are applied in natural forests. The most commonly harvested tree species are shown in Table 4; 12–15 tree species are harvested and marketed to a significant extent. Species commonly harvested in the past include *Carapa guianensis* (tangare), *Prioria copaifera* (cativo), *Tabebuia rosea* (oak), *Calophyllum brasiliense* (maria), *Copaifera aromatica* (cabimo), *Dalbergia retusa* (cocobolo), *Ocotea* spp (bambito) and *Swietenia macrophylla* (caoba). Species now being considered in the market include *Miroxylum balsamum* (bálsamo), *Platymiscium pinnatum* (quirá), *Hieronyma alchorneoides* (zapatero), *Puteria* spp (platano), *Gyranthera darinensis* (cucharero) and *Astronium graveolens* (zorro). Since 1970 about 50 species have been used by rural communities for local use.^a

Planted forest and trees outside the forest. In 2009 there were about 71 000 hectares of planted forest^a, an increase of 15 000 hectares over that reported in ITTO (2006). Most are privately

Table 4 Commonly harvested species for industrial roundwood

Species	Notes
<i>Anacardium excelsum</i> (espavé)*	Important timber species over the past ten years with an annual cut of more than 5000 m ³ .
<i>Miroxylum balsamum</i> (bálsamo)*	Major timber species in the national market annual cut more than 4000 m ³ .
<i>Bombacopsis quinata</i> (cedro espino)*	Important timber species that has maintained its value for many years.
<i>Cedrela odorata</i> (cedro amargo)	Old secondary forests, annual cut nearly 2000 m ³ .
<i>Tectona grandis</i> (teca)*	From plantations, increasingly important in the national timber market; nearly 7000 m ³ per year.

* Also listed in ITTO (2006).

Source: Government of Panama (2009a).

owned.^a About 1.2 million hectares of land is potentially available for plantation development.^a Of the total planted forest estate, 59 000 hectares have been established since 1992^{a,b}, the majority by private and community landowners. While the main plantation species before 1990 was *Pinus caribaea* (pino caribe), *Tectona grandis* (teak, teca) has become the major species, with more than 47 000 hectares established since 1995.^a Combined, teca and pino caribe (11 000 hectares in 2008) account for about 82% of the planted area. Other planted species include valuable timber species such as *Cordia alliodora* (laurel, planted as a shade tree for cacao), *Bombacopsis quinata* (cedro espino), *Terminalia amazonia* (amarillo), caoba, zapatero, *Dipteryx panamensis* (almendro) and cocobolo.

Forest certification. Nine companies have valid FSC certificates covering a total area of 16 430 hectares (FSC 2011); all are for teak plantations. No natural forests have been certified.

Estimate of the area of forest sustainably managed for production. Of the 350 000 hectares of production forests, 27 000 hectares managed by the forest enterprise of five communities in Río Tupiza in the Emberá-Wounaan *comarca* can be considered as sustainably managed for timber production, as can an area of about 17 000 hectares in Río Marragantí (Table 5). Another 18 000 hectares have been inventoried in Río Tuqueza and an inventory for 10 000 hectares in Río Chucunaque is being prepared (Diaz 2009, I. Diaz, pers. comm., 2010). The total area of forest covered by management plans is about 72 000 hectares. More than 1000 small landowners manage about 60 000 hectares of planted forest (ANAM 2008), which can also be considered as well managed.

Timber production and trade. Total roundwood production in 2005 was estimated at 1.54 million m³, the majority of which was for fuelwood (FAO 2010a). Official industrial log production was estimated at 42 000 m³ in 2009, down from

78 000 m³ in 2005 (ITTO 2011), but there is also considerable production that is not officially registered.^b

Sawnwood production in 2009 was estimated at only 9000 m³, down from about 30 000 m³ in 2005 (ITTO 2011). The production of veneer and plywood was negligible (*ibid.*). Total installed sawmill capacity is unknown^a, although it has been estimated at 200 000 m³ (ITTO 2006). The primary processing industry is very small. There are about 250 small secondary processing units using antiquated equipment located in the periphery of Panama City and in the central provinces.^a

Panama exported about 7000 m³ of tropical hardwood logs in 2009, down from about 37 000 m³ in 2008 and nearly 80 000 m³ in 2004. The main exported timber is a planted species, teca, but a significant quantity of balsamo is also exported.

Non-timber forest products. Numerous wildlife species provide important sources of protein in Indigenous territories, including *Agouti paca* (conejo pintado), *saino* and *venado*. Many plants are collected for medicinal purposes. Handicraft products are important, such as the palm fruit *Phytelephas seemannii* (tagua, known as vegetable ivory) and more than 70 species producing fibres such as *Astrocaryum* spp (chunga, used for baskets), *Socratea durissima* (jira) and, in particular, *Carludovica palmata* (the Panama-hat palm). The wood of *Dalbergia retusa* is also the main raw material for wooden handicrafts. Poles and the leaves of the palms *Cryosophila guagara* and *Sabal mauritiformis* (guágara) and various species of bamboo are used for local construction. Fruits and nuts from forest trees are collected for local use and sale, including *Borojoa patinoi* (borojó), a fruit with aphrodisiac properties, the fruit of *Quararibea cordata*, which was introduced from Colombia, and the oil of *Jessenia bataua* (aceite de trupa, an alternative to palm oil). The key cultural plant for both the Kuna and the Embera is *Genipa*

Table 5 Management of the production PFE ('000 hectares)

Reporting year	Natural					Planted		
	Total	Available for harvesting	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
2005*	350	86	63	0	0	56	32	12
2010	350	86**	72	0	44	71	47	16

* As reported in ITTO (2006).

** Comprising forests under concession or private and community permits.

americana, which is used for body-painting (C. Potvin, pers. comm., 2010).

Forest carbon. According to Government of Panama (2009b), forests and other wooded land stock 1250 million tonnes of carbon in the five carbon pools (above and below-ground living biomass, dead wood, litter, and soil organic carbon), of which 620 million tonnes are in living forest biomass. Gibbs et al. (2007) estimated the forest biomass carbon stock at 509–763 MtC and FAO (2010a) estimated it at 367 MtC.

Panama was one of the first countries to prepare a REDD+ readiness plan for the Forest Carbon Partnership Facility. Panama is participating in UN-REDD and is a member of the REDD+ Partnership. Panama’s engagement in global REDD negotiations was high to early 2010, but it is unclear how the new government will position itself. Panama has also submitted five reforestation projects to the CDM.

A good proportion of Panama’s forests are intact, and there is considerable potential to enhance carbon stocks through forest restoration and reforestation (Government of Panama 2009b; Table 6).

Forest for protection

Soil and water. Forests managed principally to protect soil and water cover about 156 000 hectares.^a An estimated 406 500 hectares are classified under the National System of Protected Areas of Panama (*Sistema Nacional de Áreas Protegidas de Panamá* – SINAP) as protection forests.^a Most of this forest is situated in the watershed of the Panama Canal, which covers an area of 518 000 hectares (ITTO 2005); forests have the important function of protecting the Canal from siltation and ensuring an adequate supply of water for the locks. The Ministry of Health, supported by ANAM, has a program of forest restoration and reforestation in small watersheds that serve as water sources for rural communities and municipalities, supporting 200 tree nurseries.^a

Biological diversity. Panama is very biodiverse for its size, with more than 10 400 species of vascular plants, 259 mammal species, 957 bird species, 229 reptile species and 179 amphibian species, and 1059 plant species are endemic.^a Eleven mammals, 16 birds, 50 amphibians, one insect and eleven plants found in forests are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species (IUCN 2011). Four plant species are listed in CITES Appendix I, 462 species – mainly from the families Orchidaceae, Cactaceae and Zamiaceae, but also the tree species *Swietenia macrophylla*, *S. humilis*, *Guaiacum officinale* and *G. sanctum* – are listed in Appendix II, and three are listed in Appendix III (UNEP-WCMC 2011).

Protective measures in production forests. No protective measures are applied in the production PFE beyond some general measures described in the Forest Law. However, in those areas where integrated forest management plans are being implemented, high standards of soil and water protection are being applied.^a

Extent of protected areas. Currently 34% of the total land area of Panama is classified as under protection. The legal basis for this is Resolution JD-022-92, which defines the SINAP, and the 1998 General Law on the Environment. SINAP (which includes the production PFE) covers more than 2.95 million hectares, of which 2.69 million hectares are terrestrial and 1.88 million hectares are forested.^a The smallest protected area is 290 hectares in size, the largest greater than 0.5 million hectares.^a Protected areas (not including the production PFE) are distributed according to the following management categories (not all of which are forested):

- Seventeen national parks with a total area of 1.3 million hectares, of which 1.08 million hectares are forested (IUCN category II).

Table 6 Forest carbon potential

Biomass forest carbon (MtC)	% forest with canopy cover >60%	Deforestation/ degradation potential to 2030	Enhancement of carbon sink capacity to 2030	Forest area change monitoring capacity	Forest/ GHG inventory capacity	Importance of forest fire/ biomass burning	Engagement in international REDD+ processes
509–763	49	++	++	++	+	+	++

+++ high; ++ medium; + low; estimate of national forest carbon based on Gibbs et al. (2007); estimate of % total forest with canopy cover >60% based on UNEP-WCMC (2010).

- Three natural monuments totaling 5700 hectares (IUCN category III).
- Five forest wildlife sanctuaries (136 000 hectares), six (partly forested) wetlands (192 000 hectares) and two protected landscapes (13 000 hectares), all corresponding to IUCN category V.

There are also 20 areas covering a total of 580 000 hectares in hydrological reserves, natural recreational areas, biological corridors, multiple-use areas and municipal protected areas not classified into IUCN categories.^a

The Darien National Park encompasses nearly 59% of the total forested protected area. Twenty-four of the 65 protected areas in SINAP are reported to be interconnected.^a

Estimate of the area of forest sustainably managed for protection. An estimated 722 000 hectares of forests in the protection PFE are covered by administrative instruments (ITTO 2005) and benefit from some form of management.^a Simple management plans exist for 29 protected forested areas, covering about 368 000 hectares, although these are generally not implemented due to a lack of financial resources and personnel.^a Oestreicher et al. (2009) concluded, however, that a great majority of Panama's forests in protected areas has been protected effectively by applying a balance of strong surveillance and enforcement measures and stakeholder participation to find protection strategies that generate alternative livelihood options and economic benefits from conservation for local communities. The core protected forest area in the watershed of the Panama Canal/Chagres National Park (about 180 000 hectares) is generally considered well managed.^b About 108 000 hectares of forested protected areas are physically demarcated.^a These areas, together with the core forest zone of the Panama Canal/Chagres National Park and the high mountain cloud forest area of the La Amistad International Park/Bocas del Toro



A member of the Kuna Yala community, Panama.

(which stretches across the border between Panama and Costa Rica and covers about 80 000 hectares) comprise the estimate of the protection PFE considered to be under SFM shown in Table 7.

Socioeconomic aspects

Economic aspects. The contribution of the forest sector to GDP was a low US\$510 million in 2008 (about 0.3% of GDP).^a The sector makes an important contribution locally, however, particularly in Indigenous communities. The National Forest Development Plan estimated the potential value of forest services at US\$3180 per hectare, of which US\$782 is the estimated carbon value. The forest sector employs about 10 600 people, many of them working in forest plantation development. An additional 2000 people are employed in processing units such as sawmills and timber workshops.^a

Table 7 Management of the protection PFE ('000 hectares)

Reporting year	Protection PFE	Attributed to IUCN categories I-IV	Allocated for soil and water	With management plans	Sustainably managed
2005*	1580	1040	326	396	180
2010	1880	850**	406‡	396	368

* As reported in ITTO (2006).

** According to UNEP-WCMC (2010). The Government of Panama (2009a) estimated 1.1 million hectares.

‡ 156 000 hectares are allocated strictly for watershed protection; 406 000 hectares are considered protection forests in more general terms.

Livelihood values. Forty-four per cent of Panama's population lives in rural areas. Most of these people are classified as either poor or extremely poor (Larson 2006). Forests are generally considered a common good and there is little awareness among stakeholders – local communities, settlers invading forest areas from other regions, and commercial logging operators – of sustainable management practices. ANAM gives special consideration to the *comarcas*, where community forest concessions can contribute to the livelihoods of local communities. Such an approach has been tested through an ITTO project in the Kuna Yala communities on the Atlantic coast, with limited success.

Social relations. Indigenous peoples comprise 10% of the Panamanian population. The seven major Indigenous groups – Ngabes (60% of the total Indigenous population), Kunas (21%), Emberá, Buglé/Bokata, Wounaan, Nasos and Bri-Bri (Moreno 2005) – (headed by a total of eleven traditional authorities) are represented in an apex body, the *Organisation Coordinadora Nacional de los Pueblos Indígenas de Panamá*, which acts as a united body in Indigenous matters (C. Potvin, pers. comm., 2010). There is constant migration between *comarcas* and *tierra colectivas* and urban centres for schooling and employment (ibid.).

Summary

The management of Panama's PFE remains problematic. Some pilot efforts have been initiated and increased attention has been paid recently to the preparation of inventories and forest management plans, but small-scale subsistence logging is still being carried out with little oversight and makes a significant contribution to continuing forest degradation. Forest plantations are continuously being developed, mainly on private properties, and are the main driver of forest development. The wood-processing industry is in a poor state, with antiquated equipment and an under-supply of legally produced timber. Large areas of forest are classified as protected, but a relatively small area of these is considered to be under SFM. Forest management appears strongest near the Panama Canal, indicating the importance of forests for watershed protection, while increased efforts are being undertaken to improve the management of production and protection forests in the *comarcas*.

Key points

- Panama has an estimated PFE of 2.30 million hectares (compared with 1.99 million hectares in 2005), comprising 350 000 hectares of natural production forest (the same as estimated for 2005), 1.88 million hectares of protection forest (compared with 1.58 million hectares in 2005) and 71 000 hectares of planted forest (compared with 56 000 hectares in 2005).
- An estimated 44 000 hectares of the production PFE is under SFM. No forest is certified. An estimated 368 000 hectares of the protection PFE is under SFM.
- The forest law recognizes the rights of Indigenous communities to manage forests in Indigenous reserves (*comarcas*).
- Until recently, at least, the Government of Panama has been fully engaged in REDD negotiations and initiatives. The new government has placed an emphasis on development, including through the economic development of Darien.
- ANAM has insufficient human and financial resources to carry out the field-level monitoring and control of forest operations necessary to ensure adherence to forest-related laws and regulations.
- The private sector and civil society have been involved only minimally in the preparation of SFM policies and strategies. REDD-readiness planning and ANAM's new forest strategy may lead to a more inclusive role for all stakeholders in forest-based development.
- There is a lack of information on the state of the forests and silviculture in the country's natural forests and an apparent lack of research and training capacity.
- Illegal logging is widespread in the humid forests, even in protected areas, and remains a significant impediment to SFM.

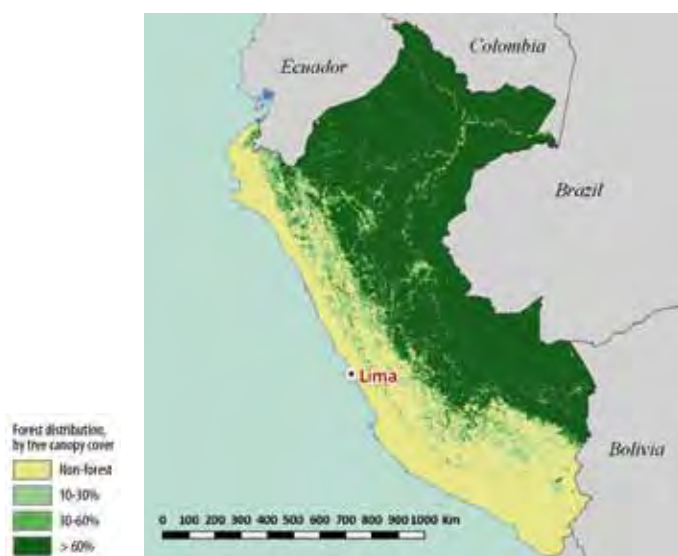
Endnotes

- a Government of Panama (2009a).
- b Information derived from the report of, and discussions with participants at, a training workshop on ITTO criteria and indicators, held 29 March–2 April 2004, Panama City, Panama, attended by 42 people from government, civil society and the private sector.

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PERU



Forest resources

Peru has a land area of 129 million hectares and an estimated population in 2010 of 28 million people (United Nations Population Division 2010). It is ranked 78th out of 182 countries in UNDP's Human Development Index (UNDP 2009).

Peru has three broad ecoregions: the desert coastal region, which covers 13.6 million hectares; the semi-arid Andean mountain range (*sierra*), which covers 39.2 million hectares; and the Amazon Basin, including the eastern humid slopes of the Andes, covering 75.7 million hectares. FAO (2010a) estimated Peru's forest cover at 67.9 million hectares, which is 53% of the total land area; 92% of these forests are in the Amazon Basin. Other estimates of forest area include 71.3 million hectares^a and 72 million hectares (Government of Peru 2010).

Forest types. The main forest type in Peru is humid forest (rainforest) in the Amazon. It covers about 57 million hectares, with sub-types that depend on altitude and soils, particularly their position in relation to rivers. Terrace and hill forests – on rolling terrain with moderate slopes – are the most widespread humid forest sub-type, covering about 37 million hectares. The alluvial forests, including those on the lower river terraces, offer some of the best potential for integrated forest management and agroforestry because of their vigorous growth, flat terrain and good accessibility; their upper stories

are generally 35–40 m in height. These forests have been used intensively in the past, leaving large expanses of secondary forest (*purma*) dominated by stands of fast-growing, light-demanding pioneer species.

There are about 11.2 million hectares of arid and semi-arid forests on the coast and semi-humid forests in mountain and inner-mountain valleys.^a Peru has about 5300 hectares of mangroves at Tumbes, in the extreme north bordering Ecuador (Spalding et al. 2010).

Permanent forest estate. Under the 2000 Forest Law (*Ley 27308/2000*), the forest is classified into the following categories: production forests (permanent and in reserve); forests on protection land; forests for future use (forest plantations, secondary forests and degraded forests for restoration); natural protected areas; forests in Indigenous and rural communities; and local forests. Permanent production forests are intended for timber and non-timber production and the conservation of forest resources, and an approved forest management plan is required. As of 2010, 33.3 million hectares of permanent production forests had been classified within the PFE.^a However, only an area of 18.7 million hectares has so far been allocated for production purposes (Kometter 2010), and this figure is used in Table 1 for the production PFE. The area of protection forest is about 19.4 million hectares, including forests designated in the national protected-area system, privately protected areas, and regional protected areas (*áreas de conservación regionales*).^a About 15.4 million hectares of forests are unallocated. The total planted forest is estimated at 820 000 hectares^a, nearly 600 000 hectares of which are for timber and fuelwood production and the remainder are for protection.^a The map in Box 1 shows Peru's production forests.

Forest ecosystem health

Deforestation and forest degradation. The estimated average annual rate of forest change in Peru in the period 1990–2000 was 269 000 hectares, or 0.4%; between 2000 and 2010 it was 94 000 hectares (0.1%) (FAO 2010b). Direct causes of deforestation include the development

Box 1 Permanent production forests, Peru



Note: Inserted as supplied, in original language.

Source: Government of Peru.

of new infrastructure such as highways (e.g. *carretera* Iquitos–Nauta, the Brasil–Peru Inter-ocean Highway and *carretera* Pucallpa–Lima); new settlements in the Amazon Basin, including the expansion of urban centres; the expansion of the agricultural frontier, including for cash crops and shifting cultivation; the expansion of oil exploitation and hydro-electric schemes; mining in the southern part of the Peruvian Amazon; illegal logging; and the illicit cultivation of coca (Government of Peru 2010). Indirect causes of deforestation include migration to the

Amazon region; agricultural policies favouring cash-crop development; development policies that favour energy generation; and new investment opportunities due to globalization (ibid.). About one-third of the forest estate is degraded or secondary (Table 2).

Vulnerability of forests to climate change. Peru is highly vulnerable to climate change, having low-lying coastal areas; arid and semi-arid areas, forested areas and areas liable to forest decay; areas prone to natural disasters; areas liable to drought and desertification; areas of high urban atmospheric pollution; areas with fragile ecosystems, including mountainous ecosystems; and an economy that is highly dependent on income generated from the production, processing, export and/or on consumption of fossil fuels and associated energy-intensive products.

Peru has 70% of the world's tropical glaciers, many of which are retreating at a rapid rate (there has been a decrease of 30% of glacial mass in 40 years; Government of Peru 2008). A prolonged glacial melt will exacerbate water shortages, mainly in the drier areas of the country.

Peru is strongly affected by hydro-meteorological phenomena associated with el Niño. An estimated 72% of registered emergencies (e.g. droughts, heavy rains, floods, frosts, hailstorms, avalanches and landslides) are related to these phenomena, which increased more than six-fold between 1997 and 2006. Climate models project that el Niño will intensify in coming decades.

According to the Government of Peru (2008), there was a mean increase in temperature in the 20th century of 0.31 °C and climate models project that there will be a minimum increase in mean temperature of 2.6 °C in the next 50 years. Almost the entire agricultural sector is suffering from

Table 1 Permanent forest estate

Reporting year	Estimated total forest area, range (million ha)	Total closed natural forest ('000 ha)	PFE ('000 hectares)			
			Production		Protection	Total
			Natural	Planted		
2005*	65.2–86.4	64 204	24 600	200–300	16 300	41 150
2010	67.9–72.0	55 990**	18 700†	820†	19 400	38 920

* As reported in ITTO (2006).

** Calculated using the ratio of forest with greater than 60% forest cover estimated by UNEP-WCMC (2010) (81%) and the total natural forest area as estimated by FAO (2010).

† Includes only state production forests for timber use.

† Comprises 580 000 hectares of production plantation, 240 000 hectares of plantations for protective purposes.

Table 2 Forest condition

	PFE	Non-PFE	Total
	'000 ha		
Area of primary forest	30 300	10 400	40 700
Area of degraded primary forest	5600	7100	12 700
Area of secondary forest	1200	4500	5700
Area of degraded forest land	-	-	-

Source: Derived from Government of Peru (2010).

increasing water stress due to melting glaciers and changing precipitation patterns. The productivity of especially small-scale agricultural production systems is under threat, particularly in mountainous regions, jeopardizing the income of smallholder families.

Through a supreme decree, the Government of Peru recently established the National Commission for Climate Change (*Comisión Nacional de Cambio Climático*) led by the Ministry of Environment (*Ministerio del Ambiente – MINAM*) comprising representatives of government agencies, NGOs and the private sector. The 2003 Climate Change National Strategy is being updated. Forests and trees play an important role in Peru's climate-change adaptation strategy. However, adaptation and mitigation strategies remain separate, and forest activities are considered to deal with mitigation rather than adaptation.

SFM policy framework

Forest tenure. Table 3 shows Peru's forest area by tenure. Forest lands are classified as public forests, Indigenous forests or private forests. Communities own an estimated 12.6 million hectares of the country's forests (ITTO & RRI 2009), and nearly 1200 Indigenous communities possess land

rights in the Peruvian Amazon. However, there is uncertainty over this ownership.^a

Criteria and indicators. Peru has developed standards for forest management. It has adopted national C&I based on the Tarapoto Process, and concession management plans are based on these. The Government of Peru used the ITTO C&I in its submission to ITTO for this report.^a

Forest policy and legislation. The revised national forest strategy prepared in 2002 was officially adopted by the Peruvian government in August 2004 (in *Decreto Supremo 031-2004-AG*) (ITTO 2006). It is implemented through the Forestry and Wildlife Law (*Ley Forestal y de Fauna Silvestre – Ley 27308*), which was adopted in 2000. The law prescribes several options for SFM and reforestation, including 40-year concessions for commercial timber, NTFPs, ecotourism and environmental services (Article 10); the sustainable management of forests belonging to Indigenous communities (Article 12); the sustainable management of local forests by local governments and rural populations (Decree 014/2001); and the establishment of 40-year reforestation concessions (Article 28) (ITTO 2006).

As a consequence of the ratification of the United States–Peru Trade Promotion Agreement, in 2007

Table 3 Forest area, by tenure

Ownership category	Total area*	Of which PFE	Notes
	'000 ha		
State ownership (national, state or provincial government)	54 500**	39 300	PFE: publicly administrated forests, including forest concessions for timber and Brazil nut, state reforestation and protected areas. ^a
Other public entities (e.g. municipalities, villages)		2900	Forests reserved for communities and Indigenous groups (ITTO & RRI 2009).
Owned by local communities and/or Indigenous groups	13 200	13 200	<i>Tierras de comunidades indígenas</i> (ITTO & RRI 2009).
Private owned by individuals, firms, other corporate	1950	1650	Industrial owners and smallholders combined. ^a (ITTO & RRI 2009 gave a figure of 5.2 million hectares.)

* Note that the total is in the range given in Table 1.

** Includes 15.2 million hectares of forests that are not yet classified.

the Government of Peru embarked on a process to reform the forest policy and law as well as to restructure and decentralize the system of forest administration and governance. This was done on a fast track through a series of supreme decrees, including the issuance of a new forest law. However, the outcome was highly controversial and led to a prolonged period of (at times violent) protest by civil society and Indigenous people. Ultimately it led to the rescinding of the forest law and other related decrees and to the formation of a national roundtable for dialogue and reconciliation.

The approval of transference of responsibilities from the National Institute of Natural Resources (*Instituto Nacional de Recursos Naturales* – INRENA, the former forest service) to regional governments for forest-sector administration and governance was enacted by Supreme Decree No 011-2007-AG. Decentralization focuses on four key faculties: administration; control; monitoring; and promotion. The process of decentralizing facilities to regional governments has been slow and problematic, and the transfer of funding and resources is proving to be a major obstacle.

Based on the extended reform dialogue since 2007, a process to completely review the forest law and forest policy was launched in 2009 through the creation of a multi-stakeholder platform to advance the reform process in a participative and transparent way. The proposed new law emphasizes issues relating to the governance of forest resources and SFM and particularly refers to participatory forest management and the need to apply the principle of free, prior and informed consent to the management and conservation of forest resources. The draft law proposes the creation of the National Forest and Wildlife Service (*Servicio Nacional Forestal y de Fauna Silvestre* – SERFOR) under the Ministry of Agriculture as the national forest authority. It further recognizes regional governments as the regional forest authorities following the prescriptions of Article 51 of the Organic Law on Regional Governments (*Ley Orgánica de Gobiernos Regionales*).

The National Forest Conservation Program for Climate-Change Mitigation (*Programa Nacional de Conservación de Bosques para la Mitigación del Cambio Climático*) was launched in July 2010 and is considered to be the country's major forest development plan. The project Conserving Community Forests (*Conservando Bosques*

Comunitarios) is the Program's first intervention, aiming to generate direct financial transfers to Indigenous communities that contribute to forest conservation.

Institutions involved in forests. Restructuring and decentralization processes are ongoing in the administration of forests in Peru and there have been rapid and sometimes chaotic changes (Kometter 2010). The first steps were taken in 2007 with the dismantling of INRENA and the redistribution of its forest administration and governance functions to the Ministry of Agriculture (*Ministerio de Agricultura* – MINAG), the newly created MINAM, and the Agency for the Supervision of Forest Resources and Wildlife (*Organismo Supervisor de Recursos Forestales y del Fauna Silvestre* – OSINFOR). OSINFOR was created in June 2008 under the Presidency of the Council of Ministers (*Presidencia del Consejo de Ministros*) and oversees forest-related taxation, the sustainable management of forest goods and services and forest conservation. Within MINAG, a new General Directorate of Forests and Wildlife (*Dirección General de Flora y Fauna Silvestre* – DGFFS) was created in 2008. However, for most of the period since its creation the DGFFS has operated with a very limited budget and few staff. In mid 2010, based on the proposals made in the draft forest law, SERFOR was made operational under MINAG, with particular functions in a new system of decentralized forest management under the regional authorities for forests and wildlife (Government of Peru 2010). The National Service for Protected Areas (*Servicio Nacional de Áreas Naturales Protegidas* – SERNANP) under MINAM manages the National System of Public Protected Areas (*Sistema Nacional de Áreas Naturales Protegidas por el Estado* – SINANPE). MINAM is also responsible for the development of REDD+ in Peru.

Indigenous peoples' associations have an increasing influence on the development of forest policies in Peru. The Inter-ethnic Association for Development of the Peruvian Jungle (*Asociación Interétnica de Desarrollo de la Selva Peruana*) and the National Institute for the Management of Andean, Amazonian and Afro-Peruvian Settlements (*Instituto Nacional de Desarrollo de Pueblos Andinos, Amazónicos y Afroperuanos*), which deals with the protection of the interests and cultural heritages of Indigenous peoples in Peru as well as territorial reform, are both strongly involved in forest issues.

Box 2 Active forest concessions by administrative region (December 2009)

Region	Number of concessions	Total area (ha)	Average area (ha)
Huánuco	48	284 342	5923
Loreto	250	2 644 756	10 579
Madre de Dios	85	1 267 111	14 907
San Martín	34	494 668	14 549
Ucayali	171	2 871 925	16 794
Total	588	7 562 802	12 861

Source: Based on Kometter (2010).

The National Strategic Planning Centre (*Centro Nacional de Planeamiento Estratégico*) also plays a role on questions relating to forest-tenure allocation and forest use.

National development institutions such as the Peruvian Amazon Research Institute (*Instituto de Investigación de la Amazonía Peruana*) continue to play important roles in the promotion of SFM at the local level. National and international NGOs are very active in Peruvian forestry and are influential in the development of policy. For example, WWF Peru, *Foro Ecológico*, Conservation International Peru, ProNaturaleza (*Fundación Peruana para la Conservación de la Naturaleza*) and *Red Ambiental* are important in driving forest conservation and the forest concession reform process. Various private-sector organizations are also involved, the most active being the National Forestry Chamber (*Cámara Forestal Nacional*), the National Timber Corporation (*Corporación Nacional de la Madera del Perú*) and regional forest producer associations, in particular those of Madre de Dios and Ucayali. The University Agraria La Molina has a strong forestry faculty that is actively involved in SFM research and serves in an advisory capacity to MINAG regarding CITES listings of timber species.

Status of forest management

Forest for production

Details on the allocation of forest concessions in Peru given in ITTO (2006) were still valid in 2010. As of the end of 2009, 588 forest concessions had been registered in the Huánuco, Loreto, Madre de Dios, San Martín and Ucayali regions of Peru over a total area of 7.56 million hectares (Kometter 2010; Box 2). Five hundred forest concessions had approved and valid contracts with government, 27 concession contracts were under review, contracts

had been annulled in 29 concessions, and 32 contracts were in the process of annulment. Of all concessions (most of them established between 2002 and 2004), 85% had contracts at the beginning of 2010 (Kometter 2010).

The average area per concession is quite small – 12 900 hectares. Given their relatively small size, their financial viability will depend in large measure on their ability to obtain good prices. Many are in formerly selectively harvested areas such as the flood zone along Amazonian tributaries and constitute what in some areas will be the third intervention within the last 30–40 years (ITTO 2006). Since many primary species are no longer present in large volumes, the concessions are increasingly harvesting lesser-known species and intensifying their logging operations.

In addition to forest concessions, there are two other concession types that allow for the exploitation of timber: Brazil nut concessions and reforestation concessions. There are a total of 983 Brazil nut concessions, all located in Madre de Dios, covering an area of 864 000 hectares (Kometter 2010). As of the end of 2009, 293 reforestation concessions covering 135 000 hectares were registered in Peru, with most (245) located in Madre de Dios over an area of 112 000 hectares.

The forest law still in force (Law 27308, 2000) specifies forest audits every five years. The renewal or suspension of concession agreements depends absolutely on the results of such audits, which are based on the application of a set of C&I for SFM derived from ITTO and the Tarapoto Process (ITTO 2006). In addition, inspections are still being carried out in forest concessions as part of the country's CITES Appendix II mahogany observation strategy (Kometter 2010).

Silviculture and species selection. The regulations for concession agreements require the application of

detailed silvicultural prescriptions. Concessionaires must apply a polycyclic management system with a minimum rotation of 20 years.^a A minimum diameter limit is determined for each species, and at least 10% of adult trees of each species must be retained in each harvest area as seed trees.^a Liberation thinning, refinement and enrichment planting are specified to help regenerate forests after harvesting.

At least 100 species are used for timber, but about 25 meet 80% of the demand.^a In the past, the most important timber species harvested in the Peruvian Amazon was *Swietenia macrophylla* (caoba). While still an important species, caoba is no longer in the top ten harvested species by volume. However, the falsification of information concerning the illegal cutting of caoba and other illegal practices have been reported: in 2008, for example, 32 concessions covering an area of more than 400 000 hectares were prosecuted for such offences.^a

Peru and Bolivia are the largest exporters of caoba, while *Guazuma* spp (bolaina) and *Calycophyllum spruceanum* (capirona) are the most traded species in the domestic market. Other important species include *Virola* spp (cumala) *Amburana cearensis* (ishipingo), *Dipteryx micrantha* (shihuahuaco), *Hura crepitans* (catahua) and *Cariniana decandra* (cachimbo). Table 4 shows the five most commonly harvested species, ranked by average sawnwood production for the period 1991–2008. The most important fuelwood species are *Prosopis pallida* (algarrobo), *Eucalyptus globulus* (eucalipto), *Calycophyllum spruceanum* (capirona), *Acacia macracantha* (huarango) and *Polylepis* spp (queuña).^a

Planted forest and trees outside the forest. Peru has the third-largest area of forest plantations in tropical America (820 000 hectares). Most plantations are located outside the Amazon in

the Andes and the main species being planted are *Eucalyptus globulus*, *Polylepis* spp and *Abnus acuminata*. Many of these plantations are on poor soils and have had only limited success.^a Reforestation was declared of national interest by Supreme Decree 003-2005-AG (2005); a national reforestation plan has been developed and is to be launched shortly.

In the Amazon, a considerable number of long-term reforestation and enrichment-planting trials of native species such as *Cedrelinga catenaeformis* (tornillo), *Simarouba amara* (marupa), *Parkia velutina* (pashaco) and others in the Peruvian Amazon (e.g. in Jenaro Herrera, Bosque Von Humbolt and Tingo Maria) have been established, with good results (ITTO 2006). However, these trials have not yet been expanded to an operational scale. Reforestation concessions have been created to promote planted forests in the Amazon using valuable species. Numerous such concessions have been registered but, to date, the associated regulations have not been put in place.

Forest certification. The Government of Peru promotes voluntary forest management certification as a tool for SFM.^a Since 2004, a national working group on forest certification coordinated by WWF Peru has been working on the establishment of an FSC-accredited system for voluntary certification. According to Kometter (2010), a total area of 713 380 hectares was certified as of early 2010, including 15 forest concessions covering 458 600 hectares and 16 community forest areas.^a Combined, three export-oriented forest enterprises (Aserradero Espinoza, Empresa Forestal Venao, and A&A Perú) have 256 100 hectares of certified forest. Twelve native communities have a group certificate over a total area of 150 700 hectares (ibid.). The certified area has increased more than tenfold since 2005.

Table 4 Commonly harvested species for industrial roundwood

Species	Notes*
<i>Eucalyptus globulus</i> (eucalipto)	258 000 m ³ ; from planted forests in Andean valleys.
<i>Virola</i> spp (cumala)**	218 000 m ³ ; from low-lying and low hill Amazon forests.
<i>Cedrelinga catenaeformis</i> (tornillo)**	173 300 m ³ ; from low hill Amazon forests.
<i>Chorisia integrifolia</i> (lupuna)	147 100 m ³ ; from terrace and low hill Amazon forests.
<i>Cedrela odorata</i> (cedro)**	127 000 m ³ ; from inundated and low hill Amazon forests.

* Volumes are average sawnwood production for the period 1991–2008.

** Also listed in ITTO (2006).

Source: Kometter (2010).

Estimate of the area of forest sustainably managed for production. Since 2005, regulated concession management in the Peruvian Amazon has been launched. All active concessions must have a forest management plan and are closely monitored. Nevertheless, it is too early to assess the effect of this new system on SFM. Table 5 shows the estimated sustainably managed production forest in Peru comprising the FSC-certified forest area and the 890 000 hectares under Brazil nut concession (Kometter 2010).

Timber production and trade. There has been a steady increase in log production in Peru in recent years, from 1.29 million m³ in 2003 to 2.37 million m³ in 2009 (ITTO 2010). Sawntwood production in 2009 was 1.12 million m³, more than double that in 2003. The export of logs is not permitted but about 40% (480 000 m³) of sawntwood production is exported (ibid.). The maximum sustainable harvest under a 40-year polycyclic system is estimated to be in the range 25–40 m³ per hectare (ITTO 2006); current off-take would appear to be well below that. There are about 250 sawmills in Peru, most of which have a small installed capacity (averaging 2900 m³ per year). Only about 25% of sawmills have band-saws and a capacity of 10 000 m³ per year or more (ibid.). The export value of timber products increased from US\$66 million in 2000 to US\$191 million in 2008 (WWF Peru 2009).

Non-timber forest products. The use of NTFPs is widespread in Peru. Over 130 products have been identified in the Amazon for local consumption and national and international trade. Tara (obtained from *Caesalpinia spinosa*) is the basis of a growing industry in Peru. It is an excellent source of environmentally friendly tannins (tara tannins). It is used as a hydrocolloid thickener and gelling agent and has application in frozen desserts, instant soups, cream cheese, baked goods and other products.



Logs at the Port of Pucallpa, Peru.

Brazil nut is another important NTFP produced for export in Amazon forests, with an annual production of more than 1 million kg. Extracts of *Lonchocarpus nicou* (barbasco) are exported as a vegetative insecticide.

The production of palm hearts (palmito, 200 000 kg per year) is also important. Medicinal plants, such as cat's claw (*Uncaria tomentosa* – uña de gato, 500 000 kg per year), and sangre de grado (*Croton lechleri*), are increasingly popular.^a

Forest carbon. Gibbs et al. (2007) estimated the forest biomass carbon stock in the range 7690–11 520 MtC and FAO (2010a) estimated it at 8560 MtC. Land use, land-use change and forestry contribute about 60% (110 000 gigagrams of CO₂e) of Peru's annual GHG emissions.

MINAM is responsible for REDD+ and coordinates the National Commission on Climate Change. A multi-stakeholder REDD Group (*Mesa REDD*) was formed in 2008 to support MINAM in the further development of REDD+ in Peru (Government of Peru 2010).

Table 5 Management of the production PFE ('000 hectares)

Reporting year	Natural					Planted		
	Total	Available for harvesting	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
2005*	24 600	8000	5000	59	560	200–300	8	0
2010	18 700**	8431	7563‡	713	1603	820	-	0

* As reported in ITTO (2006).

** Potential timber concession areas as classified by law (Government of Peru 2010).

‡ Only timber concessions (unidades de manejo forestal and community concessions) valid as of end 2009 counted here.

Peru is a participant in the Forest Carbon Partnership Facility, and its REDD readiness preparation proposal was approved in March 2011. Peru is a recipient country of the Forest Investment Program, and it benefits from bilateral support programs in REDD+ in the Amazon region. Several REDD+ pilot projects are under way in the country's forested regions. The proportion of intact forests with crown cover greater than 60% is high (81% of the total forest area). There is also considerable potential to enhance carbon stocks through forest restoration and reforestation in deforested landscapes. Table 6 summarizes Peru's forest carbon potential.

Forest for protection

Soil and water. Soil and watershed conservation are of considerable importance in Peru, particularly in the Andes. The National Program for the Management of Water Catchments and Soil Conservation (*Programa Nacional de Manejo de Cuencas Hidrográficas y de Conservación de Suelos*), which is implemented by *Agrorural*, is conducting the country's most extensive forestry program with the aim of applying participatory approaches to soil and water conservation based on reforestation. In 2008, a legislative decree (Decree 1081) was enacted to create the National System for Water Resources (*Sistema Nacional de Recursos Hídricos*), which emphasizes the protection and restoration of watersheds. A total of 389 000 hectares of forest is classified as exclusively for soil and water protection. In addition, in 2007 an area of about 367 000 hectares was reforested for the single purpose of protecting destabilized watersheds.^a

Biological diversity. Peru has a great range of geographical conditions and is very biodiverse. It contains 10% of the global total of flowering plant species (40 000–50 000 plant species), 462 mammals, 1816 birds, 360 reptiles, 332 amphibians, 2000 sea fish and 797 freshwater fish (ITTO 2006). Thirty-seven mammals, 61 birds,

77 amphibians, two reptiles and seven plants found in forests are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species (IUCN 2011). Eight plants are listed in CITES Appendix I, 363, including caoba, are listed in Appendix II, and three (including cedro) are listed in Appendix III (UNEP-WCMC 2011).

Protective measures in production forests.

Management-plan prescriptions for forest concessions give clear and detailed instructions on leaving protection strips along streams, and they specify species to be protected and refer to wildlife protection in concession areas. There are also prescriptions for reduced impact logging and related measures.^a Tree species that are officially excluded from commercial harvesting are palo de ora, romerillo, cedro de altura and nogal.^a

Extent of protected areas. In 2001, new natural protected areas were defined and existing protected areas were reclassified. The well-developed and relatively well-funded system of protected areas, SINANPE, now contains 61 protected areas covering an area of 18.5 million hectares, or 15% of the country. Protected areas include national parks, national reserves, national sanctuaries and other zones (Box 3). SINANPE is complemented by regional conservation areas (*areas de conservación regionales* – ACRs). Recently there has been a move to encourage the creation of ACRs by regional governments: Presidential Resolution 205-2010-SERNANP (dated 26 October 2010) is designed to stimulate the creation of ACRs through regional governments that are also financing such areas. Three ACRs have been created: Choquequirao, Bosque de Puya Raimondi-Titankayoc and Ampiyacu–Apayacu.

A large part of the protected-area network is heavily forested. An estimated 13.7 million hectares of forested land are classified under IUCN protected area categories I–IV.^a Many protected areas are

Table 6 Forest carbon potential

Biomass forest carbon (MtC)	% forest with canopy cover >60%	Deforestation/ degradation potential to 2030	Enhancement of carbon sink capacity to 2030	Forest area change monitoring capacity	Forest/ GHG inventory capacity	Importance of forest fire/ biomass burning	Engagement in international REDD+ processes
7690–11 520	81	+++	++	++	+	++	+++

+++ high; ++ medium; + low; estimate of national forest carbon based on Gibbs et al. (2007); estimate of % total forest with canopy cover >60% based on UNEP-WCMC (2010).

Box 3 Categories of protected areas

Category	Number	Area (ha)
National parks	12	7 967 119
National reserves	13	3 719 347
National sanctuaries	9	317 366
Historical sanctuaries	4	41 279
Landscape reserves	2	711 818
Protection forests	6	389 987
Communal reserves	8	1 777 466
Reserved zones	9	3 396 364
Hunting reserves	2	124 735
Wildlife refuges	2	8 591
Small islands		140 833
Total SINANPE	67	18 594 909
Regional conservation areas	5	695 227
Private conservation areas	20	124 991
TOTAL	92	19 415 127

Source: Kometter (2010).

under pressure, however, including from conversion to other land uses (particularly shifting cultivation but also monoculture agriculture and illegal crops such as coca), small-scale and large-scale timber theft, illegal mining, oil and gas exploration, and illegal hunting and fishing.

In 2001 INRENA granted an area of 135 832 hectares as a 'conservation concession' for a period of 40 years to a private association (the Amazon Watershed Conservation Association – *Asociación para la Conservación de la Cuenca Amazónica*). In 2010 a total of 423 000 hectares were under such concessions and another 55 000 hectares were under ecotourism concessions. These areas are not counted as part of the protected-area network. In such concessions, protection activities, ecotourism and the sustainable use of NTFPs may be carried out, but not logging. It is expected that more concessions will be granted in the future for NTFPs and conservation.

Estimate of the area of forest sustainably managed for protection. Large areas of the protection PFE are under no imminent threat due to their remoteness but are not counted here as under SFM. A total area of about 11.6 million hectares of protected area is clearly defined and is covered by some sort of management planning.^a The area of protection PFE managed sustainably is estimated at 1.88 million hectares (Table 7). This includes the core water protection forests of about 60 000 hectares and the totally protected portion of the Peruvian part of the transboundary protected areas of Tambopata (1.09 million hectares) and El Condor (253 000 hectares), both of which have been supported by ITTO and other international donors, plus the areas under conservation and ecotourism concessions.

Socioeconomic aspects

Economic aspects. The contribution of the forest sector to GDP is about 1.02% of a total GDP of US\$1.03 trillion.^a An estimated 250 000 jobs are generated directly by forestry activities, over 50% of them in the Peruvian Amazon (ITTO 2006). The forest industry, including many small and medium-sized enterprises, are mostly located in Lima, Trujillo, Chiclayo, Cuzco, Iquitos, Pucallpa and Tarapoto and employ more than 82 000 people (ibid.). The contribution of forestry, however, is not only made through direct employment but also through the provision of a wide range of goods for consumption, handicrafts and small commerce. Fuelwood collection is still the main extractive use of the country's forests, in particular in forest-poor mountain areas. Small-scale logging is important both economically and socially in the Amazon, and nearly all forest areas close to the main rivers have been heavily harvested.

Livelihood values. Many NTFPs are used and traded locally, such as fruits and vegetables like aguaje (*Mauritia flexuosa*), camu-camu and palmito, local bamboo (*Guadua angustifolia*), palms and

Table 7 Management of the protection PFE ('000 hectares)

Reporting year	Protection PFE	Forests attributed to IUCN categories I-IV	Allocated for soil and water	With management plans	Sustainably managed
2005*	16 300	3130	390	-	1540
2010	19 400	3404**	389	11 600	1880

* As reported in ITTO (2006).

** According to UNEP-WCMC (2010).

fibres. Wildlife, particularly fish, is an important source of protein throughout the Amazon.

Social relations. The Peruvian Amazon remains a frontier for settlers from other parts of Peru, many of whom engage in small-scale agriculture and the gathering of forest products, often illegally. Poaching, the illegal harvesting of valuable timber species and illegal mining are all widespread.^a Narcotic crops, particularly coca, are planted by shifting cultivators in fields and small openings in the forests. The social impacts of the new concession system are unknown. Logging by outsiders of Indigenous and community lands can cause intra-community conflicts, including over the distribution of payments.

More than 1354 Indigenous communities (*comunidades nativas*) are known to make their living in the Peruvian Amazon, occupying about 14.95 million hectares or 17% of the total area of the Peruvian Amazon. Their livelihoods are closely interlinked with forests. An estimated 13.5 million hectares of potentially productive forests are in areas claimed by Indigenous peoples and about 1.75 million hectares are situated within Indigenous reserves. About 100 timber licences are located in the immediate vicinity of Indigenous territories (G. de Freitas, pers. comm., 2009). While new forms of collaboration and benefit-sharing are being established between concession-holders and local people, the new situation is also prone to misunderstanding and conflict. Although REDD+ is developing rapidly in Peru, many local and Indigenous people see it as a threat. Considerable efforts are needed to clarify REDD+ and related forest issues with local stakeholders.

Summary

The forest sector of Peru has been undergoing rapid change. After signing the Trade Promotion Agreement with the United States in 2007, the Government of Peru embarked on a new process to reform the forest policy and law as well as to restructure and decentralize the system of forest administration and governance. This was done on a fast track through a series of supreme decrees, including the issuance of a new forest law, decentralization efforts and new central institutions. However, the outcome was highly controversial and led to a prolonged period of protest by civil society and Indigenous peoples. Nevertheless, Peru has

taken significant steps towards integrating the forest sector into the broader macroeconomic objectives of sustainable development and has put in place a system of control that allows further progress in SFM. An independent forest-control mechanism has been established and a broad coalition of stakeholders from the public and private sectors and civil society works together to develop the forest agenda. The Government of Peru is engaged in the development of REDD+ with a nested approach and in a broad stakeholder dialogue to develop REDD+ as a major instrument for forest-based development in the Amazon. Peru still faces some major challenges in enforcing and applying regulations and planning instruments in the country's vast Amazon forests and in guaranteeing the rights of Indigenous and local people.

Key points

- Peru has an estimated PFE of 38.9 million hectares (compared with 41.1 million hectares in 2005), comprising 18.7 million hectares of natural production forest (compared with 24.6 million hectares in 2005), 19.4 million hectares of protection forest (compared with 16.3 million hectares in 2005) and 820 000 hectares of planted forest (compared with 200–300 000 hectares in 2005).
- An estimated 1.60 million hectares of the production PFE is under SFM. About 713 000 hectares of natural production forest is certified (compared with 59 000 hectares in 2005). An estimated 1.88 million hectares of protection PFE is under SFM. Large areas of the protection PFE, even if not formally under SFM, are under no imminent threat due to their remoteness.
- The rate of deforestation has declined. The country has an ambitious plan to reduce deforestation to zero by 2020 and has put in place programs (e.g. the National Forest Conservation Program) for this purpose.
- A broad consultation process on the preparation of a new forest law and policy is under way and new institutions have been created to manage forests on the principles of SFM.
- Despite the difficult macro-economic situation for the timber trade, Peru has increased its exports of hardwood timber and further developed its domestic timber industry.

Nevertheless, most exports are in the form of sawnwood and there has been only limited development of further-processing in Peru.

- There is considerable potential for REDD+ in Peru. However, many local and Indigenous people see it as a threat, and considerable efforts are needed to clarify REDD+ and related forest issues with local stakeholders.

Endnote

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SURINAME



Forest resources

In 2010 the estimated population of Suriname was 524 000 people (United Nations Population Division 2010), and the country is ranked 97th out of 182 countries in UNDP's Human Development Index (UNDP 2009). A lowland region and the southern highlands account for 80% of the country and form part of the pre-Cambrian Guyana Shield that straddles Suriname, Guyana and French Guiana. Along the northern edge of the shield lies a savanna belt, beyond which is a narrow swampy coastal plain where 90% of the population is concentrated. The estimated forest area is 14.8 million hectares (FAO 2010, Government of Suriname 2009a), which is 91% of the total land area (16.3 million hectares).

Forest types. Three broad forest zones can be distinguished, corresponding to the three major biogeographical zones: the hydrophytic forests in the north, which comprise swamp forests, mangroves and ridge and marsh forests; xerophytic savanna forests in the savanna belt; and the predominant mesophytic humid forest types of the Guyana Shield. These, in turn, comprise the following forest types^a:

- high dryland forest (rainforest) – 13.3 million hectares
- high savanna forest or dry evergreen forest – 132 000 hectares

- low savanna forest – 18 000 hectares
- high swamp forest – 483 000 hectares
- low swamp forest – 239 000 hectares
- mangrove forest – 100 000 hectares
- marsh forest – 468 000 hectares
- ridge forest – 35 000 hectares.

The Government of Suriname (2009a) estimated the total area of mangroves at 115 000 hectares, but FAO (2010) put the area at 100 000 hectares and Spalding et al. (2010) at about 50 900 hectares.

Permanent forest estate. There is no formally established PFE in Suriname. Nevertheless, all formally established nature reserves and other protected and conservation areas have been established by explicit legal documents that provide strict guidelines for protection and use, thus providing a reasonable guarantee that those protected areas will be maintained as such. Since the establishment of the first protected areas in the 1950s, no protected area has been revoked. Recently, a procedure has been introduced to use a compatible GIS-GPS system to determine the exact location of boundaries and whether any given point on the ground is inside or outside the nature reserve or other protected area.

Concession areas are also allocated on the basis of explicit legal documents that provide information on boundaries as well as guidelines for their management and use. In practice, however, there are few guarantees that these areas will remain in the category of production forest. In the past, some concessions have been converted to protection areas or assigned to other economic uses (such as mining or large-scale agriculture). This was the case, for example, for the community forest in the Brokopondo district, which was allocated to Cambior (now Iamgold) for gold-mining, and some concessions in the district of Marowijne, which have been allocated to China Zhong Heng Tai Investment (Suriname) NV for large-scale oil-palm plantations. The vast majority of forests in Suriname is legally classified "as forests to be provisionally maintained"; forests thus classified will be maintained as forest until such time that they are legally designated to a specific use.

In Table 1, PFE has been taken to include all formally established protected forest areas and all forest concessions and formally designated community forests, but forests “to be maintained provisionally” have been excluded. Also excluded are forested lands of the state that are leased to private individuals for conversion (mainly to agriculture), as well as privately owned forested land that is currently used for timber production but could be converted to non-forest at any time at the discretion of the owners.

Thus, 5.32 million hectares of forest may be considered to be designated as production forest in the PFE, while 2.19 million hectares have been designated for protection and conservation.

Since the PFE has restricted formal status, its demarcation on the ground is minimal. Concessionaires are supposed to demarcate their concession boundaries but, in practice, this is generally confined to the cutting and maintenance of outer boundaries of the cutting compartment under harvest.

Forest ecosystem health

Deforestation and forest degradation. Suriname does not face the population and migration pressures that have led to deforestation in many other countries. According to FAO (2010),

Suriname lost 18 000 hectares of forest between 1990 and 2010 (0.1%). The estimated forest loss since 1650 is 400 000 hectares^a, or less than 3% of the extant forest estate. Until about 1980, mining on forested land was mainly for bauxite, which was exported. In the 1980s, however, gold-mining emerged as an activity of growing importance, both economically and environmentally. The total area of forest destroyed due to gold-mining is about 90 000 hectares^a, including 30 000 hectares in the last decade (Fox 2010). An estimated 14 000 small-scale miners and service providers work in Suriname’s interior (ibid.). There is no significant occurrence of forest fire from natural causes.

At least 13 million hectares of Suriname’s forest estate is primary forest^a; Table 2 presents an estimate of 13.8 million hectares, which is slightly less than the estimate shown in FAO (2010). Of the 4.5 million hectares of forest designated for timber production, an estimated 744 000 hectares have been logged selectively over time and more intensively, though still selectively, in the last five decades. This forest is considered ‘selectively logged primary forest’. The low intensity of harvesting over relatively long felling cycles has helped to maintain these forests in relatively good shape. About 250 000 hectares of forest are used for shifting agriculture and could be considered degraded; the extent of this area is not increasing.^a There is also

Table 1 Permanent forest estate

Reporting year	Estimated total forest area, range (million ha)	Total closed natural forest ('000 ha)	PFE ('000 hectares)			
			Production		Protection	Total
			Natural	Planted		
2005*	13.6–14.8	14 100	6890	7	4430	11 327
2010	14.8	14 100**	5319[‡]	13[†]	2194	7513

* As reported in ITTO (2006).

** Calculated using the ratio of forest with greater than 60% forest cover estimated by UNEP-WCMC (2010) (95.5%) and the estimated total natural forest area.

‡ Includes inactive concessions (either not issued or revoked or lapsed), active concessions, and community forests.

† Government of Suriname (2009a). The status of this planted forest in the PFE is unclear and is not included in the total.

Table 2 Forest condition

	PFE	Non-PFE	Total
	'000 ha		
Area of primary forest	6769	7037	13 806
Area of selectively logged primary forest	744	0	744
Area of degraded primary forest	0	250	250
Area of secondary forest	0	0	0
Area of degraded forest land	0	90	90

Source: ITTO estimate based on Government of Suriname (2009a) and FAO (2010).

degraded forest in the vicinity of mining operations, although the extent of this is unquantified.

Vulnerability of forests to climate change. The mean annual temperature in Suriname is projected to increase by 0.9–3.3 °C by 2060 (McSweeney et al. undated). Increased rainfall variability and changes in the geomorphology of the coast and in water resources are also projected (Government of Suriname 2002). Suriname’s low-lying coastal zone is vulnerable to sea-level rise. This is Suriname’s most fertile land, where most economic activities are practised and where the population is mostly concentrated (ibid.). Inland forests are vulnerable to increased drought and forest fire in extreme el Niño years.

SFM policy framework

Forest tenure. According to the 1987 Constitution, all forests, except those on privately owned land, belong to the state. Accordingly, Table 3 shows that almost all of Suriname’s forest estate is publicly owned, although more than 1 million hectares have been allocated as private concessions (see below).

The Constitution does not provide for collective rights or the collective use of land, but Amerindian and Maroon people (the latter being descendants of slaves of African origin) claim these rights.

Criteria and indicators. The Forest Management Act (1992) provides criteria for the sustainable use of forest resources. The Government of Suriname used the ITTO C&I in its submission to ITTO for this report.^a

Forest policy and legislation. The Forest Management Act (1992) covers the sustainable and rational use of forest resources, taking into account the interests of forest-dwellers and the conservation of nature and biological diversity. It provides rules governing timber production (and, to some extent, timber processing) and export. It covers the various licences for forest harvesting, including different types of timber concession and the use of community forests.

A national forest policy was adopted in 2003 after an extensive process of consultation with stakeholders. This policy provides broad guidelines for the use of forests for production, protection and conservation. According to the policy, the main goal of forest management is “enhancing the contribution of the forests to the national economy and the welfare of the current and future generations, taking into account the preservation of the biodiversity”. It contains economic, sociocultural and environmental goals of equal weight. The Interim Strategic Action Plan for the Forest Sector was published in 2008.

An environmental law was drafted in 2001 and a revised version is under review by the Ministry of Labour, Technological Development and Environment. If enacted, this law will have important procedural consequences for the issuance of timber licences and the installation of timber-processing units. In the absence of agreed national C&I, the environmental impact assessments described in the draft law will be essential for monitoring progress towards SFM.

Table 3 Forest area, by tenure

Ownership category	Total area	Of which PFE	Notes
	'000 ha		
State ownership (national, state or provincial government)	14 752	7513	PFE includes nature reserves and other protected areas, MUMAs, community forests, inactive concessions, and active concessions held by firms, associations, individuals or families. Non-PFE includes 'forests to be provisionally maintained', and forest for which leases have been issued for clearing and development.
Other public entities, including municipalities, villages, etc.*	0	0	With its centralized government structure, Suriname's regional governments at the district and local levels do not own (forest) land.
Total public	14 752	7513	
Owned by local communities and/or Indigenous groups	0	0	
Private owned by individuals, firms, other corporate	24	0	

Source: Government of Suriname (2009a).

Institutions involved in forests. The government institutions responsible for the management and protection of Suriname's forest resources are the Ministry of Physical Planning, Land and Forestry Management, the semi-autonomous Foundation for Forest Management and Forest Control (*Stichting voor Bosbeheer en Bostoezicht* – SBB), and NB (the Nature Conservation Division of the old Suriname Forest Service – *Lichtwet en BosBeheer*, LBB). SBB is responsible for the enforcement of the Forest Management Act (1992) and, consequently, for the management of production forests. NB is responsible for the enforcement of the Nature Conservation Act (1954) and the Game Act (1954) and, consequently, for the management of nature reserves and other protected areas. There has been an ongoing process to establish a single authority for the management of production and protection forests, the Forest and Nature Management Authority (Bosnas), but this is still pending.

Suriname has one university (Anton de Kom University of Suriname) with a modest school for forestry, one for biology and another for the environment. Most currently active forestry professionals in Suriname, however, received their education abroad. The Institute for Natural Resources and Engineering Studies is a well-established training institute for forestry technicians, one level below the Bachelor of Science. The Interim Strategic Action Plan for the Forest Sector includes an ambitious training component in line with the recommendations made on the training needs of the forest sector in the context of ITTO pre-project proposal PPD 97/04(I). The Jan Starke Vocational Training and Recreation Center provides forest-related vocational courses, although it is in decline.

Status of forest management

Forest for production

There are several systems for timber harvesting, including concessions, community forests and incidental cutting licences (ICLs). The procedures for granting concessions and licences were not transparent in the past.

Although for a decade or longer prior to the establishment of SBB, ICLs had become a popular way to evade the relative rigid requirements for concessions, in the last decade this practice has been redressed almost completely. ICLs are now

restricted to salvage logging areas and conversion forests.

In early 2010, a total area of 1.22 million hectares¹ were under 68 active concessions, comprising 34 licences for areas smaller than 5000 hectares in size (116 000 hectares in total), ten licences for areas 5000–10 000 hectares in size (69 000 hectares in total), three licences for areas 10 000–15 000 hectares in size (32 300 hectares in total), five licences for areas 15 000–25 000 hectares in size (83 700 hectares in total), twelve licences for areas 25 000–50 000 hectares in size (411 000 hectares in total), and four licences for areas 100 000–150 000 hectares in size (507 000 hectares in total). In addition, community cutting licences have been issued for 437 000 hectares, and 114 000 hectares have been designated as community forests for Indigenous or Maroon communities. Six ICLs have been issued for a total of 54 800 hectares, and one ICL for Submerged Wood has been issued for 116 000 hectares. In total, cutting licences of all forms have been issued for about 2 million hectares of forest.^b

Effective forest management and forest production control were virtually non-existent when SBB was established in 1998 with a mandate to establish a leaner and more cost-effective forest management organization than the Forest Service it replaced. SBB subsequently developed a comprehensive computerized log-tracking system, LogPro, to monitor harvesting operations, the payment of forest fees and forest planning at the FMU level. Although this system is still under development it has already proved useful in promoting SFM. GIS technology was introduced in the forest sector with the support of the WWF Guianas program for the mapping and planning of forest operations on the ground. Initially this was done for SBB's own operations, but the system has been extended gradually to logging companies and other private operators in the forest to facilitate the mutual exchange of planning and other information related to ground-level activities. Training courses in the use of GIS were conducted for representatives of the private sector, including consultants, who are being hired increasingly by logging companies to prepare

¹ In October 2010 this had reportedly increased to 1.3 million hectares in 62 concessions, comprising 18 intensively managed concessions covering 605 000 hectares, 16 extensively managed concessions covering 55 000 hectares, and 28 "idle concession or preparatory harvesting activities" covering 640 000 hectares.^b

the planning of their operations to the (higher) standards that now prevail.

The management and control style adopted by SBB can be categorized as either *intensive forest management* (for large concessions) or *extensive forest management* (for small concessions).

Operators with a relatively large production capacity, including operators that produce mainly for export, were deemed capable of causing extensive damage to a large area of forest in a relatively short time. A high priority was therefore placed on ensuring their adherence to stringent regulations. Application for concessions larger than 5000 hectares must include a business plan (including a financial feasibility plan for wood-processing and logging activities, and a forest management plan) that sets out the intended approach of the applicant to the development of the concession, if granted. After the granting of the concession and before any actual harvesting, a more detailed overall management plan must be submitted to SBB indicating the division of annual cutting areas and the infrastructure to be built. In addition, specific planning is required for each annual cutting area for that year, including 100% inventories and the detailed layout of skidding roads, taking into account the maximum allowable cut as suggested by the Celos Management System (normally 20–25 m³/hectare) and the selection and marking of the trees to be felled (in the field as well as on tree maps to be included in the planning documents for submission to SBB for approval). Since the requirements for 100% inventories in cutting blocks were introduced, about 17 500 hectares (175 blocks of 100 hectares each) have been surveyed in this way.

Restricting harvesting to inventoried 100-hectare cutting blocks allows the close monitoring of the actual cut in relation to inventoried stock. According to observations of 87 cutting blocks exploited between 2006 and 2009, the average harvest in intensively managed concessions was 12.3 m³ per hectare.^a The average annual harvest area for concessions and community forests in the PFE is about 13 500 hectares.

The approved harvest plan forms the basis of production control by SBB. The trees actually cut are labelled with a polyethylene label with a unique number that is issued by SBB from LogPro, its computerized log-tracking system. These

label numbers, together with the tree number as assigned in the 100% tally and indicated on the tree map included in the approved harvest plan, must be entered in a felling register, as prescribed by law. The label numbers are thus linked to the tree numbers of the inventory. When the logs are prepared for transport from the production site their label numbers are entered in a way bill. If the original log is cross-cut prior to transport from the production site, the resulting smaller logs are numbered with new labels linked to the number of the original log (and therefore automatically to the tree number assigned in the 100% tally). A copy of the felling register must be presented to the forest guard covering the particular production area, who forwards it to SBB headquarters, where it is entered into LogPro. Systematic inspections of sawmills and other processing facilities are also conducted to ensure that any timber not seen during earlier inspections is detected, registered, and entered into LogPro.

Despite the establishment of these elaborate planning and administrative procedures, for a variety of reasons only a relatively small area and only a few operators are presently under such 'intensive' management.

Extensive forest management is confined to smaller operators, including those active in community forests. Such operators must maintain the boundaries of their concessions and of the annual cutting areas in which they are active (just as in intensive management). Systematic 100% inventories are not required, but the felled timber must be registered in a felling register, as required for intensive management operations. Extensive forest management is applied in concessions where the impact of harvesting on the economy and the environment is relatively low. The ultimate goal is that all concessions are managed according to the procedures of intensive management. All granted licences, whether for intensively managed or extensively managed concessions, are monitored by SBB.^b An estimated 10–20% of (commercial) production is not registered (FAO 2010).

Although there is growing interest among private forest-owners to produce timber on a sustainable basis, for which they seek assistance from the growing number of consultants available for this kind of supporting service, the practice is not well established and cannot be enforced by SBB given



Forest river scene near Botopasie, Suriname. © istockphoto/B. Coenders

its current capacity.^a It should be noted that timber production in conversion forests is, by definition, unsustainable.

Under SBB, significant progress has been made towards SFM in Suriname's forests, but for a variety of reasons the impact is currently sub-optimal.^a A major constraint is the relatively low educational level of the forestry workforce, although, to some extent, this problem has been reduced by the development of a group of reasonably competent forestry professionals acting as consultants to assist in the planning of operations by both smaller and larger operators. Another major constraint for the industry is a lack of capital, which hampers the acquisition of equipment that would, for example, enable the effective application of reduced impact logging techniques. An even bigger constraint is of an institutional nature: the formal establishment of the Bosnas has been delayed for more than four years, with a consequent impact on the availability of the resources needed for adequate coverage of the entire production forest area.^a

Silviculture and species selection. The forests are characterized by a wide variety of species –

more than 600 tree species have been described. Some 50 species are known as class A commercial species and about 100 as class B. There has been a significant shift in the last three decades in the species harvested for industrial roundwood. An important reason for this shift pertains to the restricted access to the production forests in more remote parts of the interior during the country's civil war (1986–1993), which led to the use of species previously considered useless or of low value. Many such species proved highly suitable for some very demanding applications in construction and furniture manufacturing.

About 375 000 hectares of the PFE have been inventoried for their standing timber stocks. Table 4 lists some of the most commonly harvested species.

Planted forest and trees outside the forest. In ITTO (2006) the area of forest plantations, and the area of plantations under management plans, were both reported at 7000 hectares. In this report, the estimated planted-forest area has been adjusted to 13 000 hectares on the basis of Suriname's submission^a, but the area under management plans is probably zero (Table 5). The predominant

Table 4 Commonly harvested species for industrial roundwood

Species	Annual harvest quantity (m ³)		Notes
	PFE	Non-PFE	
<i>Qualea</i> spp*	27 175	6507	Harvested predominantly from high dryland forest.
<i>Dicorynia guianensis</i> *	22 114	8136	
<i>Goupia glabra</i> *	11 019	3851	
<i>Vochysia tomentosa</i>	4621	5502	
<i>Vatairea guianensis</i>	6644	1674	

* Also listed in ITTO (2006). In the case of *Qualea*, *Q. rosea* was specified in ITTO (2006).

Note: Data are averages for 2004–2008.

Source: Government of Suriname (2009a).

Table 5 Management of the production PFE ('000 hectares)

Reporting year	Natural					Planted		
	Total	Available for harvesting	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
2005*	6890	1740	73	0	0	7	7	0
2010	5319	2000	899	89	247	13	-	0

* As reported in ITTO (2006).

planted species for industrial purposes is *Pinus caribaea*, comprising about 58% of the plantation estate. The principal indigenous species are *Cedrela* spp, *Cordia alliodora* and *Simaruba amara*; the main broadleaved exotic species are eucalypts. There is little information about standing volume, growth rates or current condition. No expansion of the plantation estate, or replanting of harvested sites, is planned.

Forest certification. The FSC has certified one forest area operated by Timberindustry Suriname NV, with a total production area of 23 858 hectares (FSC 2010).

Estimate of the area of forest sustainably managed for production. Of the 1.30 million hectares in the PFE under concessions (plus another 170 000 hectares under ICLs), 899 000 hectares are covered by, in total, 21 management plans.^a Two concessions (one of which is FSC-certified), covering a total of about 89 000 hectares, are under harvest using reduced impact logging to a high standard. A further 158 000 hectares of concessions are being harvested using 'controlled' logging (i.e. natural directional felling, and planned skidding), and 655 000 hectares are being harvested using sometimes poor techniques.^a Given the low volume of timber extracted per hectare, the first two of these harvesting categories (a total of 247 000 hectares) may be considered to be under

SFM. Apart from some areas where gold-mining is occurring, the remainder of the production PFE is likely to be under little threat of deforestation or degradation.

Timber production and trade. The annual production of industrial roundwood in 2009 was estimated at 190 000 m³, up from about 94 000 m³ in 1999 and 159 000 m³ in 2004. Sawwood production increased from 28 000 m³ per year in 1999 to 65 000 m³ per year in 2009, plywood production decreased from 4000 m³ in 1999 to 1000 m³ in 2009, and veneer production increased from zero in 1999 to 3000 m³ in 2009 (ITTO 2011). Installed national sawmilling capacity is estimated at 280 000 m³ per year. In total, more than 160 species are harvested.^a In 2009, Suriname exported logs valued at US\$2.70 million and sawnwood valued at US\$2.80 million (ITTO 2011).

Non-timber forest products. NTFPs are used to varying degrees by different groups, predominantly people living in the country's interior. Apart from incidental small-scale efforts, no significant inventory of NTFPs has been conducted to date. There is a significant export trade of Surinamese wildlife: FAO (2010) reported that wildlife exports (mainly birds) were worth about US\$404 000 in 2007 (a reduction of more than US\$500 000 compared to 2004, due largely to a ban on bird

Table 6 Forest carbon potential

Biomass forest carbon (MtC)	% forest with canopy cover >60%	Deforestation/ degradation potential to 2030	Enhancement of carbon sink capacity to 2030	Forest area change monitoring capacity	Forest/ GHG inventory capacity	Importance of forest fire/ biomass burning	Engagement in international REDD+ processes
663–2753	96	+	+	++	++	+	++

+++ high; ++ medium; + low; estimate of national forest carbon based on Gibbs et al. (2007); estimate of % total forest with canopy cover >60% based on UNEP-WCMC (2010).

imports in the European Union during an outbreak of Avian flu). In 2006 an estimated 55 000 kg of medicinal plants valued at US\$453 000 were exported to the Netherlands.

Forest carbon. Suriname has a large and mostly intact forest resource. The REDD+ mechanism is designed to assist countries like Suriname by providing positive incentives for conserving forests and improving forest management. Taking into account Suriname's developmental needs, REDD+ could assist in mitigating some of the drivers of deforestation and forest degradation.

Gibbs et al. (2007) estimated Suriname's forest biomass carbon stock at 663–2753 MtC, and FAO (2010) estimated it at 3165 MtC. Box 1 shows the quantity of carbon contained in Suriname's forests estimated by Tjon (1998) on the basis of observations in 30 plots distributed over a range of forest types.

Box 1 Forest carbon stock, Suriname

	Carbon store (MtC)	
	PFE	Non-PFE
Above-ground biomass	1340	1210
Soil	365	330

Source: Based on estimates by Tjon (1998) of carbon stocks in various forest types.

Nearly one-third (31%) of Suriname's GHG emissions are produced by the land-use change and forest sector (Government of Suriname 2002). Since 2009 the Government of Suriname has been developing a REDD+ readiness preparation proposal in the framework of the Forest Carbon Partnership Facility and is a member of the REDD+ Partnership. The preparation of a national REDD+ strategy is coordinated by the National REDD+ Working Group, which comprises representatives of governmental institutions, forest-dependent communities (Indigenous and Maroon peoples), the

timber industry, academia, civil society and other observers (Government of Suriname 2009b). Table 6 summarizes Suriname's forest carbon potential.

Forest for protection

Soil and water. No part of Suriname's forest is managed exclusively for the protection of soil and water, but the relative lack of human pressure means that, in effect, vulnerable slopes in the hinterlands, the productive capacity of the soils, and the water storage and production capacity of the vast majority of forested lands are generally well conserved. Nevertheless, threats do exist. For example, some waterways are contaminated with mercury as a result of uncontrolled gold-mining, and river siltation and soil erosion are prevalent (ITTO 2003b, Fox 2010).

Biological diversity. Suriname has large intact forest ecosystems of global significance and forests have extremely high conservation and ecological values, particularly in the swamps and on the Guyana Shield. The inventoried biota comprises 5800 species of plant, including 200 endemic species, 185 species of mammals, 668 species of birds, 152 species of reptiles, 95 species of amphibians and 790 species of fish (Malone 2007); it is certain that much remains to be discovered. Five mammals, one amphibian, one arthropod and one plant are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species (IUCN 2011). Two plant species are listed in CITES Appendix I, 30 in Appendix II and one in Appendix III (UNEP-WCMC 2011).

Protective measures in production forests.

Harvesting guidelines to protect soil, water and conservation values devised by SBB must be incorporated in the harvesting plans of concessionaires and approved prior to actual harvesting. They include the maximum allowable cut per hectare and the alignment and maximum area of skidding roads to be constructed in a felling

compartment. In addition, rules are stipulated in concession agreements regarding the storage and disposal of chemicals, machine oils and other chemical waste. These are closely monitored by SBB and adhered to reasonably well by loggers, although standards related to the spillage of used motor oils and waste may slip through control from time to time, meaning that adherence may be less than optimal.^a

Extent of protected areas. According to the Government of Suriname (2009a), an estimated 1.89 million hectares of forest are contained within protected areas classified in IUCN protected-area categories I–IV, including 1.15 million hectares of lowland evergreen broadleaved rainforest. The estimate of UNEP-WCMC (2010) is slightly lower, at 1.46 million hectares. Of particular significance is the Central Suriname Nature Reserve, created in 1998 (1.6 million hectares). A further 245 000 hectares are in protected areas classified as IUCN protected area categories V–VI. Just under 1.5 million hectares of protected areas are covered by management plans (Table 7).^a

Estimate of the area of forest sustainably managed for protection. Most of the protected area – and a large area of ‘unprotected’ forest in remote parts of the country – is intact due to a lack of development pressure. Therefore, all protected areas subject to management plans are assumed to be under sustainable management.

Socioeconomic aspects

Economic aspects. Forest-based activities contributed about 2% of Suriname’s GDP, which was worth about US\$1.8 billion in 2007. The formal market value of timber and NTFPs was estimated at about US\$19 million and the value of the informal market was estimated at US\$2.52 million.^a In addition, the Water Supply Company of Suriname reported a production of 32 million m³ of drinking water in 2007, with an estimated market value of US\$18 million.^a The water-bottling industry has developed rapidly in the last decade

and currently comprises at least five significant-sized companies. Local consumption as well as exports of bottled water are growing steadily, although no data on the value of these were available for this report.

The Government of Suriname charges a fee per m³ of timber felled and per hectare of forest concession held. However, there are inconsistencies in the fee structure: for example, there is little difference in the level of fees for timber according to the marketability of species and therefore there is little incentive to use lesser-known species (moreover, local forestry entrepreneurs consider the fees to be too high). The fees per area of concession are very low, which tends to encourage the application for and holding of large concessions for speculation rather than production. For these reasons, a revision of the forest charges system has been prepared, and will soon be enacted, in which the number of timber classes for fee calculation will be increased, there will be greater differentiation between timber classes, and, overall, the average fee per m³ will be reduced by about 50%. Concurrently, the fee per area of concession will be increased significantly, which will help to compensate government for the decrease in revenue resulting from the reduction in the fee per m³. The fee per area will be lower for remote areas to encourage their development and to alleviate pressure on timber production areas closer to existing infrastructure.

An estimated US\$60 million has been invested in foreign-owned logging operations and processing equipment. The Government of Suriname invests in SFM through its funding of SBB and NB. Combined, those two institutions have an annual budget for forest management, administration, research and human-resource development of about US\$2.56 million. Annual grants and loans from international organizations amount to about US\$850 000.^a In total, just under 1100 people work in the forest sector to implement or support forest management, including 133 with professional qualifications (45 in government and 88 in the private sector) and 135 trained (part-time or full-time) forest workers (51 in government and 84

Table 7 Management of the protection PFE ('000 hectares)

Reporting year	Protection PFE	Attributed to IUCN categories I–IV	Allocated for soil and water	With management plans	Sustainably managed
2005*	4430	1390	1160	-	-
2010	2194	1890	0	1460^a	1460

* As reported in ITTO (2006).

in the private sector). The private sector comprises 29 logging companies and about 30 consultants (17 of whom are university-trained). In addition, the wood-processing sector has about 2400 employees.^a About 250 people are employed in the management of protected areas (FAO 2010).

Livelihood values. An estimated 65 000 Amerindian and Maroon people rely on forests for 50% or more of their livelihoods, particularly in the districts of Sipaliwini, Brokopondo, Para and Marowijne.^a Forest resources are important for medicines, building materials and fibres, but particularly for wild animals, fruit, seeds and nuts, which are major food sources. More than a thousand plant and animal species are known to be used in one form or another (van Andel et al. 2003).

People inhabiting the more remote hinterlands have very large areas of forests available for subsistence purposes: while their daily activities would mostly be confined to a couple of kilometres from their settlements, they may also undertake longer trips by boat or by foot away from their settlements (e.g. for prospecting, hunting and fishing). The issue of 'how much land' is required for customary use has emerged in discussions regarding the land rights claims of Amerindian and Maroon peoples, and an attempt has been made to identify the extent of the area around their settlements that could eventually be declared their economic zone. In the settlements closest to Paramaribo and other urban centres, the need to share living space has given rise to a certain balance, whereby traditional lifestyles tend to be confined closer to settlements. However, in large part this issue remains to be resolved.

About 550 000 hectares of forest has been allocated to Amerindian and Maroon peoples as community forests. SBB considers these to be under 'extensive' management^b, although some have been over-exploited due to weak communal business management capacity, which allows the forest to be logged by entrepreneurs from outside the communities on the basis of very poor agreements.^a SBB, Celos (an agricultural research organization) and WWF are working together to provide training that will enhance the capacity for sustainable management among communities in the Pokigron and Marshall Creek region.

Social relations. Suriname's people comprise a racial mix of Amerindians, Creoles, Hindus, Maroons, Javanese, Chinese and Caucasians. About 10% of

the population is Amerindian or Maroon, who claim collective land-use rights, including to forests.

Amerindian and Maroon groups have sought international support for their land-rights claims, including through the Inter American Court of Justice. In 2007 this court delivered a verdict in favour of the Saramaccan tribes, who had filed a complaint that the Government of Suriname had neglected their land rights by granting concessions and other rights to people from outside their community without their permission. The Court ordered the government to redress the disputed acts and to recognize the claimed rights.

Land rights continue to be a difficult issue between the government, tribal communities and other stakeholders. The government has established an official working group to help find a resolution.^a

Seminars, workshops and other interactive communication modalities involving all relevant stakeholders have, to a certain extent, proven effective in reconciling views over forest policy development and SFM. Well-identified stakeholder groups with strong voices in such processes are:

- The Platform for the Timber Sector in Suriname (PHS), comprising a relatively small but vocal number of private logging entrepreneurs, with a persistent dislike of any initiative undertaken by the SBB.
- Representatives of Indigenous and Maroon people who live in the forests in the hinterlands of the country.
- Several national and international NGOs, including Conservation International, WWF and Tropenbos Suriname.^a

SBB has also often been able to provide effective mediation in conflicts between concessionaires over boundary demarcation. Where this mediation proves insufficient, the protagonists may take the case to a judicial court. Conflict prevention, or the early resolution of emerging conflicts between the Government of Suriname (particularly the forest management agencies) and private operators, is attempted by providing for a representation of relevant stakeholders in the governing bodies of the forest management agencies. Representatives of stakeholders are also included in ad hoc committees and work-groups dealing with particular issues regarding the sustainable use and management of the country's forest resources.^a

Not all attempts at conflict resolution have been successful. Some stakeholders have failed to take their seats in the governing bodies of existing and proposed management agencies. It has also proven very hard to obtain agreement between the forest management agencies and some stakeholders, particularly the PHS, on most of the issues subject to discussion.^a

In all sectors, including the forest sector, the rules and requirements regarding health and safety in the workplace are set out in the Safety Act (1947), which is administered by the Ministry of Labor, Technological Development and Environment. The Directorate for Labor in this ministry conducts frequent inspections in different working locations, including sawmills and timber-harvesting sites. There is close correspondence between the prevailing labour regulations and International Labour Organization (ILO) conventions. Labour unions play a role in assuring that ILO recommendations and regulations are taken into account and adhered to. However, labour unions have only a limited role in companies active in the forest sector.^a

Among the 29 enterprises interviewed in the context of the present report, two deaths were recorded in forest-based operations in the three years to 2009. In addition, three cases of permanent disabilities and six instances of injuries followed by complete recovery were recorded.^a

The contribution of members of the Amerindian and Maroon communities to tree-spotting and botanical research regarding plant species in the forest is indispensable, as is their contribution to all forms of surveys in forest areas in the hinterlands.^a

Summary

Suriname has taken some important steps towards SFM. A GIS–GPS system has been introduced to help locate boundaries of protected areas and to assist in the mapping and planning of forest operations. A computerized log-tracking system is being rolled out. There is almost no deforestation, and most of the forest estate is primary forest. There is an interim strategic action plan for implementing the national forest policy. About 2 million hectares of forest are under licence, although not all concessions are currently under harvest. There has been an ongoing process to establish a single authority for the management of production and protection forests, the Bosnas, but

this is still pending. A number of steps have been taken to improve conflict resolution in Suriname's forests, but land rights are an ongoing issue between government, Amerindian and Maroon peoples, and other stakeholders.

Key points

- More than 90% of Suriname is forested, and very little deforestation is taking place. Gold-mining has become a significant cause of forest and environmental degradation.
- Suriname has an estimated PFE of 7.51 million hectares (compared with 11.3 million hectares in 2005), comprising 5.32 million hectares of natural production forest (compared with 6.89 million hectares in 2005) and 2.19 million hectares of protection forest (compared with 4.43 million hectares in 2005).
- As of late 2010, 62 logging concessions had been allocated over a total area of 1.3 million hectares.
- An estimated 247 000 hectares of the production PFE is under SFM, including 89 000 hectares that are certified.
- An estimated 1.46 million hectares of the protection PFE is under SFM.

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TRINIDAD AND TOBAGO



Forest resources

Trinidad and Tobago consists of two main islands and a number of small islets; it has a total land area of 513 000 hectares. In 2010 it had an estimated population of 1.34 million people (United Nations Population Division 2010) and it is ranked 64th out of 182 countries in UNDP's Human Development Index (UNDP 2009).

Trinidad, the much larger island, is traversed by three ranges of hills running more-or-less east to west with a highest point in the northern range of 936 m. Tobago has a central ridge that runs for two-thirds the length of the island and rises to 576 m. FAO (2010) estimated the forest area at 226 000 hectares. A new forest-cover map of Trinidad and Tobago under development by the United States Department of Agriculture, expected to be available by the end of 2010, will provide new information on the country's forest resources.^a

Forest types. There are nine forest types in Trinidad and Tobago: evergreen seasonal forest; semi-green seasonal forest; deciduous seasonal forest; dry evergreen forest; montane forest; mangrove forest; herbaceous swamp; palm marsh; and marsh forest. The most widespread forest formation is evergreen (about 94 000 hectares – FAO 2010) and semi-evergreen seasonal forest (about 14 000 hectares – Pantin & Ram 2010), characterized in the lowlands by two main canopy species, *Carapa guianensis* (crappo) and *Eschweilera subglandulosa* (guatecare). Tropical evergreen submontane and montane forests occur in the northern range of hills. There are also about 14 000 hectares of swamp forests (FAO 2010). Mangrove forests cover about 6500 hectares. The largest area of mangrove cover is Caroni Swamp, which is south of Port of Spain (Spalding et al. 2010). Mangrove forests are widely used for timber and charcoal production and play an important role as near-shore fisheries, including for oyster, crabs and shrimps (ibid.).

Permanent forest estate. An estimated 131 500 hectares of state-owned forests are designated as 'proclaimed forest reserves' and 11 700 hectares are designated as 'unproclaimed forest reserves', comprising both natural and planted forests. These – and some other protection forests – constitute the PFE (Table 1). Only state forests are counted, since the permanency of private forest is unreported. FAO (2010) reported that the PFE (for production) was 'fixed' at 143 000 hectares. Due to agricultural encroachment, squatting for housing, and illegal quarrying, however, the actual forest area has been reduced.

Table 1 Permanent forest estate

Reporting year	Estimated total forest area, range (million ha)	Total closed natural forest ('000 ha)	PFE ('000 hectares)			
			Production		Protection	Total
			Natural	Planted		
2005*	0.248–0.259	250	128	15.4	59.1	202.5
2010	0.226	150**	127	15.4	59.1	201.5

* As reported in ITTO (2006).

** Calculated using the ratio of forest with greater than 60% forest cover estimated by UNEP-WCMC (2010) (66.4%) and the estimated total natural forest area.

Forest ecosystem health

Deforestation and forest degradation. According to FAO (2010), the total forest area decreased by 3600 hectares between 2005 and 2010 and by 14 300 hectares between 1990 and 2010. Both natural forests and plantations are affected by over-harvesting, encroachment, fire and other forms of damage, although the extent of these has generally not been quantified (ITTO 2006). FAO (2010) reported that fire affected about 9500 hectares of forest and other wooded land in the five-year period 2004–08. ITTO (2003) identified non-legal settlement (squatting) as a major cause of deforestation in forest reserves. Another factor that has resulted in forest degradation is strip-mining of sand and gravel; this activity has degraded forests in large areas of the forest reserves, especially along the southern foothills of the northern range. Table 2 presents available estimates of forest condition.

Vulnerability of forests to climate change. As a small island state, Trinidad and Tobago is among the most vulnerable countries to climate change and has a relatively low adaptive capacity. According to the Caribbean Community (CARICOM 2010), the direct effects of temperature rises in the Caribbean are periodical heat stress of the vegetation,

increased biodiversity loss, coral bleaching and an increased risk of insect-borne diseases. The effects of climate change and climate variability include an increased frequency of flooding and extreme weather events (such as hurricanes, which can have a major effect on forest structure). Rising sea level is of concern, mainly in the Caroni Basin and for coastal settlements. Increased coastal erosion has been observed at Cedros and saltwater intrusion is a problem on the southwest peninsula of Trinidad. Trinidad and Tobago is involved in the regional efforts of the Caribbean Community to address climate change, which are coordinated by the Caribbean Community Climate Change Centre.

SFM policy framework

Forest tenure. Most forested land is owned and administered by the state (Table 3). State-owned forest accounts for 192 200 hectares, including all the PFE, and the remainder is owned privately.

Criteria and indicators. Trinidad and Tobago has a long history of systematic forest management. For example, its block management and shelterwood systems have been applied for more than 60 years (ITTO 2006), but it lacks a system of C&I suited to its needs. Trinidad and Tobago's submission to

Table 2 Forest condition

	PFE	Non-PFE	Total
	'000 ha		
Area of primary forest	-	-	62.4
Area of degraded primary forest	-	-	-
Area of secondary forest	-	-	146*
Area of degraded forest land	-	-	-

* 'Other naturally regenerated forest'.

Source: FAO (2010).

Table 3 Forest area, by tenure

Ownership category	Total area	Of which PFE	Notes
	'000 ha		
State ownership (national, state or provincial government)	192	143	Includes some planted forests.
Other public entities (e.g. municipalities, villages)	-	-	
Total public	192	143	
Owned by local communities and/or Indigenous groups	-	-	
Privately owned by individuals, firms, other corporate	34	-	

Note: FAO (2010) estimated the area of forest under public ownership in 2005 at 174 000 hectares and the area of forest under private ownership at 56 000 hectares.

Source: ITTO estimate based on Government of Trinidad and Tobago (2010).

ITTO for this report was not in the ITTO C&I reporting format.

Forest policy and legislation. Trinidad and Tobago adopted its first forest policy for the sustainable management of its PFE in 1942. A revision was made in 1981 to take into account the significant social, economic, political and technological changes that had taken place in the country since 1942, but it was never adopted by government. A further revision took place in 1998 and while the cabinet has approved this revision it has not been adopted formally. There is an absence of an agreed strategy and policy in the forest sector (ITTO 2006).

Recently a new draft forest policy (2008) and a draft protected-areas policy were produced and public consultations undertaken. It is expected that the final review of both these policies will be completed shortly for approval by Cabinet. The purpose of the draft national forest policy is to guide the sustainable management of the forest resources of the nation, including their use and the impacts and consequences of that use. It covers natural as well as plantation forests, includes deforested and degraded forest lands, and addresses forests located on both private and public lands. The draft national forest policy recognizes that while a few government agencies will have primary responsibility for implementing the policy it will inform the behaviour, programs and activities of all stakeholders, including state, private and community groups.^a

Institutions involved in forests. In Trinidad, the Forestry Division of Agriculture, Land and Marine Resources is the state's sole management authority for the forest sector, having responsibility for forestry, watershed management, wildlife, parks, use, research and services in support of the private forest sector. In the last decade, three strategic plans were produced for the Forestry Division to cover the periods 2001–05, 2006–09 and 2009–12, respectively. It is expected that the latter plan, if approved, will enable the Division to be more effective and efficient in delivering goods and services demanded by emerging challenges. Apart from a restructuring of the existing professional staff, several specialist positions are being sought to meet the challenges of added roles and responsibilities (the seeking of specialist positions was also reported in ITTO 2006). In Tobago, forests are

under the jurisdiction of the Assistant Conservator of Forests, who reports to the Secretary of Agriculture, Land Marketing and the Environment. In 2008 the total number of people employed in public forest institutions in the country was 946 (19% of whom were women), including 16 with a university degree or equivalent (FAO 2010).

Civil-society organizations are gradually becoming more involved in forest management. Through the National Reforestation and Watershed Rehabilitation Programme, for example, several community-based groups and organizations are becoming active in the growing and protection of forests. Others are involved in the protection of leatherback turtles during the nesting season (from April to August) and in other conservation-oriented activities.^a

Status of forest management

Forest for production

Both natural forests and particularly planted forests are actively managed. About 75 000 hectares of natural forests are regarded as intensively managed and have management plans. All forest reserves and the external boundaries of the PFE have been fully demarcated. However, the boundaries are not properly maintained and there are frequent incursions/encroachments. The police force and honorary game wardens participate in forest patrols to help control illegal activities. The most recent official forest inventory was carried out in 1969; the lack of up-to-date data is an obstacle to forest policy reform and financing (Patin & Ram 2010).

Up to the 1980s, management plans for forest reserves were written and followed. These lapsed or were not followed in a period spanning the early 1980s to 2003, but new management plans were written for all forest reserves for the period 2004–08 and are being revised at present.^a The management of natural forests has followed a form of selection known as the 'open-range system', with diameter limits as the main form of control. Individually licensed loggers are allowed to cut a specified number of trees or volume as defined by the Forestry Division. In many cases this has amounted to a 'logger's selection system', uncontrolled by the Forestry Division. In order to ensure adequate controls a block system of management was introduced, in which areas are opened up for sale on a polycyclic basis. Several variations of this

system have been employed from time to time, known variously as silvicultural marking in blocks and the periodic block system.

Because forest resources are limited, there are no forest concessions. Some 400 private loggers (mainly wood-workers) are registered (licensed) by the Forestry Division and allotted marked trees for extraction and use. Illegal encroachment and illegal logging certainly occur in the PFE, although their extent is unknown; the police-assisted patrols no doubt reduce their prevalence. In the case of plantations, particularly *Tectona grandis* (teak) and *Pinus caribaea* (Caribbean pine), coupes to be clearfelled are sub-divided into five-hectare units and coupes to be thinned are sub-divided into ten-hectare plots for allocation to sawmillers, licensees, furniture manufacturers and logging contractors.

Silviculture and species selection. The harvesting of plantation teak and Caribbean pine provided up to 28% of the local timber supply in 2008 (Table 4). Enrichment planting in natural forests is still practiced in depleted and poorly stocked forest to improve the growing stock and thereby support multiple use and sustainability.

Planted forest and trees outside the forest. The total industrial planted-forest area is reported to be stable at about 15 400 hectares, with felled plantations replaced with new plantations but no new areas planted.^a The planted forest estate comprises 9100 hectares of teak (introduced from Myanmar in 1913), 4200 hectares of Caribbean pine and other pine species, and 2100 hectares of mixed hardwoods.

Other species planted on a limited scale in both pure and mixed stands, including by enrichment planting, include *Cedrela odorata* (cedar), *Cordia alliodora* (cypre), *Swietenia macrophylla* (mahogany) and *Tabebuia rosea* (apamate).

In 1998 the government approved a private reforestation program and made subsidies available to assist private forest farmers. To date, 3907 hectares of mixed hardwood forest have been established on private lands. In 2004 the government also established the National Reforestation and Watershed Rehabilitation Programme to reforest denuded lands across the country. Operations commenced in 2005 and 1722 hectares of forests have been planted in various areas. By the end of 2010 the total planted forest in both state lands and private lands was likely more than 21 000 hectares.^a

Forest certification. So far no forests have been certified in Trinidad and Tobago (e.g. FSC 2010).

Estimate of the area of forest sustainably managed for production. Of the natural forests, ITTO (2006) reported that 15 000 hectares had been managed for many years according to management plans which conform to basic principles of SFM and are harvested according to the periodic block system, which is considered generally consistent with sustainability; there is no evidence to suggest that the management of these forests has changed (Table 5). The balance of production forest has been managed under the open-range system and is now considered to be degraded (ITTO 2006). On the basis of an estimate provided by the Government of Trinidad and Tobago, FAO (2010) reported that 143 000 hectares of natural forest were under sustainable management.

Timber production and trade. Trinidad and Tobago produces modest quantities of industrial timber and depends mainly on imports to cover its needs for sawnwood, plywood and paper products. Its net timber import bill in 2008 amounted to about US\$80 million.^a Total industrial roundwood production in 2009 was about 50 000 m³, which

Table 4 Commonly harvested species for industrial roundwood

Species	Harvested volume (m ³), 2008
<i>Tectona grandis</i> (teak)*	9536 (17.7% of total harvest)
<i>Spondias mombin</i> (hogplum)	6266 (11.6%)
<i>Cedrela odorata</i> (cedar)	6254 (11%)
<i>Pinus caribaea</i> (Caribbean pine)*	5711 (10.6%)
<i>Virola surinamensis</i> (cajuca)	1857 (3.5%)
Others (estimated)	24 232 (45%)
Total (estimated)	53 856 (100%)

* Also listed in ITTO (2006). In the case of *Pinus caribaea*, *Pinus spp* were listed.
Source: Government of Trinidad and Tobago (2010).

Table 5 Management of the production PFE ('000 hectares)

Reporting year	Natural					Planted		
	Total	Available for harvesting	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
2005*	128	75	75	0	15	15.4	15.4	0
2010	127	75	75	0	15	15.4	15.4	0

* As reported in ITTO (2006).

(along with about 1750 m³ of imported logs) yielded about 31 500 m³ of sawnwood and 2000 m³ of veneer (ITTO 2011). Plantation areas to be thinned or clearfelled are allocated to sawmillers and woodworkers on a quota system. Annual blocks to be thinned or clearfelled are notified for sale; sawmillers are expected to indicate their interest in working in particular areas. In 2009 there were 89 licensed sawmills whose combined input capacity was 100 000 m³ per year.^a These ranged in size from typical family enterprises to large companies and processed both the domestic supply of timber and imports of round logs and squares from neighbouring Guyana and Suriname. In 2009 there were 118 registered and several unregistered furniture factories that processed lumber into finished products for domestic use and for exports.^a

Non-timber forest products. Little information was available for this report on the domestic production of the country's major NTFPs. Bamboo is grown as a commercial crop. Some NTFPs are imported from Venezuela and the countries of the Guyana Shield. Edible products such as wild tubers, bush meat, honey, beeswax and thatching grass are used extensively by rural communities but the royalty rates for such items are nominal and there is very little data capture of their harvest. In 2005 an estimated 12 000 kg of bush meat and 60 000 kg of 'other plant products' were harvested from forests (FAO 2010).

Forest carbon. FAO (2010) estimated the forest carbon stock in the living forest biomass at 19 MtC. Alternatively, using forest data produced by UNEP-WCMC (2010) the forest biomass carbon stock can be estimated at 25–32 MtC.^b Trinidad and Tobago is not engaged in international REDD+ processes. There is, however, a carbon sequestration project – the Nariva Ecosystem Restoration and Carbon Sequestration Project, which is financed by an investment loan from the World Bank. It comprises two components. The first is to sequester carbon through afforestation and reforestation of selected areas of the Nariva wetland ecosystem and the second is to mitigate methane emissions through the restoration of surface hydrology. Table 6 summarizes Trinidad and Tobago's current forest carbon potential.

Forest for protection

Soil and water. There are about 2000 hectares of protection plantations in the coastal regions. It is generally recognized that there is a need to reforest and rehabilitate critical watersheds, but land outside the forest is generally occupied. Efforts are being made to rehabilitate degraded land through tree-planting in parts of the islands. Some 37 000 hectares of forest are reportedly managed primarily for the protection of soil and water^a (FAO 2010 reported an area of 51 300 hectares).

Biological diversity. Trinidad has surprising biodiversity for its size, brought about by its proximity to other Caribbean islands and,

Table 6 Forest carbon potential

Biomass forest carbon (MtC)	% forest with canopy cover >60%	Deforestation/ degradation potential to 2030	Enhancement of carbon sink capacity to 2030	Forest area change monitoring capacity	Forest/ GHG inventory capacity	Importance of forest fire/ biomass burning	Engagement in international REDD+ processes
19–32	66	+	+	-	-	+	-

+++ high; ++ medium; + low; estimate of national forest carbon based on FAO (2010) and ITTO; estimate of % total forest with canopy cover >60% based on UNEP-WCMC (2010).

particularly, to continental South America. More than 2280 species have been recorded, 215 of them endemic. There are over 100 mammals (the richest mammal biota in the Caribbean), 420 birds and 70 reptiles. One bird and eight amphibians found in forests are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species (IUCN 2011). Thirty plants are listed in CITES Appendix II (UNEP-WCMC 2011).

Protective measures in production forests. Forest management plans prescribe measures to protect riverbanks, rare plants and wildlife in production forests.

Extent of protected areas. A system of 61 national parks and other protected areas was proposed in 1980. About 40 such national parks and other protected areas have been established and are managed by the Forestry Division; two are being developed with funds from the Inter-American Development Bank. FAO (2010) reported that 100 000 hectares had been proposed for the system of national parks and protected areas, but only 8000 hectares of forests were being managed in the system. FAO (2010) reported that the conservation of biodiversity was the primary designation for 19 500 hectares of forest.

Estimate of the area of forest sustainably managed for protection. Insufficient information was available to estimate the area of sustainably managed protection PFE (Table 7). Some protection forests are covered by management plans and are used widely for ecotourism.

Socioeconomic aspects

Economic aspects. Forests cover most requirements for fuelwood and some of the nation’s timber needs. At present, about 10 000 people are employed in local forest-related jobs and many others are linked indirectly to forestry. The Tourism Master Plan aims to make Trinidad and Tobago the foremost tourism destination in the Caribbean. This will involve



Shoreline forest vegetation, Trinidad and Tobago. © istockphoto/R. McClean

ecotourism, in which forests will undoubtedly play a substantial role.^a

In 2005 the forest sector generated an estimated 7.42 million Trinidad and Tobago dollars. Total public-sector expenditure in the sector in that year – including on the conservation of forest biodiversity, reforestation, the protection of soil and water, forest stand improvement, the establishment and management of protected areas, and patrols to protect turtles during the nesting season – was 88.1 million Trinidad and Tobago dollars (FAO 2010).

Pantin and Ram (2010) reported that total public expenditure (capital and recurrent) on forest-related activities amounted to US\$10.78 million in 2005, US\$10.71 in 2008 and US\$12.43 million in 2009, which was about 0.1% of GDP and less than one-third the estimated ‘basic’ annual funding requirements for SFM. They concluded that the underfunding was due primarily to “incorrect price signals and insufficient recognition of economic values of forest services and products”. They recommended that greater emphasis be placed on generating revenue for the provision of forest ecosystem services, such as water production.

Livelihood values. Forests do not generally provide the living area of the poor but they provide important subsistence products for many people. There is no direct conflict between timber harvesting and livelihood interests, but forest is still being cleared for agriculture, mining for sands

Table 7 Management of the protection PFE ('000 hectares)

Reporting year	Protection PFE	Attributed to IUCN categories I-IV	Allocated for soil and water	With management plans	Sustainably managed
2005*	59.1	29.2	-	12	-
2010	59.1	8	-	12	-

* As reported in ITTO (2006).

and gravels, oil and gas exploration, and other purposes.

Social relations. Although there are no significant social conflicts associated with the management of the country's forests, the draft forest policy proposes the increased involvement of local communities in forest management. Some ten sites have been earmarked for recreation and are visited by approximately 300 000 people annually.^a

Summary

There has been little change in the status of forest management in Trinidad and Tobago since 2005. A new draft forest policy and a draft protected areas policy have been produced and have undergone a process of public consultation. Management plans for forest reserves are being revised. The lack of up-to-date information about the forests, the lack of a modern forest policy, and the underfunding of forest management all hinder the application of SFM.

Key points

- Trinidad and Tobago has an estimated PFE of 201 000 hectares (similar to 2005), comprising 127 000 hectares of natural production forest (compared with 128 000 hectares in 2005), 59 100 hectares of protection forest (as for 2005) and 15 400 hectares of planted forest (as for 2005).
- An estimated 15 000 hectares of the natural production PFE is under SFM. No forest is certified, and no estimate was possible for the area of protection PFE under SFM.
- A new draft forest policy and a draft protected-areas policy have been produced and have undergone a process of public consultation.

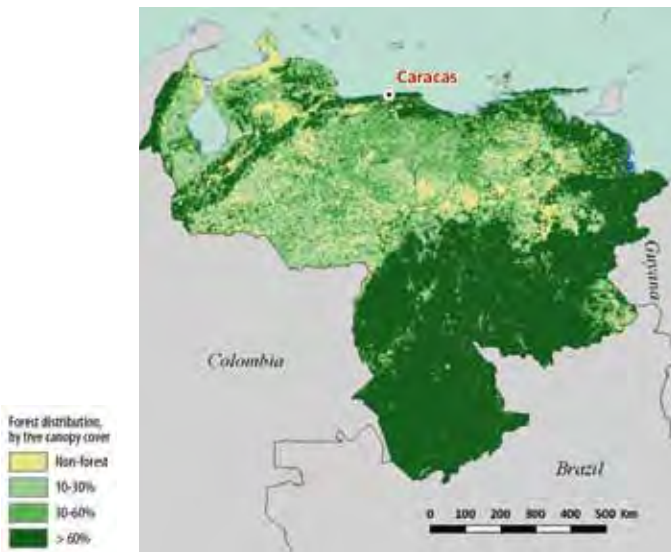
Endnotes

- a Government of Trinidad and Tobago (2010).
b ITTO estimate.

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VENEZUELA



Forest resources

Venezuela has a land area of 91.2 million hectares and a population in 2010 of 29 million people (United Nations Population Division 2010). It is ranked 58th out of 182 countries in UNDP's Human Development Index (UNDP 2009). Venezuela comprises three main biogeographical regions: a narrow coastal area; the Andean mountain range, which reaches 5000 m above sea level and supports dry and humid montane and cloud forests; and the basins of the Orinoco and Amazon rivers. The Orinoco Plain is part of the *llanos* biome¹, which covers 31% of the country. The Guayana region (the states of Bolivar and Amazonas), which is part of the Guiana Shield, occupies about half the country and contains 70% of its forests. FAO (2010) estimated Venezuela's forest area at 46.3 million hectares.

Forest types. Tropical humid forest, Venezuela's most extensive forest type, occurs in the Orinoco delta, the Guayana region and in small areas south and southwest of Lake Maracaibo; it stretches from sea level to 400 m in altitude. The most common species found in the tropical humid forest are *Couroupita guianensis*, *Ceiba pentandra*,

Coumarouna punctata, *Erisma uncinatum* and *Carapa guianensis*. Tropical mountain forest is found in three zones: the Merida range; the coastal range by the Caribbean; and the eastern massif in the states of Sucre and Monagas. Cloud forest forms in the Andes between 500 and 2000 m. Valuable timber species found in Venezuela's cloud forest include *Cedrela mexicana*, *Guarea* spp, *Roupala montana*, *Terminalia* spp, *Virola sebifera*, *Rollinia fendleri*, *Calophyllum brasiliense* and, in higher areas, species of *Podocarpus*. Deciduous forest occurs in the *llanos*, generally on flat ground of the Orinoco Plain, but has nearly disappeared due to conversion to agriculture and pasture. Once-common species in these forests include *Swietenia macrophylla* (caoba), *Bombacopsis quinata*, *Tabebuia pentaphylla* and *Ceiba pentandra*. Venezuela has an estimated 356 900 hectares of mangroves, a significant part of which is under threat (Spalding et al. 2010).

Permanent forest estate. The entire forest area is contained within specially designated areas (*áreas bajo régimen de administración especial* – ABRAEs) managed for specific purposes according to law. About 16.2 million hectares of the country's estimated 46.3 million hectares of forest are allocated for production as part of the PFE, but 3.38 million hectares of these are classified as protection forests^a and are therefore not included in the estimate of production PFE shown in Table 1. The production PFE is made up of 15 forest reserves (12.8 million hectares, of which two reserves, El Caura in Bolivar and Imataca in Delta Amacuro and Bolivar, make up about 8.8 million hectares) and four forest lots (*lotes boscosos* – covering about 83 000 hectares). The total planted forest area is about 845 000 hectares, a considerable part of which is in forest reserves. The total area of officially classified protection forests (forests in protected areas and forests set aside for soil and water protection) is at least 19.6 million hectares (Table 1).

Forest ecosystem health

Deforestation and forest degradation. FAO (2010) estimated the average annual rate of deforestation between 2000 and 2010 at 288 000

¹ An extensive system of grasslands, seasonally-flooded plains and forests shared by Venezuela and Colombia. It is located to the north and west of the Orinoco River and borders the Amazon Basin along its entire southern edge. About 61% (27.5 million hectares) of the *llanos* biome lies within Venezuela.

Table 1 Permanent forest estate

Reporting year	Estimated total forest area, range (million ha)	Total closed natural forest ('000 ha)	PFE ('000 hectares)			
			Production		Protection	Total
			Natural	Planted		
2005*	49.5–55.0	49 926	13 000	863	20 600	34 463
2010	46.3	25 300**	12 920[‡]	845	19 640[†]	33 405

* As reported in ITTO (2006).

** Calculated using the ratio of forest with greater than 60% forest cover estimated by UNEP-WCMC (2010) (54.7%) and the total natural forest area estimated by FAO (2010).

‡ Areas for permanent forest production, including forest reserves (reservas forestales) and forest vocation land areas (areas de vocación forestal) within the ABRAEs, less those forests classified as ABRAEs for protection (Government of Venezuela 2010).

† Includes environmental recovery and protection areas (áreas de protección y recuperación ambiental (APRA) – 15.2 million hectares; wildlife fauna reserves (reservas de fauna silvestre) – 0.3 million hectares; 3.38 million hectares of protection forests classified in production ABRAE (Government of Venezuela 2010); and watershed and soil protection areas.

hectares (0.6%). In the past, deforestation was highest in the *llanos*; for the last 20 years, however, it has been highest in the drier northwestern Zulia region, which has lost almost two-thirds of its forest cover, and south of Orinoco (Guayana region). The main causes of deforestation are the expansion of commercial crops and small-scale farming. A significant part of Venezuela's forest estate is degraded (Table 2), caused partly by small-scale and larger-scale mining, which is also a significant cause of river pollution. Informal gold and diamond miners are particularly active in Bolivar state, where there is a history of violent conflict between miners and local Indigenous peoples. Successive Venezuelan governments have taken steps to control mining in the region but have made relatively little progress.^b

Vulnerability of forests to climate change.

Climate change is considered by the Government of Venezuela to be a significant threat. Extreme weather events such as inundations and extended droughts are occurring with increasing intensity and frequency, claiming lives and causing considerable damage. Venezuela is participating in international negotiations on climate-change adaptation and is playing a leading role on climate-related issues within the Bolivarian Alliance for the Peoples of Our America (*Alianza Bolivariana para los Pueblos*

de Nuestra América). Nevertheless, land-use change and human-induced forest degradation are expected to have a larger impact on forest vulnerability in the next two to five decades. Uncontrolled forest fires occur regularly, both in natural and planted forest. There are, on average, more than 3000 forest fires annually, affecting at least 100 000 hectares of forest per year.^a

SFM policy framework

Forest tenure. There is no forest cadastre in Venezuela and thus it is difficult to estimate the ownership status of forests^a, although the vast majority is owned by the state (Table 3). There are private forest lots in both natural and planted forest areas, but their extent is unknown. The 1999 Constitution recognizes the right of Indigenous people to the collective ownership of forest territories, access to resources and cultural uses (articles 119–126), but no demarcation or formal recognition process is in place.^b The extent to which local communities have the right to administer, conserve and manage timber resources in ABRAEs remains unclear. Venezuela's legislature passed a new law on Indigenous peoples and communities (*Ley Orgánica de Pueblos y Comunidades Indígenas*) in 2005, which includes a provision ensuring the

Table 2 Forest condition

	PFE	Non-PFE	Total
	'000 ha		
Area of primary forest	-	-	21 000
Area of degraded primary forest	-	-	18 000
Area of secondary forest	-	-	7 000
Area of degraded forest land*	-	-	-

Source: Derived from Government of Venezuela (2010) and personal communications – see endnote b.



Small-scale mining in Guiana, Venezuela.

land and property rights of Indigenous peoples and communities (ITTO & RRI 2009). This law recognizes ancestral rights to forestlands and specifies the process for demarcating and titling Indigenous lands. Approximately 700 000 hectares have been titled to Indigenous peoples' communities in agricultural areas (ibid.).

Criteria and indicators. Venezuela has a long tradition of forest management and professional foresters are involved at all levels of forest production and conservation. The country is an active member of the Amazon Cooperation Treaty Organization, which has developed the Tarapoto C&I framework for SFM and a platform for dialogue between national forest authorities. The Government of Venezuela used the ITTO C&I in its submission to ITTO for this report.^a

Forest policy and legislation. The framework for forest conservation and management is laid out in articles 127–129 of the country's 1999

Constitution, which define the framework of environmental rights. Sustainable natural resource management is defined as a fundamental task of the state; it is the basic principle of the 2006 Organic Law for the Environment (*Ley Orgánica del Ambiente*), which replaced the 1976 Law for the Environment. The 1983 Organic Law of Land Management (*Ley Orgánica para la Ordenación del Territorio*) defines territories that are under a specific management regime, including natural forests and areas for reforestation and rehabilitation (Article 15). The Penal Law of the Environment (*Ley Penal del Ambiente*), which came into force in 1992, defines offences against the environment. In December 2008 a new law for the management of biological diversity (*Ley de Gestión de la Diversidad Biológica*) was passed, replacing the former law of 2000.

Decree 6070 of June 2008 constitutes the Law on Forests and Forest Management (*Ley de Bosques y Gestión Forestal*), superseding the Forest Law (1966). It contains the framework for SFM and forest protection and recognizes the wider functions of forests for the production of goods and services as well as the environmental and cultural values linked to forests.^a Since 2009 the Forest Service (*Dirección General de Bosques*) has been developing revisions to the new law, including provisions for the national development plan (*Proyecto Nacional Simón Bolívar*) and the emerging role of forests in climate change. Those revisions are under discussion in the national legislature.

The country's domestic timber trade is regulated by the 1966 Forest Law for Soil and Water (*Ley Forestal de Suelos y de Aguas*) and the international trade by the Fiscal Law (*Ley de Timbre Fiscal, Decreto*

Table 3 Forest area, by tenure

Ownership category	Total area	Of which PFE	Notes
	'000 ha		
State ownership (national, state or provincial government)	46 300	-	No distinction can be made between state ownership categories.
Other public entities (e.g. municipalities, villages)		-	
Total public	46 300		
Owned by local communities and/or Indigenous groups	-	-	About 0.7 million hectares have been attributed to Indigenous peoples' groups, but it is unclear how much of this area is forested.
Private owned by individuals, firms, other corporate	120	-	Mainly planted forests owned by private persons or enterprises.

Source: Government of Venezuela (2010).

363/1999). The latter includes tariff instruments for the control of imports and exports and stipulates that logs harvested in natural forests cannot be exported. Industrial logging (since 1978; Decree 269) and mining (since 1989; Decree 2552) are prohibited in Amazonas, the country's second-largest state after Bolívar (ITTO 2006). The extent to which these regulations are still being applied is unclear, however.

A new forest policy to replace the general policy of 1998 (*Política Nacional de Bosques*) is under preparation, with a view to better encompassing the human dimension and sustainable development approaches to forest management. The principle of the new forest policy is to secure the multiple and sustainable uses of forest resources, with particular emphasis on the livelihood values of forests for local people. Special emphasis will be given to the control of illegal logging and encroachment in forest reserves by shifting cultivators and illegal miners.

Institutions involved in forests. The Ministry for the Environment (*Ministerio del Poder Popular para el Ambiente* – MPPA) is the lead ministry responsible for forests (replacing the former Ministry for Environment and Natural Resources). The Forest Service is the MPPA's implementation agency. Other ministries involved in forest development are the Ministry for Agriculture and Lands (*Ministerio del Poder Popular para la Agricultura y Tierras* – MAT) and the Ministry for Sciences and Technology (*Ministerio del Poder Popular para la Ciencia, Tecnología e Industrias Intermedias*). Particularly south of Orinoco, which is also an important development area, there is a lack of clarity on the relative roles and responsibilities of institutions, in particular between the MPPA, MAT and the Ministry for Energy and Petrol (*Ministerio del Poder Popular para la Energía y Petróleo*, the former Ministry for Energy and Mining).

Other important institutions supporting the development of SFM in Venezuela include the Reforestation Company (*Compañía Forestal de Reforestación*), which deals with plantation forest development and forest restoration on public and private land; and the Institute for National Parks (*Instituto Nacional de Parques*), which deals with forest conservation and protected areas. The Forestry Institute of Latin America (*Instituto Forestal Latinoamericano*) is responsible for forest research, along with other institutions such as the National Forest Products Laboratory (*Laboratorio*

Nacional de Productos Forestales) and the Botanical Institute Foundation of Venezuela (*Fundación Instituto Botánico de Venezuela*). The university in Merida, *Universidad de los Andes*, is the main body for high-level forest education in the country.

To monitor forest management and trade in forest products, the MPPA has a functional national forest information statistical system (*Sistema Nacional de Información Estadística Forestal*), initiated with the support of ITTO, and an information system for forest inventory (*Sistema de Información Nacional del Inventario Forestal*), which allows the management of forest growth data and the monitoring of forest carbon. The first comprehensive national forest inventory is under preparation and results are expected in 2012.

Decentralization was proposed in the Law of Decentralization (1989) and reinforced by principles embodied in the 1999 Constitution. However, natural resource management and, in particular, forest management remain under the control of the centrally organized Forest Service – with the exception of urban forestry, which is managed directly by the municipalities (ITTO 2006).

Status of forest management

Forest for production

In mid 2010, the total area managed under integrated forest management plans for goods and services was 4.38 million hectares, comprising three forest reserves – Imataca, Guarapiche and Ticoporo.^a Timber harvesting in natural forests is done on a relatively small scale in Venezuela. Under the new national forest policy, the integrated co-management of forests in collaboration with local populations will involve multiple land uses and the production of timber, NTFPs and ecosystem services. Model forest and land management plans have been prepared to fully integrate various interests in the management of forest reserves in Ticoporo (187 000 hectares, plan approved in 2008) and Caparo (174 000 hectares, plan currently at the approval stage); both reserves are located in the *llanos*. Only small parts of these reserves are dedicated to timber production and a multiple-use management approach is employed. SFM for timber production is being tested over about 3% of the 3.8 million hectares of the Imataca Forest Reserve in the Guayana region.^a

Two kinds of permit for timber production are available: forest concessions, granted for areas of more than 5000 hectares; and annual logging permits, for areas smaller than 5000 hectares. Forest concessions are granted for 20–40 years in forest reserves and forest lots, the latter established by the MPPA (ITTO 2006). The forest concession policy lacks clarity. Concessions are officially granted at public auction, but information about the process is not available publicly and the criteria for awarding concessions are not transparent.^b Concessionaires often struggle to comply with the forest law, but there is no public information on how and to what extent they fail to comply (ITTO 2006).

Because nearly all forest reserves north of the Orinoco River are deforested, all forest concessions are now south of the Orinoco in the Guayana region. In mid 2003, 14 forest concessions were operating in forest reserves and in forest lots over a total of 1.21 million hectares (ITTO 2006). No newer information was available for this report.^b In June 2010, through Governmental Decree 7.457, the Social Forest Enterprise (*Empresa Socialista Forestal S.A.*) was created under the MPPA to reform forest concession management.

All concessionaires are Venezuelan nationals. Concession management is based on detailed forest management plans (*planes de ordenación y manejo forestal* – POMFs) that include inventories of commercial timber species. High-grading, in which only the most valuable species are extracted, is commonplace (ITTO 2006). By law, all concessions must be managed by professional forest engineers and trained foresters. Harvesting in concessions is carried out on the basis of an annual cutting plan approved by the MPPA. Concessionaires are required to establish line enrichment planting after harvesting at a distance between strips of 30–50 m. Annual logging permits require a simplified management plan prepared by a forest engineer (*ibid.*).

Silviculture and species selection. The minimum cutting diameter for native species was reassessed through Government Resolution 30 of June 2009. At least 40 species are harvested from natural forests.^a Commonly harvested species are shown in Table 4; others include *Copaifera officinalis* (aceite), *Tabebuia rosea* (apamate), *Hymenaea courbaril* (algarrobo), *Catostemma commune* (baramán), *Sterculia apetala* (camoruco), *Carapa guianensis* (carapa), *Simarouba amara* (cedro blanco), *Ceiba pentandra* (ceiba), *Brosimum alicastrum* (charo), *Pterocarpus officinalis* (drago), *Hura crepitans* (jabillo), *Qualea dinizii* (guarapo), *Spondias mombin* (jobo), *Nectandra* spp (laurel), *Anacardium excelsum* (mijao), *Mora excelsa* (mora), *Erisma uncinatum* (moreillo), *Piptadenia* spp (palo blanco), *Cordia alliodora* (pardillo), *Manilkara bidentata* (purguo), *Tabebuia serratifolia* (puy), *Peltogyne pubescens* (zapatero) and *Pithecellobium saman* (samán).^a

Under Government Resolution 217 (2006) the following species are completely protected and may not be harvested: *Tabebuia spectabilis* (acapro), *Swietenia macrophylla* (caoba), *Cedrela odorata* (cedro), *Anacardium excelsum* (mijao), *Cordia thaisiana* (pardillo negro) and *Bombacosis quinata* (saqui saqui).^a Under Government Resolution 35 (2008), the harvesting of samán, the main species remaining in the scattered forests north of the Orinoco region, is prohibited in the states of Apure, Aragua, Barinas, Portuguesa and Zulia.^a

Planted forest and trees outside the forest.

There has been a tradition of official and private plantations in Venezuela for nearly 60 years. Venezuela had an estimated 727 000 hectares of plantations in 1998 (of which 115 000 hectares were private; ITTO 2006). The MPPA reported an increase of planted forest between 2002 and 2007 of 118 000 hectares (20 000 hectares by private companies), which would bring the planted-forest area to about 845 000 hectares. The majority of the plantations are for industrial purposes. The

Table 4 Commonly harvested species for industrial roundwood

Species	Notes
<i>Pinus caribaea</i> (pino caribe)*	From plantations – about 79% of the total harvest in 2004–08.
<i>Eucalyptus</i> spp	From plantations – about 10% of the total harvest in 2004–08.
<i>Pithecellobium saman</i> (samán)*	From open forests – about 45 000 m ³ per year.
<i>Erisma uncinatum</i> (moreillo)*	From the Guayana region – about 30 000 m ³ per year.
<i>Manilkara bidentata</i> (purguo)	From the Guayana region – about 6000 m ³ per year.

* Also listed in ITTO (2006).

Source: Government of Venezuela (2010).

most important species is *Pinus caribaea* (pino caribe), which provides more than two-thirds of the country's total roundwood production. Other planted species include *Eucalyptus* spp, *Gmelina arborea*, *Leucaena leucocephala*, *Fraxinus americana*, *Cupressus lusitanica*, *Tabebuia rosea*, cedro, caoba and *Tectona grandis*.^a

A new reforestation plan (*Plan Socialista de Plantaciones Forestales*) was approved in early 2010 with the aim of establishing 2 million hectares of additional planted forests in the next 20 years.^a A plantation program using *Acacia mangium* has been launched in the south of Apure state with the aim of planting 300 000 hectares of new forests there.^a

Forest certification. As of October 2010, Venezuela had one certified planted forest of *Pinus caribaea* covering an area of 139 650 hectares. Natural-forest certification has not generated interest among producers in Venezuela because the entire production is used to satisfy the domestic market, which is not yet demanding certified timber.

Estimate of the area of forest sustainably managed for production. According to one government estimate, 77% of the volume of timber harvested – 40% from areas under POMFs and 37% from plantations of *Pinus caribaea* – was derived from sustainably managed sources and therefore met the ITTO Year 2000 Objective (ITTO 2006). The estimate of sustainably managed natural-forest PFE given in Table 5 is more conservative and corresponds to timber concessions that have been managed according to forest management plans for more than 25 years. An estimated area of about 510 000 hectares of natural forests is currently managed under rigid silvicultural provisions by eight enterprises in forest reserves and forest lots.^a

Timber production and trade. Nearly the entire volume of timber production serves the domestic market. ITTO (2011) estimated a total industrial roundwood production in 2009 of 2.35 million m³ (1.71 million m³ of which was softwood, mainly *Pinus caribaea*^a), up from 1.44 million m³ in 2005. An estimated 93% of roundwood is cut outside forest reserves and forest lots.^a

A considerable portion of total industrial roundwood production is used for pulp and paper. A large part of the remainder is used for sawnwood: for example, an estimated 950 000 m³ of sawnwood was produced in 2009 (ITTO 2011). Exports of primary timber products are negligible, but the value of primary wood product imports has grown to over US\$59 million per year, mostly comprising sawnwood and plywood (ibid.). Hardwood from Roraima state in the Brazilian Amazon is increasingly important because of a new and well-maintained road system (ITTO 2006).

Non-timber forest products. Between 30 and 50 NTFPs are important and used at the local, regional and national levels. Among them are various palm products for food, construction, medicine and handicrafts, including the fruits of *Bactris gasipaes* (pejibaye), *Dipteryx odorata* (sarrapia), *Mauritia flexuosa* (moriche palm) and *Bactris gasipaes* (pijiguao). The latter two are important food sources for Indigenous communities in the Orinoco delta and the Amazon.^a Cooking oil is extracted from the *Acrocomia aculeata* palm (corozo). Palm heart (palmito) from *Euterpe oleracea* is an important export product; it is now increasingly planted and integrated into multiple-use forest management plans. Other products are various nuts, including Brazil nut and merey (*Anacardium occidentale*), pepper, cinnamon, bamboo, nutmeg, aniseed, cumin, ginger, cucumber and resins, many sold in the national market. A food additive

Table 5 Management of the production PFE ('000 hectares)

Reporting year	Natural					Planted		
	Total	Available for harvesting	With management plans	Certified	Sustainably managed	Total	With management plans	Certified
2005*	13 000	3120	1480	0	480	863	727	140
2010	12 920	4379**	4379**	0	510	845	845	140

* As reported in ITTO (2006).

** Government of Venezuela (2010). Includes the production forest area of the Imataca Forest Reserve (about 1.37 million hectares).

extracted from *Bixa orellana* (onoto o achote) is also widely used.^a *Heteropsis spruceana* (mamure), a local liana, has been used as a raw material for furniture but is now threatened by over-use (ITTO 2006).

Forest carbon. Deforestation is a significant factor in Venezuela’s carbon budget, accounting for more than 40% of national GHG emissions (UNFCCC undated). Human interference has affected large areas of forest; many forests have been cleared for agricultural and pasture development and other projects. Gibbs et al. (2007) estimated the biomass carbon stock in a broad range of 2326–9202 MtC and FAO (2010) did not provide an estimate. An industrial plantation (Uverito) and a managed protected area (Ticoporo Reserve) have been used as case studies of carbon emissions reduction and sequestration. The Uverito plantation achieved a net carbon storage of 6.2 MtC in 100 000 hectares of new plantations at a net cost of US\$17/tC (UNFCCC undated). The Ticoporo Reserve stored an estimated 75 tonnes of carbon per hectare, or 7.5 MtC for 100 000 hectares of natural forest management. The costs for this latter type of project were estimated at about US\$700 per hectare, including the opportunity cost of land. Thus, the cost for carbon storage was an estimated US\$9 per tonne of carbon (ibid.).

The Bolivarian Alliance of the Peoples of Our America, of which the Government of Venezuela is a member, made a submission to the Conference of the Parties to the UNFCCC in 2010 in which it proposed that polluting countries directly transfer financial and technological resources to pay for the restoration and conservation of forests and jungles, in favour of Indigenous peoples and ancestral social structures. While Venezuela is an active participant in climate-change negotiations, it does not participate in any of the major ongoing international REDD+ initiatives (Table 6).

Forest for protection

Soil and water. A significant area of forest is set aside for the protection of soil and water within ABRAEs. These forests are classified under ‘normative protection’ (*protección normada*) and include:

- Soil and watershed protection forests (*zonas protectoras*) – 7.9 million hectares.
- Watershed reserves (*reservas hidráulicas*) – 1.7 million hectares.
- Reserves for dams and reservoirs (*zonas de reserva para construcción de presas y embalses*) – 7800 hectares.
- Protected areas for public infrastructure (*áreas de protección de obras públicas*) – 133 400 hectares.
- Critical areas for restoration (*áreas críticas con prioridad de tratamiento*) – 4.5 million hectares.
- Environmental rehabilitation and protection areas (*áreas de protección y recuperación ambiental*) – 2350 hectares.^a

Fourteen ABRAEs serve primarily watershed protection functions and extend over about 1.74 million hectares.^a Large tracts of forests in the Guayana region help to regulate the flow of water into the Guri Dam, which provides 70% of the nation’s electricity. The most extensive protected areas are in the Andean mountain belt, where forests are important in watershed protection.

Biological diversity. The country harbours a significant portion of the world’s biodiversity, ranking in the top 20 countries in the number of endemic plants, birds, amphibians and reptiles (ITTO 2006). More than 8000 plant species have been recognized as endemic, as have some 122 amphibians, 66 reptiles, 40 birds and 15 mammals. Twenty-six mammals, 22 birds, two reptiles, 65 amphibians, four arthropods and

Table 6 Forest carbon potential

Biomass forest carbon (MtC)	% forest with canopy cover >60%	Deforestation/ degradation potential to 2030	Enhancement of carbon sink capacity to 2030	Forest area change monitoring capacity	Forest/ GHG inventory capacity	Importance of forest fire/ biomass burning	Engagement in international REDD+ processes
2326–9202	55	+++	++	++	++	+++	-

+++ high; ++ medium; + low; estimate of national forest carbon based on Gibbs et al. (2007); estimate of % total forest with canopy cover >60% based on UNEP-WCMC (2010).

three plants found in forests are listed as critically endangered, endangered or vulnerable on the IUCN red list of threatened species (IUCN 2011). Four plants are listed in CITES Appendix I, 163, including *Swietenia macrophylla* and *S. humilis*, in Appendix II, and two in Appendix III (UNEP-WCMC 2011). Several timber species have special protection status under national law, including *Podocarpus rospigliosii*, *Pterocarpus* spp, *Spondias* spp, *Tabebuia spectabilis*, *Cedrela odorata*, *Anacardium excelsum*, *Cordia thaisiana* and *Pithecellobium saman*.^a

Protective measures in production forests. The Law on Forests and Forest Management requires that 10% of the managed production forest be protected as a preservation zone, with emphasis on areas along watercourses and swamps.^a

Extent of protected areas. The estimated total area contained in reserves compatible with IUCN categories I–IV is 17.9 million hectares^a, including 94 ABRAEs, as shown in Box 1.

This amounts to nearly 20% of the national territory, one of the largest proportions of any country worldwide. As well as forests, protected areas include montane ecosystems and other non-forested areas. UNEP-WCMC (2010) estimated the total area of forests in protected areas conforming to IUCN protected-area categories I–IV at 16.5 million hectares. Although the declared protected area is huge, only about 15–20% has land-use and zoning plans. In addition, many conservation sites are subject to unresolved land claims by Indigenous groups (ITTO 2006). Some of the protected areas (e.g. the protected area classified within the Imataca Forest Reserve in northeastern Venezuela) have been seriously affected by commercial gold and diamond mining. In 2008 the President of Venezuela ordered a complete cessation of mining activities in protected areas.^a

Estimate of the area of forest sustainably managed for protection. Of the 265 ABRAEs with protection status (including 64 protected areas^a), 71 have forest management plans (Bevilacqua et al. 2004). Thirty-five per cent of the protected areas in IUCN protected-area categories I–IV have management plans or instructions for their use (*reglamentos de uso*) (ibid.). However, many of these areas exist only on paper. Protected areas are used for logging and mining – both illegal and government-sanctioned – and other forms of development, while some protected areas have been designated despite being cleared long ago. It is difficult to secure the integrity of some of these areas, particularly in the *llanos* and south of Orinoco, because of mining and other explorative activities (ibid.). For example, it has been reported that legal and illegal miners and loggers have encroached the Cainama National Park – famous for Angel Falls, the world's tallest waterfall – in recent years.^b Nonetheless, much of the protected-forest estate is intact and faces relatively little development pressure.^a It is estimated that about 10% of the protection PFE with management plans can be classified as sustainably managed (Table 7).

Socioeconomic aspects

Economic aspects. Forests provide less than 1% of GDP.^a Data on the number of people employed in the forest sector were unavailable for this report.

Livelihood values. NTFPs are essential for the livelihoods of Indigenous peoples living in the Guayana and Amazon regions. Wildlife and fish still supplement the protein needs of a large part of the population in the states of Bolivar and Amazonas. Wildlife also provides raw material for handicrafts and medicines. Intensified hunting and fishing with new techniques and in-migration into frontier areas may increase pressure on some animal species

Box 1 Protected areas, Venezuela

ABRAE	Number	Area ('000 ha)	% of land area
National parks (<i>parques nacionales</i>)	43	13 100	14.3
Natural monuments (<i>monumentos naturales</i>)	36	4280	4.7
Wildlife refuges (<i>refugios de vida silvestre</i>)	7	251	0.3
Wildlife sanctuaries (<i>santuario de fauna silvestre</i>)	1	0.072	0
Wildlife reserves (<i>reservas de fauna silvestre</i>)	7	293	0.3
Total	94	17 900	19.5

Source: Government of Venezuela (2010).

Table 7 Management of the protection PFE ('000 hectares)

Reporting year	Protection PFE	Attributed to IUCN categories I-IV	Allocated for soil and water	With management plans	Sustainably managed
2005*	20 600	20 600	1740	7210	-
2010	19 640	16 500**	1740†	7250†	725

* As reported in ITTO (2006).

** UNEP-WCMC (2010).

† Including reservas hidráulicas, zonas de reserva para construcción de presas y embalses and áreas de protección de obras públicas.

‡ Including the protected area in the new management plan of Caparo.

(ITTO 2006). Some 20 000 Warao Indians in the Orinoco delta have a semi-nomadic lifestyle and depend heavily on mangroves for fishing (Spalding et al. 2010).

Social relations. Significant populations of Indigenous people live in three forest reserves – Sipapo (1.2 million hectares) in Amazonas; Imataca (3.7 million hectares) in Amacuro Delta and Bolívar; and El Caura (5.1 million hectares) in Bolívar. The two main economic activities in these reserves are logging and mining for gold and diamonds, which have brought improved health and education services to local people and induced a trend towards settlement (ITTO 2006). They have also brought non-indigenous settlers (*colonos*) into the areas, increasing conflicts with local people and pressure on existing forest resources, especially along access roads and around settlements. North of the Orinoco River, particularly in the Province of Barinas bordering Colombia, nearly all forest reserves have been encroached by *colonos*.

Summary

Venezuela possesses considerable untouched forest resources in its two largest states of Bolivar and Amazonas. Relatively modest logging concessions and cutting permits have been granted over the past 40 years. Instead of increasing the harvest of natural forests, a well-developed plantation sector is the most important source of industrial timber in the country. Over the past few years, the government has made many political and institutional changes to the forest sector, maintaining strong environmental provisions and increasing legislative provisions for the inclusion of local communities in forest management. SFM has not yet been fully achieved, however. The enforcement of forest regulations still requires strengthening and illegal logging, hunting and encroachment (e.g. mining) are reportedly widespread. Nevertheless, a basis has been laid for the development of SFM and effective forest conservation.

Key points

- Venezuela has an estimated PFE of 33.4 million hectares (compared with 34.5 hectares in 2005), comprising 12.9 million hectares of natural production forest (compared with 13.0 million hectares in 2005) and 19.6 million hectares of protection forest (compared with 20.6 million hectares in 2005).
- Venezuela has the second-largest extent of planted forests in tropical America, with a plantation estate of 845 000 hectares. The government has ambitious plans to continue increasing the estate.
- An estimated 510 000 hectares of the production PFE and 725 000 hectares of protection PFE are under SFM. No natural forest is certified.
- The forests north of the Orinoco River (*llanos*) are heavily degraded and encroached. South of the Orinoco River are extensive and timber-rich forest resources with good potential for SFM, although this area is under increased pressure, with new roads and planned conversion to agriculture.
- A national forest inventory is currently being conducted and a forest database is under establishment, which will help improve the monitoring of forest resources and the implementation of SFM.
- The Ministry in charge of forests and the Forest Service have proposed revisions to the main forest-related laws and are currently formulating a new forest policy.
- A national forest enterprise (*Empresa Socialista Forestal*) was created in June 2010 that will probably replace the former forest concession structure.

Endnotes

- a Government of Venezuela (2010).
- b Information derived from the report of, and discussions with participants at, a training workshop on ITTO criteria and indicators, held 30 August–4 September 2004, Ciudad Bolívar, Venezuela, attended by 47 people from government, civil society and the private sector, updated through email exchanges in 2010.

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APPENDICES

Appendix I Tropical forest area, 65 countries

Country	Total forest area	Deforestation rate 2005–10	Primary forests
	'000 ha	%	'000 ha
Angola	58 480	-0.21	0
Benin	4561	-1.06	0
Burundi	172	-1.01	40
Cameroon	19 916	-1.07	3250
CAR	22 605	-0.13	2370
Congo	22 411	-0.05	7436
Côte d'Ivoire	10 403	-	625
DRC	154 135	-0.20	69 000
Equatorial Guinea	1626	-0.71	0
Gabon	22 000	0	14 334
Gambia	480	0.38	1
Ghana	4940	-2.19	395
Guinea	6544	-0.54	63
Guinea Bissau	2022	-0.49	0
Kenya	3467	-0.31	654
Liberia	4329	-0.68	175
Madagascar	12 553	-0.45	3036
Mozambique	39 022	-0.53	0
Nigeria	9041	-4.00	0
Rwanda	435	2.47	7
Sierra Leone	2726	-0.70	113
Tanzania	33 428	-1.16	0
Togo	287	-5.75	0
Uganda	2988	-2.72	0
Zambia	49 468	-0.33	0
Zimbabwe	15 624	-1.97	801
Subtotal	440 450		102 260
Brunei Darussalam	380	-0.47	263
Cambodia	10 094	-1.22	322
Fiji	1014	0.34	449
India	68 434	0.21	15 701
Indonesia	94 432	-0.71	47 236
Lao PDR	15 751	-0.49	1490
Malaysia	20 456	-0.42	3820
Myanmar	31 773	-0.95	3192
PNG	28 726	-0.49	26 210
Philippines	7665	0.73	861
Solomon Islands	2213	-0.25	1105
Sri Lanka	1860	-0.77	167
Thailand	18 972	0.08	6726
Timor Leste	742	-1.44	0
Vanuatu	440	0	-
Vietnam	13 797	1.08	80
Subtotal	316 749		107 622

Country	Total forest area	Deforestation rate 2005–10	Primary forests
	'000 ha	%	'000 ha
Belize	1393	-0.68	599
Bolivia	57 196	-0.53	37 164
Brazil	519 522	-0.42	476 573
Colombia	60 499	-0.17	8 543
Costa Rica	2605	0.90	623
Cuba	2870	1.25	0
Dominican Republic	1972	0	-
Ecuador	9865	-1.89	4 805
El Salvador	287	-1.47	5
French Guiana	8082	-0.04	7690
Guatemala	3657	-1.47	1619
Guyana	15 205	0	6790
Haiti	101	-0.77	0
Honduras	5192	-2.16	457
Jamaica	337	-0.12	88
Mexico	64 802	-0.24	34 310
Nicaragua	3114	-2.11	1179
Panama	3251	-0.36	0
Paraguay	17 582	-0.99	1850
Peru	67 992	-0.22	60 178
Suriname	14 758	-0.02	14 001
Trinidad & Tobago	226	-0.32	62
Venezuela	46 275	-0.61	21 000
Subtotal	906 783		677 536
Total 65 countries	1 663 982		887 418

Source: Based on FAO (2010). Data in italics are from country profiles in Part 2. Countries in bold are ITTO producer member countries.

Appendix II Summary tables, ITTO producers

Total forest area (range), and area of closed forest ('000 hectares)

Country	Estimated total forest area, 2010		Closed forest
	Minimum	Maximum	
Cameroon	19 700	21 200	16 900
CAR	22 700	30 100	4600
Congo	22 400	26 900	18 500
Côte d'Ivoire	7500	10 400	1760
DRC	112 000	154 000	87 800
Gabon	21 800	24 600	18 700
Ghana	4680	4680	838
Liberia	4330	9600	2420
Nigeria	9040	9040	958
Togo	500	1680	287
Subtotal	224 650	292 200	152 763
Cambodia	10 000	10 700	3900
Fiji	1014	1014	566
India (tropical)	37 800	37 800	23 100
Indonesia	94 400	98 500	69 230
Malaysia	18 400	18 600	14 700
Myanmar	30 800	35 400	17 500
PNG	28 600	33 000	22 800
Philippines	7170	7660	3248
Thailand	17 200	19 000	6140
Vanuatu	440	440	394
Subtotal	245 824	262 114	161 578
Bolivia	52 400	58 700	36 700
Brazil	519 000	519 000	264 700
Colombia	56 900	64 400	51 300
Ecuador	9870	11 200	5813
Guatemala	3650	4510	1850
Guyana	15 200	20 500	13 600
Honduras	5190	6660	2630
Mexico	64 800	64 800	22 600
Panama	3100	4300	2110
Peru	67 900	72 000	55 990
Suriname	14 800	14 800	14 100
Trinidad and Tobago	226	226	150
Venezuela	46 300	46 300	25 300
Subtotal	859 336	887 396	496 843
Total	1 329 810	1 441 710	811 184

Source: Derived from country profiles in Part 2.

Production PFE ('000 hectares)

Country	Natural-forest PFE										Planted-forest PFE			
	Area		Available for harvesting		With management plans		Certified		Sustainably managed		Area		With management plan	
	2005	2010	2005	2010	2005	2010	2005	2010	2005	2010	2005	2010	2005	2010
Cameroon	8840	7600	4950	6100	1760	5000	0	705	500	1255	17	19	-	2
CAR	3500	5200	2920	3100	650	2320	0	0	186	0	3	3	-	0
Congo	18 400	15 200	8440	11 980	1300	8270	0	1908	1300	2494	72	85	45	45
Côte d'Ivoire	3400	1950	1870	1950	1110	1360	0	0	277	200	167	180	120	133
DRC	20 500	22 500	15 500	9100	1080	6590	0	0	284	0	55	67	40	43
Gabon	10 600	10 600	6923	10 300	2310	3450	1480	1870	1480	2420	25	25	10	10
Ghana	1150	774	1035	1124	1150	774	0	150	270	155	97	164	97	24
Liberia	1310	1700	1310	1000	0	265	0	0	0	0	-	9.7	0	0
Nigeria	2720	2720	1060	1060	650	-	0	0	-	33	375	382	175	-
Togo	41	0	41	0	5.5	0	0	0	5.5	0	14	15	1.2	7
Subtotal	70 461	68 244	44 049	45 714	10 015.5	28 029	1480	4633	4302.5	6557	825	949.7	488.2	264
Cambodia	3460	3710	3370	5	150	150	0	0	0	0	17	69	7	-
Fiji	0	0	-	-	-	6.3	-	0	-	6.3	113	176	90	68
India	13 500	26 160	13 500	16 800	9720	16 800	0	0	4800	4800	32 600	5600	8150	-
Indonesia	46 000	38 600	43 200	26 200	18 400	13 700	275	1125	2940	3160	2500	2500	2500	2500
Malaysia	11 200	10 298	6790	9910	11 200	9910	4620	5228	4790	5950	183	539	183	539
Myanmar	9700	15 800	-	-	9700	15 800	0	0	291	291	710	882	0	882
PNG	8700	8700	5600	4900	4980	738	19	2.7	1500	193	80	58	-	31.2
Philippines	4700	4700	-	4700	910	658	0	0	76	79	274	314	274	164
Thailand	0	251	-	251	-	251	-	11	-	11	1870	1900	250	8
Vanuatu	117	0	-	0	0	0	0	0	0	0	2.1	0	2.1	0
Subtotal	97 377	108 219	72 460	62 766	55 060	58 013.3	4914	6366.7	14 397	14 490.3	38 349.1	12 038	11 456.1	4192.2
Bolivia	17 000	25 100	5470	9680	5470	9680	2210	1720	2210	1720	60	73	-	-
Brazil	98 100	135 000	-	15 340	5250	15 340	1160	2700	1360	2700	3810	6650	1350	3380
Colombia	5500	5500	2150	-	-	-	0	9	200	315	148	405	80	150
Ecuador	3100	1964	-	115	65	86	0	0	101	176	164	175	65	90
Guatemala	1140	1140	540	540	697	697	520	481	672	630	71	85	27	27
Guyana	5450	11 090	3800	6710	3730	4053	0	184.5	520	520	12	12	0	0
Honduras	1590	1096	1070	1096	671	1096	37	111	187	276	48	48	28	31
Mexico	7880	8400	8600	8400	8600	750	163	12	163	750	100	171	34	84
Panama	350	350	86	86	63	72	0	0	0	44	56	71	32	47
Peru	24 600	18 700	8000	8431	5000	7563	59	713	560	1603	250	820	8	-
Suriname	6890	5319	1740	2000	73	899	0	89	0	247	7	13	7	-
Trinidad and Tobago	128	127	75	75	75	75	0	0	15	15	15.4	15.4	15.4	15.4
Venezuela	13 000	12 920	3120	4379	1480	4379	0	0	480	510	863	845	727	845
Subtotal	184 728	226 706	34 651	56 852	31 174	44 690	4149	6019.5	6468	9506	5604.4	9383.4	2373.4	4669.4
Total	352 566	403 169	151 160	165 332	96 249.5	130 732.3	10 543	17 019.2	25 167.5	30 553.3	44 778.5	22 371.1	14 317.7	9125.6

Note: Refer to country profiles for explanations of change between 2005 and 2010.

Source: Derived from country profiles in Part 2.

Protection PFE ('000 hectares)

Country	Area		Allocated for soil and water protection		With management plans		Sustainably managed	
	2005	2010	2005	2010	2005	2010	2005	2010
Cameroon	3900	5200	-	-	-	2230	-	1420
CAR	300	560	6	6	-	120	-	120
Congo	2860	3650	3660	3660	380	536	380	536
Côte d'Ivoire	734	2090	195	374	345	840	150	840
DRC	27 000	25 800	-	-	-	630	0	0
Gabon	2700	2900	0	0	491	1230	1090	1230
Ghana	353	396	-	353	-	230	108	230
Liberia	101	194	0	0	0	180	0	0
Nigeria	1010	2540	-	-	-	-	-	-
Togo	313	368	200	200	-	5	-	5
Subtotal	39 271	43 698	4061	4593	1216	6001	1728	4381
Cambodia	4620	4530	4200	551	-	1490	-	-
Fiji	241	43	18	304	37	-	55	-
India	25 600	4540	-	4540	-	722	-	722
Indonesia	22 500	27 300	16 000	26 400	5000	2180	1360	1360
Malaysia	3210	3579	3210	3579	3210	3579	3210	3579
Myanmar	3300	5330	6560	21 100	-	5330	-	-
PNG	1700	1700	-	0	-	-	-	-
Philippines	1540	1340	-	613	-	1340	-	-
Thailand	8260	10 000	9320	1330	-	402	522	402
Vanuatu	8.37	8.37	-	0	-	0	-	0
Subtotal	70 979.37	58 370.37	39 308	58 417	8247	15 043	5147	6063
Bolivia	14 700	13 100	6790	-	-	3500	2380	2690
Brazil	271 000	175 000	-	243 000	-	-	-	-
Colombia	8860	9340	312	456	-	456	-	456
Ecuador	4300	6554	2403	2355	513	2211	-	629
Guatemala	1240	1240	184	235	-	-	-	265
Guyana	980	1110	-	-	243	332	243	332
Honduras	1600	2521	352	319	-	608	-	439
Mexico	5600	3649	-	-	-	3015	-	3015
Panama	1580	1880	326	406	396	396	180	368
Peru	16 300	19 400	390	389	-	11 600	1540	1880
Suriname	4430	2194	1160	0	-	1460	-	1460
Trinidad and Tobago	59.1	59.1	-	-	12	12	-	-
Venezuela	20 600	19 640	1740	1740	7210	7250	-	725
Subtotal	351 249.1	255 687.1	13 657	248 900	8374	30 840	4343	12 259
Total	461 499.47	357 755.47	57 026	311 910	17 837	51 884	11 218	22 703

Note: Refer to country profiles for explanations of change between 2005 and 2010.

Source: Derived from country profiles in Part 2.

Appendix III Notes on methodology

Forest area

Although the data in UNEP-WCMC (2010) are likely to lead to a consistent over-estimate of forest cover, they can still be used in several ways. For example, the data become more reliable when the forest is relatively intact. Protected areas typically include relatively intact tracts of contiguous forest, in which case estimates of forest are likely to be closer to reality than in more fragmented landscapes. Therefore, UNEP-WCMC (2010) estimates of forest in protected areas are used in this report where other data are lacking.

In addition, since FAO (2010) did not report on the area of closed forest, this parameter is estimated in this report using UNEP-WCMC (2010) estimates of forest with greater than 60% canopy cover and total forest cover to calculate the percentage of total forest with greater than 60% canopy cover (a surrogate for closed forest). This ratio was then applied to total forest-cover estimates provided by FAO (2010) to derive a new estimate of forest with greater than 60% canopy cover (i.e. closed forest area). For example, UNEP-WCMC (2010) estimated that Nigeria had a total forest area of 52.3 million hectares, including 5.53 million hectares of forest with greater than 60% canopy cover. Therefore, the estimated area of forest with greater than 60% canopy cover is 10.6% of total tree cover. Using the FAO (2010) estimate of forest area (9.04 million hectares) and the ratio calculated using UNEP-WCMC (2010) data, the area of forest with greater than 60% canopy cover is estimated at 0.958 million hectares. The accuracy of this methodology is unknown, and therefore estimates of closed forest given in this report should be treated with caution.

Significant figures

Throughout the report, estimates given in tables are generally made to three significant figures, except where they are the product of summing within tables.

IUCN red list of threatened species

For each country, the following criteria were used to report on critically endangered, endangered or vulnerable species, using the searchable database at www.iucnredlist.org:

Taxonomy:	No taxonomy classifiers specified.
Location:	Relevant country specified (in the case of India, only Indian states located mostly in the tropics specified) (default 'native' modifier applies).
Systems:	No systems specified.
Habitats:	Forests specified.
Threats:	No threats specified.
Assessment:	Critically endangered, endangered and vulnerable specified. All available years (1996 (animals only), 1998 (plants only), 2000, 2002, 2003, 2004, 2006, 2007, 2008, 2009, 2010) specified.
Life history:	No life history specified.

CITES appendices

For each country, the number of species listed in Appendix I, Appendix II and Appendix III, as shown in the UNEP-WCMC searchable database (available at www.cites.org/eng/resources/species.html), are given. The number of reservations and withdrawals were not taken into account.

Forest carbon

Assessing forest carbon is a relatively new undertaking and few data are available. Quantitative estimates of forest carbon stocks (forest biomass carbon stocks, reported as millions of tonnes of carbon) are based on an analysis by Gibbs et al. (2007), and, where available, other estimates are given in the text. While there is no practical method to directly measure all forest carbon stock in a country, both ground-based and remote-sensing measurements of forest attributes can be used to estimate national carbon stock using allometric relationships. Gibbs et al. (2007) synthesized, mapped and updated forest biomass carbon databases and created a first complete set of national-level forest carbon stock estimates.

In each country profile in Part 2, Table 6 summarizes some of the parameters that indicate a country's capacity for carbon capture and storage, along the lines of the methodology proposed by Herold (2009). These are deforestation/degradation potential to 2030; enhancement of carbon sink capacity to 2030; capacity for forest and GHG inventories; the role of forest fire and biomass burning; and engagement of the country in international REDD+ processes. Table 6 also provides an estimate of the percentage of forest with a canopy cover greater than 60%, derived from UNEP-WCMC (2010) (see above).

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- Herold, M. (2009). *An Assessment of National Forest Monitoring Capabilities in Tropical Non-annex I Countries: Recommendations for Capacity Building*. Final report. GOF-C-GOLD Land Cover Project Office, Friedrich Schiller University, Jena, for The Prince's Rainforests Project and the Government of Norway.

Appendix IV Timber species and their common names, by country

Africa

Scientific name	Common name(s)
<i>Azelia africana</i>	lingué (Côte d'Ivoire)
<i>Aningeria</i> spp	aniegré-longhi (CAR)
<i>Antiaris africana</i>	ako (Togo)
<i>Aucoumea klaineana</i>	okoumé (Gabon, Congo)
<i>Baillonella toxisperma</i>	moabi (Gabon, Cameroon)
<i>Borassus aethiopum</i>	rônier (Gabon, Congo)
<i>Brachystegia</i> spp	bomanga (DRC)
<i>Butyrospermum paradoxum</i>	shea butter tree
<i>Butyrospermum parkii</i>	karité (CAR)
<i>Canarium schweinfurthii</i>	aiélé (Côte d'Ivoire, DRC, Gabon)
<i>Ceiba pentandra</i>	ghe (Liberia), fromager (Côte d'Ivoire)
<i>Chlorophora excelsa</i>	iroko (Cameroon, CAR, Congo, Côte d'Ivoire, DRC, Nigeria, Togo); kambala (DRC)
<i>Chlorophora regia</i>	iroko (Côte d'Ivoire)
<i>Chrysophyllum</i> spp	aniégré (Côte d'Ivoire)
<i>Copaifera salikounda</i>	etimoé (Côte d'Ivoire)
<i>Cylicodiscus gabunensis</i>	okan (Gabon); okan/adoum (Gabon)
<i>Dacryodes buettneri</i>	ozigo (Gabon)
<i>Distemonanthus benthamianus</i>	movingui (Cameroon); movingui (Gabon)
<i>Entandrophragma angolense</i>	tiana (DRC, Côte d'Ivoire, CAR)
<i>Entandrophragma candollei</i>	kossipo (Cameroon, CAR, Congo, Côte d'Ivoire, DRC, Liberia); omu (Nigeria)
<i>Entandrophragma cylindricum</i>	sapelli (Cameroon, CAR, Congo, DRC); sapele (Nigeria)
<i>Entandrophragma utile</i>	sipo (Cameroon, CAR, Congo, DRC); sipo or lifaki (DRC)
<i>Eribroma oblonga</i>	eyong (Cameroon)
<i>Erythrophleum ivorensis</i>	tali (Cameroon)
<i>Gambeya africana</i>	longhi (DRC, Congo)
<i>Gilbertiodendron preussii</i>	limbali (Liberia)
<i>Gossweilerodendron balsamiferum</i>	tola (DRC); agba (Nigeria)
<i>Guarea cedrata</i>	bossé (CAR, Congo, Liberia, Côte d'Ivoire, DRC); guarea (Ghana)
<i>Guibourtia demeusei</i>	kevazingo (Gabon)
<i>Guibourtia</i> spp	benge (DRC)
<i>Hallea ciliata</i>	abura (Liberia)
<i>Khaya anthotheca</i>	iroko (Côte d'Ivoire)
<i>Khaya grandifolia</i>	acajou (Togo)
<i>Khaya ivorensis</i>	Lagos mahogany (Nigeria); mahogany (Ghana); acajou (Côte d'Ivoire)
<i>Lophira alata</i>	azobe (Cameroon); azobé (Côte d'Ivoire, Gabon); bongossi (Cameroon); ekki (Nigeria, Liberia)
<i>Lovoa trichilioides</i>	dibetou (Côte d'Ivoire, DRC); dibétou bibolo (CAR); cedar (Nigeria)
<i>Mansonia altissima</i>	bété (Cameroon); ofun (Nigeria); mansonia (Ghana); beté (Côte d'Ivoire); iroko (Côte d'Ivoire)
<i>Millettia laurentii</i>	wengé (Gabon, Congo, DRC)
<i>Nuclea diderrichii</i>	bilinga (DRC)
<i>Nesogordonia papaverifera</i>	otutu (Nigeria); danta (Liberia, Ghana); kotibé (Côte d'Ivoire)
<i>Pericopsis elata</i>	afrormosia (Cameroon, DRC)
<i>Piptadeniastrum africanum</i>	dabéma (Gabon)
<i>Pterocarpus erinaceus</i>	véne (Togo)
<i>Pterocarpus</i> spp	padouk (CAR); red padouk (Cameroon)
<i>Pterygota macrocarpa</i>	koto (Côte d'Ivoire)

Africa (cont'd)

Scientific name	Common name(s)
<i>Pycnanthus angolensis</i>	ilomba (Congo)
<i>Pycnanthus kombo</i>	ilomba (Côte d'Ivoire)
<i>Raphia</i> spp	raphia palm (Côte d'Ivoire)
<i>Sacoglottis gabonensis</i>	ozouga (Cameroon)
<i>Tarrietia utilis</i>	niangon (Côte d'Ivoire, Ghana)
<i>Tectona grandis</i>	teak (Ghana, Nigeria, Togo)
<i>Terminalia ivorensis</i>	framiré (Côte d'Ivoire); edo (Nigeria)
<i>Terminalia superba</i>	fraké (Cameroon, Côte d'Ivoire); afara (Nigeria); limba (CAR, Congo, Gabon, DRC)
<i>Testulea gabonensis</i>	izombe (Gabon)
<i>Tieghemella heckelii</i>	makore (Ghana); makoré (Côte d'Ivoire)
<i>Triplochiton scleroxylon</i>	ayous (CAR, Congo, Côte d'Ivoire, Gabon, Togo, Cameroon); obeche (Nigeria); samba (Côte d'Ivoire); wawa (Ghana)
<i>Uapaca</i> spp	assam (Ghana)

Asia and the Pacific

Scientific name	Common name(s)
<i>Acacia mangium</i>	mangium (Philippines)
<i>Agathis macrophylla</i>	kauri (Vanuatu)
<i>Agathis vitiensis</i>	kauri, dakua makadre (Fiji)
<i>Albizia lebbek</i>	kokko (India)
<i>Anisoptera glabra</i>	mersawa, phdiek (Cambodia)
<i>Anisoptera</i> spp	mersawa (Indonesia)
<i>S. kunstleri</i> , <i>S. guiso</i> , <i>S. collina</i> , <i>S. ochrophloia</i> and other <i>Shorea</i> spp	Balau (Malaysia)
<i>Barringtonia asiatica</i>	botong (Philippines)
<i>Calophyllum inophyllum</i>	palomaria (Philippines)
<i>Calophyllum</i> spp	damanu (Fiji)
<i>Cocos nucifera</i>	coconut (Vanuatu)
<i>Shorea pauciflora</i> , <i>S. curtusii</i> and other <i>Shorea</i> spp	dark red meranti (Malaysia)
<i>Dipterocarpus alatus</i>	chhoeuteal tan (Cambodia)
<i>Dipterocarpus grandiflorus</i>	apitong (Philippines)
<i>Dipterocarpus</i> spp	keruing (Indonesia)
<i>Dryobalanops</i> spp	kapur (Indonesia)
<i>Endospermum macrophyllum</i>	kauvula (Fiji)
<i>Endospermum medullosum</i>	whitewood (Vanuatu)
<i>Eucalyptus deglupta</i>	bagras (Philippines)
<i>Gmelina arborea</i>	yemane (India, Philippines); gamari (India)
<i>Gonystylus bancanus</i>	ramin (Indonesia, Malaysia)
<i>Hevea brasiliensis</i>	rubber, rubberwood
<i>Intsia bijuga</i>	vesi (Fiji); natora (Vanuatu); kwila (PNG); ipil (Philippines)
<i>Koompassia malaccensis</i>	kempas (Malaysia)
<i>Dipterocarpus</i> spp	keruing (Malaysia)
<i>Lantana camara</i>	lantana (India)
<i>Myristica</i> spp	kaudamu (Fiji)
<i>Nipa fruticans</i>	nipa palm (Philippines)
<i>Nothofagus</i> spp	southern beech (PNG)
<i>Palaquium</i> spp	sacau (Fiji)
<i>Parthenium hysterophorus</i>	carrot grass (India)
<i>Pentacme contorta</i>	white lauan (Philippines)

Asia and the Pacific (cont'd)

Scientific name	Common name(s)
<i>Pinus caribaea</i>	Caribbean pine (Fiji)
<i>Pometia pinnata</i>	taun (PNG)
<i>Pterocarpus indicus</i>	rosewood (PNG); bluwota (Vanuatu)
<i>Pterocarpus macrocarpus</i>	padauk (Myanmar)
<i>Pterocarpus</i> spp	narra (Philippines)
<i>Shorea parvifolia</i> , <i>S. macroptera</i> and other <i>Shorea</i> spp	red meranti (Malaysia)
<i>Santalum album</i>	cendana (Indonesia)
<i>Santalum</i> spp	sandalwood (Vanuatu)
<i>Shorea negrosensis</i>	red lauan (Philippines)
<i>Shorea robusta</i>	sal (India)
<i>Shorea</i> spp	meranti (Indonesia)
<i>Swietenia macrophylla</i>	mahogany (Fiji)
<i>Swietenia mahoganii</i>	mahogany (Philippines)
<i>Tectona grandis</i>	teak
<i>Terminalia catappa</i>	talisai (Philippines)
<i>Terminalia tomentosa</i>	htauk kyant (Myanmar)
<i>Vitex parviflora</i>	molave (Philippines)
<i>Xylia kerri</i>	pyinkado (Myanmar)

Latin America and the Caribbean

Scientific name	Common name(s)
<i>Abies guatemalensis</i>	pinabete (Guatemala)
<i>Alnus acuminata</i>	aliso (Bolivia, Colombia, Ecuador)
<i>Amburana cearensis</i>	cerejeira (Brazil); ; roble (Bolivia); ishipingo (Peru)
<i>Anacardium excelsum</i>	espavé (Panama); mijao (Venezuela)
<i>Anadenanthera colubrina</i>	curupaú (Bolivia)
<i>Aniba guianensis</i>	canelón (Bolivia)
<i>Aniba perutilis</i>	comino creso (Colombia)
<i>Aspidosperma</i> spp	shibadan (Guyana)
<i>Astronium graveolens</i>	zorro (Panama)
<i>Astronium urundeuva</i>	cuchi (Bolivia)
<i>Bagassa guianensis</i>	cow wood (Guyana)
<i>Bertholletia excelsa</i>	castanheira (Brazil)
<i>Bombacopsis quinata</i>	cedro espino (Panama); saqui saqui (Venezuela); ceiba tolúa (Colombia)
<i>Brosimum alicastrum</i>	charo (Venezuela); ramón (Mexico, Honduras); breadnut (Honduras)
<i>Brosimum utile</i>	sande (Colombia, Ecuador); huina (Colombia)
<i>Bucida buceras</i>	pucte (Guatemala, Mexico)
<i>Bursera simarouba</i>	chaka (Mexico)
<i>Caesalpinia pluviosa</i>	momoqui (Bolivia)
<i>Calophyllum brasiliense</i>	santa maria (Guatemala, Honduras); palo maría (Bolivia); maria (Panama)
<i>Calophyllum</i> spp	palo maria (Bolivia)
<i>Calycophyllum spruceanum</i>	capirona (Peru)
<i>Campnosperma panamensis</i>	sajo (Colombia)
<i>Carapa guianensis</i>	crabwood (Guyana); andiroba (Colombia); crappo (Trinidad and Tobago); carapa (Venezuela); macho (Honduras); tangare (Panama)
<i>Cariniana ianarensis</i>	yesquero blanco (Bolivia)
<i>Cariniana decandra</i>	cachimbo (Peru)
<i>Cariniana pyriformis</i>	abarco (Colombia)
<i>Carludovica palmata</i>	paja toquilla (Ecuador)

Latin America and the Caribbean (cont'd)

Scientific name	Common name(s)
<i>Castilla elastica</i>	castilla (Guatemala)
<i>Catostemma commune</i>	baromalli (Guyana); baramán (Venezuela)
<i>Cedrela odorata</i>	cedro (Bolivia, Colombia, Ecuador, Guatemala, Honduras, Peru, Venezuela); red cedar (Guyana); cedro rojo (Mexico); cedro amargo (Panama); cedar (Trinidad and Tobago)
<i>Cedrelinga catenaeformis</i>	tornillo (Peru); chuncho (Ecuador)
<i>Ceiba pentandra</i>	ceiba (Honduras, Venezuela), kapok (Ecuador), seiba (Mexico)
<i>Ceiba</i> spp	ceiba (Bolivia)
<i>Chamaedorea elegans</i>	palma camedor (Mexico)
<i>Chlorocardium rodiei</i>	greenheart (Guyana)
<i>Chorisia integrifolia</i>	lupuna (Peru)
<i>Clathrotropis brachypetala</i>	aromata (Guyana)
<i>Copaifera aromatica</i>	cabimo (Panama)
<i>Copaifera officinalis</i>	aceite (Venezuela)
<i>Cordia alliodora</i>	vara de humo (Colombia); cypre (Trinidad and Tobago); laurel (Ecuador, Honduras, Panama); pardillo (Venezuela)
<i>Cordia thaisiana</i>	pardillo negro (Venezuela)
<i>Cybistax donnell-smithii</i>	palo blanco (Guatemala)
<i>Cupressus lusitanica</i>	cypress (Guatemala)
<i>Dalbergia retusa</i>	cocobolo (Panama)
<i>Dalbergia</i> spp	guanciban, granadillo (Mexico)
<i>Dendropanax arboreus</i>	sac-chaca (Mexico)
<i>Dialium guianensis</i>	andiroba (Honduras)
<i>Dialium guineense</i>	tamarindo (Mexico)
<i>Dicorynia guianensis</i>	wamaradan (Guyana)
<i>Dinizia excelsa</i>	angelim (Brazil)
<i>Diploptropis purpurea</i>	tatabu (Guyana)
<i>Dipteryx micrantha</i>	shihuahuaco (Peru)
<i>Dipteryx odorata</i>	almendrillo (Bolivia); tonka bean (Guyana)
<i>Dipteryx panamensis</i>	almendro (Panama)
<i>Enterolobium cyclocarpum</i>	guanacaste (Mexico)
<i>Eperua</i> spp	wallaba (Guyana)
<i>Erisma uncinatum</i>	cedrinho (Brazil); moreillo (Venezuela)
<i>Eschweilera subglandulosa</i>	guatecare (Trinidad and Tobago)
<i>Eucalyptus globulus</i>	eucalipto (Ecuador, Peru)
<i>Euxylophora paraensis</i>	pau-amarelo (Brazil)
<i>Fagus mexicana</i>	beech (Mexico)
<i>Ficus</i> spp	bibosi (Bolivia)
<i>Gmelina arborea</i>	melina (Mexico)
<i>Goupia glabra</i>	kabukalli (Guyana); cupiúba (Brazil)
<i>Guazuma</i> spp	bolaina (Peru)
<i>Gynerthera darinensis</i>	cucharo (Panama)
<i>Hevea brasiliensis</i>	hule (Mexico)
<i>Hieronyma alchorneoides</i>	zapatero (Panama)
<i>Huberodendron patinoi</i>	carra (Colombia)
<i>Humiria balsamifera</i>	tauroniro (Guyana)
<i>Humiriastrum procerum</i>	chanó (Colombia)
<i>Hura crepitans</i>	ochoó (Bolivia); catahua (Peru); jabillo (Venezuela)
<i>Hyeronima alchornoides</i>	mascarey (Ecuador)
<i>Hymenaea courbaril</i>	jatobá (Brazil); locust (Guyana); algarrobo (Venezuela)
<i>Hymenolobium flavum</i>	darina (Guyana)

Latin America and the Caribbean (cont'd)

Scientific name	Common name(s)
<i>Jacaranda copaia</i>	futui (Guyana)
<i>Licaria canella</i>	brown silverballi (Guyana)
<i>Liquidambar styraciflua</i>	liquidambar (Guatemala); sweet gum (Mexico)
<i>Lonchocarpus castilloi</i>	manchiche (Guatemala)
<i>Lonchocarpus lanceolatus</i>	machiche (Mexico)
<i>Loxopterygium sagotii</i>	hububalli (Guyana)
<i>Lysiloma latisiliquu</i> , <i>L. bahamensis</i>	tzalam (Mexico)
<i>Manilkara bidentata</i>	bulletwood (Guyana); purguo (Guyana)
<i>Manilkara huberi</i>	maçaranduba (Brazil)
<i>Metopium brownei</i>	chechen, palo roso (Mexico)
<i>Miroxylon balsamum</i>	bálsamo (Panama)
<i>Mora excelsa</i>	mora (Venezuela, Guyana)
<i>Mora gonggripaii</i>	morabukea (Guyana)
<i>Nectandra</i> spp	laurel (Venezuela)
<i>Quercus</i> spp	oak (Panama)
<i>Ochroma lagopus</i>	balsa (Ecuador)
<i>Ocotea puberula</i>	keriti silverballi (Guyana)
<i>Ocotea rubra</i>	determa (Guyana)
<i>Ocotea</i> spp	bambito (Panama)
<i>Camptosperma panamensis</i>	orey (Panama)
<i>Otoba glycyarpa</i>	sangre de gallina (Ecuador)
<i>Parahancornia fasciculata</i>	dukali (Guyana)
<i>Parkia multijuga</i>	cutanga (Ecuador)
<i>Parkia velutina</i>	pashaco (Peru)
<i>Peltogyne maranhensis</i>	pau-roxo (Brazil)
<i>Peltogyne pubescens</i>	zapatero (Venezuela)
<i>Peltogyne venosa</i>	purpleheart (Guyana)
<i>Pinus ayacahuite</i>	pino blanco (Honduras)
<i>Pinus caribaea</i>	Caribbean pine (Trinidad and Tobago); pino costanero (Honduras); pino caribe (Panama, Venezuela)
<i>Pinus hartwegii</i>	pino de montaña (Honduras)
<i>Pinus maximinoi</i>	pino llorón (Honduras)
<i>Pinus oocarpa</i>	pino ocote (Honduras)
<i>Pinus patula</i>	pino candelabro (Colombia)
<i>Pinus pseudostrobus</i>	pinabete (Honduras)
<i>Pinus radiata</i> and <i>P. patula</i>	pino (Ecuador)
<i>Pinus</i> spp	pino (Colombia); tajibo (Guatemala)
<i>Pinus tecumumanii</i>	pino rojo (Honduras)
<i>Piptadenia</i> spp	palo blanco (Venezuela)
<i>Piratinera guianensis</i>	letterwood (Guyana)
<i>Pithecellobium saman</i>	samán (Venezuela);
<i>Platymiscium pinnatum</i>	quira (Panama)
<i>Pouteria speciosa</i>	suya (Guyana)
<i>Prioria copaifera</i>	cativo (Panama, Colombia)
<i>Prumnopitys</i> spp	romerillo (Ecuador), azucena (Ecuador)
<i>Pseudobombax ellipticum</i>	amapola (Mexico)
<i>Pterocarpus officinalis</i>	drago (Venezuela)
<i>Puteria</i> spp	platano (Panama)
<i>Qualea dinizii</i>	guarapo (Venezuela)
<i>Quercus humboltii</i>	roble (Colombia)

Latin America and the Caribbean (cont'd)

Scientific name	Common name(s)
<i>Quercus</i> spp	roble (Guatemala)
<i>Sabal mauritiformis</i>	guágara (Panama)
<i>sabino</i>	<i>Taxodium mucronatum</i> (Guatemala)
<i>Schizolobium amazonicum</i>	serebó (Bolivia)
<i>Schizolobium parahybum</i>	pachaco (Ecuador)
<i>Simarouba amara</i>	marupá (Guyana); marupa (Peru); cedro blanco (Venezuela);
<i>Simarouba glauca</i>	pasak (Mexico)
<i>Spondias mombin</i>	hogplum (Trinidad and Tobago); jobo (Venezuela)
<i>Sterculia apetala</i>	sujo (Bolivia); camoruco (Venezuela)
<i>Swartzia benthamiana</i>	itikiboroballi (Guyana)
<i>Swartzia jorori</i>	jorori (Bolivia)
<i>Swartzia leiocalycina</i>	wamara (Guyana)
<i>Swietenia macrophylla</i>	mahogany (Honduras, Trinidad and Tobago); mara (Bolivia); kobchi (Mexico); caoba (Panama, Peru, Venezuela, Guatemala, Mexico); mogno (Brazil)
<i>Tabebuia capitata</i> or <i>insignis</i>	hakia (Guyana)
<i>Tabebuia donnell-smithii</i>	guayacán (Mexico)
<i>Tabebuia espectabilis</i>	acapro (Venezuela)
<i>Tabebuia rosea</i>	apamate (Venezuela); oak (Panama); apamate (Honduras); apamate (Trinidad and Tobago)
<i>Tabebuia serratifolia</i>	washiba (Guyana); puy (Venezuela)
<i>Tabebuia serratifolia</i> / <i>T.rosea</i>	cedro rosado (Colombia)
<i>Tabebuia</i> spp	tajibo (Bolivia)
<i>Tectona grandis</i>	teak, teca (Colombia, Ecuador, Guatemala, Honduras, Mexico, Panama; teak (Trinidad and Tobago)
<i>Terminalia amazonia</i>	amarillo (Panama); cumbillo (Honduras); fukadi (Guyana); verdolago (Bolivia); roble (Mexico)
<i>Trattinickia glaziovii</i>	copal (Ecuador)
<i>Trattinickia</i> spp	ulu (Guyana)
<i>Virola koschnyi</i>	palo de sangre (Honduras)
<i>Virola</i> spp	cumala (Peru)
<i>Virola surinamensis</i>	cajuca (Trinidad and Tobago)
<i>Vochysia guatemalensis</i>	san juán (Honduras)
<i>Vochysia haenkeana</i>	cambará (Bolivia)
<i>Vouacapoua macropetala</i>	sarabebeballi (Guyana)

Appendix V Industrial roundwood production versus area of production PFE, ITTO producer countries

Country	Industrial roundwood production, 2009 ('000 m ³)	Total production PFE ('000 ha)	Industrial roundwood production per ha production forest, 2009 (m ³ /ha)
Cameroon	2270	7619	0.30
CAR	533	5203	0.10
Congo	1980	15 285	0.13
Côte d'Ivoire	1470	2130	0.69
DRC	300	22 567	0.01
Gabon	3400	10 625	0.32
Ghana	1300	938	1.39
Liberia	330	1710	0.19
Nigeria	7100	3102	2.29
Togo	123	15	8.20
Subtotal (Africa)	18 806	69 194	0.27
Cambodia	113	3779	0.03
Fiji	166	176	0.94
India	20 300	31 760	0.64
Indonesia	34 200	41 100	0.83
Malaysia	17 800	10 837	1.64
Myanmar	4050	16 682	0.24
PNG	2860	8758	0.33
Philippines	857	5014	0.17
Thailand	5100	2151	2.37
Vanuatu	30	0	0.00
Subtotal (A/P)	85 476	120 257	0.71
Bolivia	903	25 173	0.04
Brazil	23 700	141 650	0.17
Colombia	1180	5905	0.20
Ecuador	238	2139	0.11
Guatemala	443	1225	0.36
Guyana	299	11 102	0.03
Honduras	770	1144	0.67
Mexico	911	8571	0.11
Panama	41	421	0.10
Peru	2360	19 520	0.12
Suriname	190	5332	0.04
Trinidad and Tobago	45	142	0.32
Venezuela	642	13 765	0.05
Subtotal (LAC)	31 722	236 089	0.13
Total	136 004	425 540	0.32

Note: A/P = Asia and the Pacific; LAC = Latin America and the Caribbean.

Source: Country profiles in Part 2.



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